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Online reputation management for improving marketing by using a hybrid MCDM model

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ABSTRACT

Online reputation management (ORM) has been considered as a significant tool of internet marketing. The purpose of this paper is to construct a decision model for evaluating performances and improving professional services of marketing. To investigate the interrelationship and influential weights among criteria, this study uses a hybrid MCDM model including decision-making trial and evaluation laboratory (DEMATEL), DEMATEL-based analytic network process (called DANP). The empirical findings reveal that criteria have self-effect relationships based on DEMATEL technique. According to the network relation map (NRM), the dimension that professional services of marketing should improve first when carrying out ORM is online reputation. In the five criteria for evaluation, distributed reputation systems is the most important criterion impacting ORM, followed by employees and social responsibility.

1. Introduction

Good corporate reputations establish customer cross-buying intentions by enhancing expected service quality of customers, reducing information costs, and increasing trust and affective commitment [11,12]. In modern times, companies have to comprehend the actual standing of their products on the Web in that more and more consumers depend on online opinions when making purchasing decisions [14]. Online reviews of products and reviewer related data are considered as one of the most important knowledge base systems originate by online commerce websites [27]. Whereas, anyone can fill out positive or negative comments about a company online whatever the truth is, which can affect people's perception of reputation for people and organizations. Accordingly, build online reputation was investigated in many researches for internet had been regarded as one of the most important tools for marketing [17,22]. Moreover, since reputation is a significant determinant of marketing's influence in businesses, reputation management becomes more critical issue and has been utilized to reduce the risk of negative interaction outcomes in this internationalized world [18]. However, the combination of these two essential concepts is rarely discussed. Online reputation management (ORM), profoundly affecting people and organizations, is thus proposed by this research to provide people and businesses with innovation strategies to manage their reputation online for improving professional services of marketing in this time of network technology.

Consequently, the purpose of this study is to build a decision model of innovation strategy to implement ORM for improving the effects of marketing. This paper shows the specific process of carrying out ORM, the influential weights of criteria for ORM, and evaluating the performances in professional services of marketing under the full consideration of ORM by a hybrid multiple criteria decision making (MCDM) model. Previous studies regarding about ORM focused on considering solely what factors would influence online reputation [1,22,35] and reputation management [6,9,23]. However, decision making needs consideration of multiple criteria, which are interdependent and feedback in real world. Also, the messages conveyed were simply what factors have influence on ORM and whether the impact was positive or negative. Therefore, these discoveries for building a decision model of ORM to improve

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professional services of marketing have little contribution to it. In addition, the interrelationship and influential weights among factors of ORM were seldom explored.

To enhance preceding literatures about ORM for constructing a decision model of ORM for improving the effects of marketing, this research proposes a hybrid MCDM model comprising decision making trial and evaluation laboratory (DEMATEL), and DEMATEL-based analytical network process (DANP) to explore marketing based on ORM. We identify the criteria of ORM to establish a MCDM model for improving professional services of marketing through extensive literature review. This study utilizes DEMATEL technique to investigate the interdependent and feedback decision making among criteria to build the network relation map (NRM) by the survey of experts. Innovation strategies for improving the effects of marketing can thus be proposed by the influence values of criteria in NRM. To conquer the problems of dependence and feedback among criteria by using DANP according to the basic concept of analytical network process (ANP), proposed by Saaty [24], the influential weights of ORM's criteria for improving professional services of marketing can be acquired. We then rank influential weights of criteria to recognize the important ones. Eventually, simple additive weighting is used to evaluate the performances of ORM in professional services of marketing. Published work concerning such a hybrid MCDM model of ORM for improving professional services of marketing is very few. To make up this gap, this research employs an empirical case in professional services of marketing in Taiwan, and provides people and organizations with a useful decision model to manage their online reputation for improving the effects of marketing.

The rest of this paper is arranged as follows: in the next section, to recognize the criteria of ORM literatures are reviewed. Afterwards, a hybrid MCDM model for constructing a decision model of ORM is explained and an empirical case of innovation strategy for improving professional services of marketing is displayed. Eventually, conclusion is presented.

2. Criteria of ORM for improving professional services of marketing

Ref. [15] argued that companies of professional services can systematically scheme out the marketing of their services for providing value satisfactions to generate and maintain profits of their customers and produce. Moreover, Ref. [25] inspected and verified various measures of value creation and reputation in search shops and found partial support for their hypothesis that higher reputation was associated with higher value creation. ORM is the process of analysis and management for people and organizations' reputation represented by content among all kinds of online media. Fundamentally, it is fast enough to be able to respond, when people express things online about brands. However, online negative images have great influences on brands that people and organizations have taken years and tremendous resources to establish. To investigate ORM, this section according to literature review identifies the criteria of ORM's two dimensions: online reputation and reputation management.

Online reputation consists of two major types, centralized and distributed reputation systems, according to the information storage location [17]. Ref. [13] indicated the central authority (reputation centre) that accumulates the entire ratings classically received reputation scores for participants, and lets entire scores publicly available. However, there is no central location for submitting ratings or deriving reputation scores of others in a distributed reputation system. Instead, there can be distributed stores or participant merely records the comments about experiences with other parties, and offers the information on request from dependent groups. Ref. [28] found feedback about participants' past behavior was collected, distributed and aggregated by a reputation system. Aggregation of feedback was evaluated and condensed into a few values that provided users with references to make decisions suitably. Feedback was distributed eventually to the participants meaning it needed to be made accessible to people who wanted to take it as consideration when making decisions. Moreover, the reputation system was in a distributed fashion for the central authority did not retain real-time reputation information of each node. Instead, each node can only link to the central authority regularly by offline. The central authority was mainly utilized for key setup and controlling the misbehaving node [5].

In the dimension of reputation management, Ref. [23] mentioned that the reputation management system (RMS) depended on the feedbacks which were given by the members of the social network in which the RMS operated. Reputation can thus be regarded as an endogenous and self generated indicator produced by the users for their benefit, which implied that users' participation and collaboration was a critical factor for the effectiveness of RMS. Also, Ref. [32] examined and developed a customer-based corporate reputation (CBR) scale for measuring corporate reputation. Moreover, present researches employ the Walsh and Beatty CBR scale in the UK and Germany to explore he cross-cultural validity of the evaluation of customer-based corporate reputation. Ref. [33] used the CBR Short scale (with 15 items) having the same good dimensional properties as the original scale. Besides, Ref. [8] revealed that corporate reputation was important for cultivating stakeholder relationships and for retrieving public trust. Corporate reputation derived from the interactions between firms and stakeholders, accentuating the critical role employees played in reputation management. Ref. [6] indicated that corporate reputation was critical to the organization, and employees were the key to administering it. Management can obtain great accomplishments in aspect of contenting corporate strategic objectives by indentifying the synergistic role that employees can acted in the all positioning of corporate reputation. In addition, the findings of Mitra [19] suggested that firms may better associate their corporate social responsibility (CSR) efforts with regular business, and their bigger public relations campaigns with farther social perceptions of their responsibilities. Ref. [2] developed a conceptual framework that stressed the demand for fit between CSR campaigns and other critical characteristics of the business for the purposes of reputation building.

According to literature review, factors affecting ORM for improving professional services of marketing are arranged as follows. ORM includes two dimensions: online reputation (D_1) and reputation management (D_2). On the one hand, online reputation is affected by centralized reputation systems (C_1) and distributed reputation systems (C_2). And on the other hand, reputation management is influencing by customer relationships (C_3), employees (C_4), and social responsibility (C_5).

3. Constructing a hybrid MCDM model combined with DEMATEL and DANP

Multiple criteria decision making (MCDM) is used to think multiple criteria at the same time for offering decision makers with a valuable decision model for making the optimal decision [31]. To construct the network relation map (NRM) for issues of MCDM and obtain the influential weights of criteria of the structure, the technique of decision making trial and evaluation laboratory

(DEMATEL) and DEMATEL-based analytical network process (DANP) are employed by this research.

3.1. The technique of DEMATEL for establishing the NRM

The DEMATEL technique is used to investigate the interdependent and feedback problems among criteria for constructing the NRM [3,7]. This method has been practically applied to numerous fields, such as portfolio selection, hospital service quality, and knowledge management, Refs. [10,26,34].

The method is displayed as follows: in the first place, the influence matrix is derived by scores. The experts are asked to indicate the degrees of influence among criteria: point out criterion i impacts on criterion j as a_{ij}; thus, the influence matrix $\boldsymbol{A}$ can thus be obtained. Secondly, by Eqs. (1) and (2) to normalize $\boldsymbol{A}$, the normalized influence matrix $\boldsymbol{E}$ can be calculated.

$$\boldsymbol{E} = m \cdot \boldsymbol{A} \tag{1}$$

$$m = \min\left[\frac{1}{\max_i \sum_{j=1}^{n} |a_{ij}|}, \frac{1}{\max_j \sum_{i=1}^{n} |a_{ij}|}\right] \tag{2}$$

Thirdly, the total influence matrix $\boldsymbol{T}$ can be derived by using the formula, $\boldsymbol{T} = \boldsymbol{E} + \boldsymbol{E}^2 + \boldsymbol{E}^3 + \cdots + \boldsymbol{E}^q = \boldsymbol{E}(\boldsymbol{I} - \boldsymbol{E})^{-1}$, where $\boldsymbol{I}$ represents the identity matrix. In the fourth step: establish the NRM via the vectors $\boldsymbol{r}$ and $\boldsymbol{d}$, the sums of rows and columns respectively, which are obtained by:

$$\boldsymbol{r} = [r_i]_{n\times 1} = \left[\sum_{j=1}^{n} t_{ij}\right]_{n\times 1} \tag{3}$$

$$\boldsymbol{d} = [d_j]_{n\times 1} = \left[\sum_{i=1}^{n} t_{ij}\right]'_{1\times n} \tag{4}$$

where r_i denotes the sum of the ith row indicating the entire influences of criterion i on another criteria. Also, d_j represents the sum of the jth column of matrix $\boldsymbol{T}$ meaning the total impacts that criterion j gets from criteria. Furthermore, when $i = j(r_i + d_i)$, it displays the giving and received degree of influences; i.e., $(r_i + d_i)$ shows the intensity of the important role that factor i plays in the problem. When $(r_i - d_i)$ is positive, factor i has more influence on other factors. However, if $(r_i - d_i)$ is negative, other factors have more impacts on factor i. And thus the NRM can be constructed [16,30].

3.2. The DANP for obtaining criteria's influential weights

After verifying the influential relationship of the criteria by DEMATEL, the DANP is employed to obtain the influential weights of criteria. To diminish the limitations of the analytic hierarchy process (AHP) and establish a way for determining nonlinear and complicated network relationships, analytical network process (ANP) was developed by Saaty [24]. Nevertheless, the survey questionnaire of ANP, revealed by Chen et al. [4], was too laborious for interviewees to fill out. This study thus utilizes DANP [21] to solve the difficulty of implementing ANP for acquiring the influence weights based on the NRM from DEMATEL and deal with problems of dependence and feedback among criteria.

The DANP is divided into four steps, and beginning with establishing the influence network structure according to DEMATEL. Secondly, the unweighted supermatrix is obtained. The total influence matrix $\boldsymbol{T}$ shown in Eq. (5) is received from DEMATEL.

$$\boldsymbol{T}_c = \begin{array}{c} \\ D_1\ c_{11}\cdots c_{1m_1} \\ \vdots \\ D_i\ c_{i1}\cdots c_{im_i} \\ \vdots \\ D_n\ c_{n1}\cdots c_{nm_n} \end{array} \begin{array}{c} \begin{array}{cccccc} D_1 & & D_j & & D_n \\ c_{11}\cdots c_{1m_1} & \cdots & c_{j1}\cdots c_{jm_j} & \cdots & c_{n1}\cdots c_{nm_n} \end{array} \\ \begin{bmatrix} \boldsymbol{T}_c^{11} & \cdots & \boldsymbol{T}_c^{1j} & \cdots & \boldsymbol{T}_c^{1n} \\ \vdots & & \vdots & & \vdots \\ \boldsymbol{T}_c^{i1} & \cdots & \boldsymbol{T}_c^{ij} & \cdots & \boldsymbol{T}_c^{in} \\ \vdots & & \vdots & & \vdots \\ \boldsymbol{T}_c^{n1} & \cdots & \boldsymbol{T}_c^{nj} & \cdots & \boldsymbol{T}_c^{nn} \end{bmatrix} \end{array} \tag{5}$$

To obtain $\boldsymbol{T}_C^{\alpha}$, utilize the total degree of influence to normalize each level of T_C by:

$$\boldsymbol{T}_C^{\alpha} = \begin{array}{c} \\ D_1\ c_{11}\cdots c_{1m_1} \\ \vdots \\ D_i\ c_{i1}\cdots c_{im_i} \\ \vdots \\ D_n\ c_{n1}\cdots c_{nm_n} \end{array} \begin{array}{c} \begin{array}{cccccc} D_1 & & D_j & & D_n \\ c_{11}\cdots c_{1m_1} & \cdots & c_{j1}\cdots c_{jm_j} & \cdots & c_{n1}\cdots c_{nm_n} \end{array} \\ \begin{bmatrix} \boldsymbol{T}_c^{\alpha 11} & \cdots & \boldsymbol{T}_c^{\alpha 1j} & \cdots & \boldsymbol{T}_c^{\alpha 1n} \\ \vdots & & \vdots & & \vdots \\ \boldsymbol{T}_c^{\alpha i1} & \cdots & \boldsymbol{T}_c^{\alpha ij} & \cdots & \boldsymbol{T}_c^{\alpha in} \\ \vdots & & \vdots & & \vdots \\ \boldsymbol{T}_c^{\alpha n1} & \cdots & \boldsymbol{T}_c^{\alpha nj} & \cdots & \boldsymbol{T}_c^{\alpha nn} \end{bmatrix} \end{array} \tag{6}$$

where $\boldsymbol{T}_c^{\alpha 11}$ can be computed by Eqs. (7) and (8); also, by the same way we can obtain $\boldsymbol{T}_c^{\alpha nn}$.

$$d_i^{11} = \sum_{j=1}^{m_1} t_{c^{ij}}^{11}, \quad i = 1, 2, \ldots, m_1 \tag{7}$$

$$\boldsymbol{T}_C^{\alpha 11} = \begin{bmatrix} t_{c^{11}}^{11}/d_1^{11} & \cdots & t_{c^{1j}}^{11}/d_1^{11} & \cdots & t_{c^{1m_1}}^{11}/d_1^{11} \\ \vdots & & \vdots & & \vdots \\ t_{c^{i1}}^{11}/d_i^{11} & \cdots & t_{c^{ij}}^{11}/d_i^{11} & \cdots & t_{c^{im_1}}^{11}/d_i^{11} \\ \vdots & & \vdots & & \vdots \\ t_{c^{m_1 1}}^{11}/d_{m_1}^{11} & \cdots & t_{c^{m_1 j}}^{11}/d_{m_1}^{11} & \cdots & t_{c^{m_1 m_1}}^{11}/d_{m_1}^{11} \end{bmatrix} = \begin{bmatrix} t_{c^{11}}^{\alpha 11} & \cdots & t_{c^{1j}}^{\alpha 11} & \cdots & t_{c^{1m_1}}^{\alpha 11} \\ \vdots & & \vdots & & \vdots \\ t_{c^{i1}}^{\alpha 11} & \cdots & t_{c^{ij}}^{\alpha 11} & \cdots & t_{c^{im_1}}^{\alpha 11} \\ \vdots & & \vdots & & \vdots \\ t_{c^{m_1 1}}^{\alpha 11} & \cdots & t_{c^{m_1 j}}^{\alpha 11} & \cdots & t_{c^{m_1 m_1}}^{\alpha 11} \end{bmatrix} \tag{8}$$

To acquire the unweighted supermatrix, use the interdependent relationship in group to array $\boldsymbol{T}_C^{\alpha}$ by:

$$\boldsymbol{W} = (\boldsymbol{T}_c^{\alpha})' = \begin{array}{c} \\ D_1\ c_{11}\cdots c_{1m_1} \\ \vdots \\ D_j\ c_{j1}\cdots c_{jm_j} \\ \vdots \\ D_n\ c_{n1}\cdots c_{nm_n} \end{array} \begin{array}{c} \begin{array}{cccccc} D_1 & & D_i & & D_n \\ c_{11}\cdots c_{1m_1} & \cdots & c_{i1}\cdots c_{im_i} & \cdots & c_{n1}\cdots c_{nm_n} \end{array} \\ \begin{bmatrix} \boldsymbol{W}^{11} & \cdots & \boldsymbol{W}^{i1} & \cdots & \boldsymbol{W}^{n1} \\ \vdots & & \vdots & & \vdots \\ \boldsymbol{W}^{1j} & \cdots & \boldsymbol{W}^{ij} & \cdots & \boldsymbol{W}^{nj} \\ \vdots & & \vdots & & \vdots \\ \boldsymbol{W}^{1n} & \cdots & \boldsymbol{W}^{in} & \cdots & \boldsymbol{W}^{nn} \end{bmatrix} \end{array} \tag{9}$$

where $\boldsymbol{W}^{11}$ can be obtained by Eq. (10), and $\boldsymbol{W}^{nn}$ is the same. In addition, if a blank space or 0 appear in the matrix, the group or criterion is independent.

$$\boldsymbol{W}^{11} = (\boldsymbol{T}^{11})' = \begin{array}{c} \\ \boldsymbol{c}_{11} \\ \vdots \\ \boldsymbol{c}_{1j} \\ \vdots \\ \boldsymbol{c}_{1m_1} \end{array} \begin{array}{c} \begin{array}{cccccc} \boldsymbol{c}_{11} & \cdots & \boldsymbol{c}_{1i} & \cdots & \boldsymbol{c}_{1m_1} \end{array} \\ \begin{bmatrix} t_{c11}^{\alpha 11} & \cdots & t_{ci1}^{\alpha 11} & \cdots & t_{cm_1 1}^{\alpha 11} \\ \vdots & & \vdots & & \vdots \\ t_{c1j}^{\alpha 11} & \cdots & t_{cij}^{\alpha 11} & \cdots & t_{cm_1 j}^{\alpha 11} \\ \vdots & & \vdots & & \vdots \\ t_{c1m_1}^{\alpha 11} & \cdots & t_{cim_1}^{\alpha 11} & \cdots & t_{cm_1 m_1}^{\alpha 11} \end{bmatrix} \end{array} \tag{10}$$

The third step is to acquire the weighted supermatrix. The total influence matrix of dimensions $\boldsymbol{T}_D$ is calculated by Eq. (11). To obtain $\boldsymbol{T}_D^{\alpha}$, utilize the total degree of influence to normalize each level of $\boldsymbol{T}_D$ by Eq. (12).

$$d_i = \sum_{j=1}^{n} t_D^{ij}, \quad i = 1, 2, \ldots, n$$

$$\boldsymbol{T}_D = \begin{bmatrix} t_D^{11} & \cdots & t_D^{1j} & \cdots & t_D^{1n} \\ \vdots & & \vdots & & \vdots \\ t_D^{i1} & \cdots & t_D^{ij} & \cdots & t_D^{in} \\ \vdots & & \vdots & & \vdots \\ t_D^{n1} & \cdots & t_D^{nj} & \cdots & t_D^{nn} \end{bmatrix} \tag{11}$$

$$\begin{aligned} \boldsymbol{T}_D^{\alpha} &= \begin{bmatrix} t_D^{11}/d_1 & \cdots & t_D^{1j}/d_1 & \cdots & t_D^{1n}/d_1 \\ \vdots & & \vdots & & \vdots \\ t_D^{i1}/d_2 & \cdots & t_D^{ij}/d_2 & \cdots & t_D^{in}/d_2 \\ \vdots & & \vdots & & \vdots \\ t_D^{n1}/d_n & \cdots & t_D^{nj}/d_n & \cdots & t_D^{nn}/d_n \end{bmatrix} \\ &= \begin{bmatrix} t_D^{\alpha 11} & \cdots & t_D^{\alpha 1j} & \cdots & t_D^{\alpha 1n} \\ \vdots & & \vdots & & \vdots \\ t_D^{\alpha i1} & \cdots & t_D^{\alpha ij} & \cdots & t_D^{\alpha in} \\ \vdots & & \vdots & & \vdots \\ t_D^{\alpha n1} & \cdots & t_D^{\alpha nj} & \cdots & t_D^{\alpha nn} \end{bmatrix} \end{aligned} \tag{12}$$

By normalizing $\boldsymbol{T}_D^{\alpha}$ into the unweighted supermatrix, the weighted supermatrix can thus be derived displayed in the following equation:

$$\boldsymbol{W}^{\alpha} = \boldsymbol{T}_{\boldsymbol{D}}^{\alpha} \times \boldsymbol{W} = \begin{bmatrix} t_D^{\alpha 11} \times \boldsymbol{W}^{11} & \cdots & t_D^{\alpha i1} \times \boldsymbol{W}^{i1} & \cdots & t_D^{\alpha n1} \times \boldsymbol{W}^{n1} \\ \vdots & & \vdots & & \vdots \\ t_D^{\alpha 1j} \times \boldsymbol{W}^{1j} & \cdots & t_D^{\alpha ij} \times \boldsymbol{W}^{ij} & \cdots & t_D^{\alpha nj} \times \boldsymbol{W}^{nj} \\ \vdots & & \vdots & & \vdots \\ t_D^{\alpha 1n} \times \boldsymbol{W}^{1n} & \cdots & t_D^{\alpha in} \times \boldsymbol{W}^{in} & \cdots & t_D^{\alpha nn} \times \boldsymbol{W}^{nn} \end{bmatrix} \tag{13}$$

Fourthly, the limit supermatrix is obtained. According to the concept of Markov Chain, the weighted supermatrix multiplies by itself many times to calculate the limit supermatrix. Hence, the influential weight of each criterion is obtained by $\lim_{z\to\infty} = \boldsymbol{W}^z$. That is to say, the influential weights of DANP are acquired by the limit supermatrix $\boldsymbol{W}$ with power z, indicating any figure for power.

4. Empirical case analysis for improving professional services marketing

In this section, an empirical study is displayed to propose innovation strategies to manage reputation online for improving professional services of marketing. The data collected from experts are analyzed by utilizing a hybrid MCDM model, and the findings are displayed in helpful models for decision making.

4.1. Background and problem descriptions

Corporate reputation's great effects on relationship quality and the coming of information explosion make the issue of managing reputation online for people and organizations very critical [20]. Looking for information online has been a very popular tool; Taiwan especially, the population of utilizing internet has outstripped 16.95 million (73.57% of total population) in Taiwan, and the density of accessing internet is ahead of the world [29]. Therefore, it will be great damage in case professional services of marketing cannot provide people and organizations with innovation strategies to deal with ugly gossips and build good reputation online.

Furthermore, there are several factors affecting ORM, which makes professional services of marketing more difficult to manage people and organizations' reputation online. To aid professional services of marketing to comprehend what the affecting factors are, this study probes into the criteria in the experts' perspective ORM and constructs a decision model of ORM.

4.2. Data collection

The objects of questionnaire are experts with specialty of ORM and professional knowledge of marketing, including consultants of ORM, scholars of public relations and advertising, and managers of internet marketing. Moreover, the experiences of experts are described as follows: consultants of ORM are good at managing reputation on internet, scholars of public relations and advertising are those who have the specialty and teaching experience of public relation management and advertising, and managers of internet marketing specialize in using online activities to attract customers. In the point view of experts, the criteria of ORM and the professional services of marketing's performances under consideration of criteria are obtained by interviewing and filling in questionnaires. There are 15 objects comprising five consultants of ORM, five scholars of public relations and advertising, and five managers of internet marketing. The inquisition is carried out in November 2011.

4.3. Comprehending the relationships among ORM for constructing NRM

DEMATEL technique is utilized to examine interdependent and feedback problems among five criteria identified by literatures. In the first place, the influence matrix $\boldsymbol{A}$ is displayed (Table 1). Secondly, the normalized influence matrix $\boldsymbol{E}$ can be calculated by Eq. (1) (Table 2). Thirdly, the total influence matrix $\boldsymbol{T}$ is derived by Eq. (3) (Table 3). Lastly, the NRM of influential relationship is

Table 1
The initial influence matrix $\boldsymbol{A}$.

Criteria	C_1	C_2	C_3	C_4	C_5
C_1	0.000	3.467	1.267	2.267	0.000
C_2	3.133	0.000	3.667	2.467	3.133
C_3	1.267	3.867	0.000	2.133	1.267
C_4	2.333	2.067	1.933	0.000	2.333
C_5	2.133	2.733	2.067	3.267	2.133

Table 2
The normalized direct-influence matrix ***E***.

Criteria	C_1	C_2	C_3	C_4	C_5
C_1	0.000	0.281	0.103	0.184	0.157
C_2	0.254	0.000	0.297	0.200	0.249
C_3	0.103	0.314	0.000	0.173	0.173
C_4	0.189	0.168	0.157	0.000	0.232
C_5	0.173	0.222	0.168	0.265	0.000

Table 3
The total influence matrix ***T***.

Criteria	C_1	C_2	C_3	C_4	C_5
C_1	0.650	1.032	0.754	0.864	0.847
C_2	1.024	1.047	1.067	1.075	1.104
C_3	0.778	1.099	0.697	0.894	0.896
C_4	0.804	0.959	0.787	0.714	0.899
C_5	0.856	1.071	0.860	0.991	0.779

Note: $\frac{1}{n^2}\sum_{i=1}^{n}\sum_{j=1}^{n}\frac{\left|t_{ij}^{n}-t_{ij}^{n-1}\right|}{t_{ij}^{n}}\times 100\% = 2.021\% < 5\%$, where n denotes the number of sample and t_{ij}^{n} is the average influence of i criterion on j.

Table 4
The sum of influences giving and received.

Dimensions/criteria	r_i	d_i	$r_i + d_i$	$r_i - d_i$
Online reputation (D_1)	9.463	9.319	18.782	0.144
Centralized reputation systems (C_1)	4.146	4.111	8.258	0.035
Distributed reputation systems (C_2)	5.316	5.208	10.525	0.108
Reputation management (D_2)	13.084	13.228	26.312	−0.144
Customer relationships (C_3)	4.363	4.165	8.528	0.199
Employees (C_4)	4.164	4.538	8.702	−0.373
Social responsibility (C_5)	4.557	4.525	9.082	0.031

Table 5
The unweighted supermatrix.

Criteria	C_1	C_2	C_3	C_4	C_5
C_1	0.386	0.494	0.414	0.456	0.444
C_2	0.614	0.506	0.586	0.544	0.556
C_3	0.306	0.329	0.280	0.328	0.327
C_4	0.351	0.331	0.359	0.297	0.377
C_5	0.343	0.340	0.361	0.375	0.296

Table 6
The weighted supermatrix.

Criteria	C_1	C_2	C_3	C_4	C_5
C_1	0.153	0.196	0.176	0.194	0.189
C_2	0.243	0.201	0.249	0.232	0.236
C_3	0.185	0.198	0.161	0.188	0.188
C_4	0.212	0.200	0.207	0.171	0.217
C_5	0.207	0.205	0.207	0.215	0.170

Table 7
The stable matrix of DANP when power limit $z \to \infty$.

Criteria	C_1	C_2	C_3	C_4	C_5
C_1	0.183	0.183	0.183	0.183	0.183
C_2	0.231	0.231	0.231	0.231	0.231
C_3	0.185	0.185	0.185	0.185	0.185
C_4	0.201	0.201	0.201	0.201	0.201
C_5	0.200	0.200	0.200	0.200	0.200

constructed by the vector ***r*** and ***d*** (Table 4) from the total influence matrix ***T*** as shown in Fig. 1.

4.4. Finding influential weights of criteria by DANP

This research uses DANP to obtain the level of importance (global weights) of five criteria shown as Table 5–7 based on the

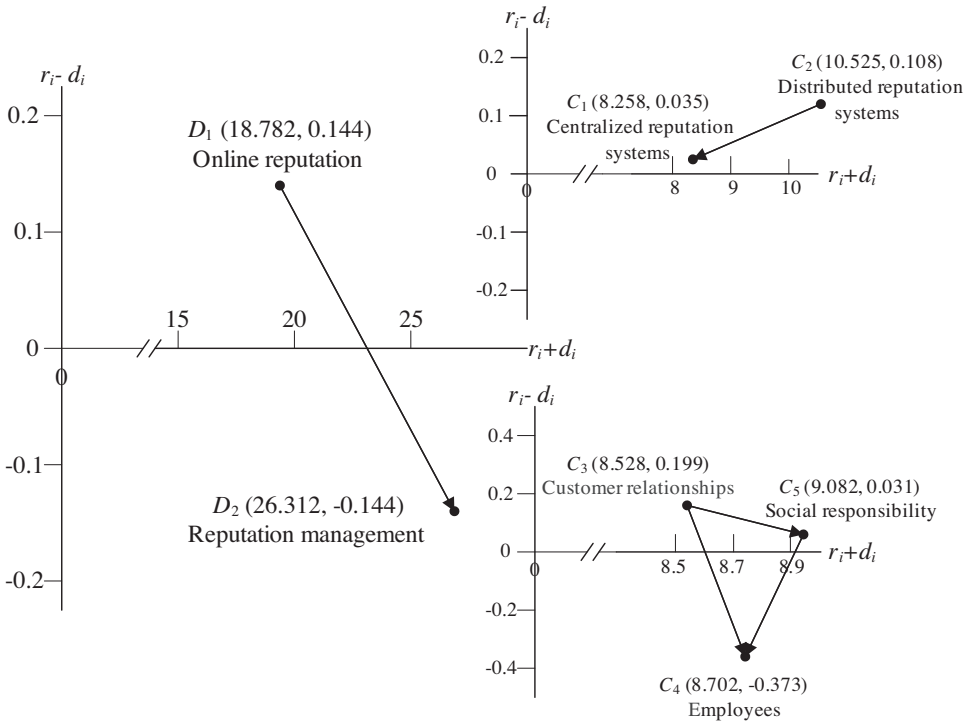

Fig. 1. The NRM of influential relationships within ORM.

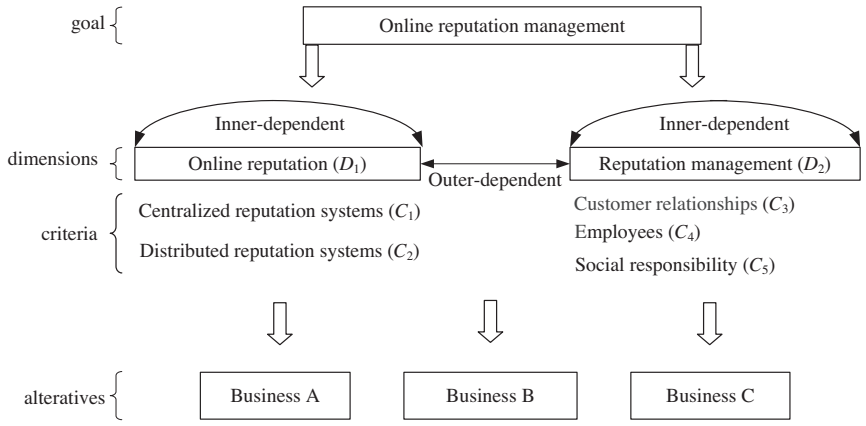

Fig. 2. Analytic framework of influence network of ORM.

Table 8
Influential weights and performances of three selected marketing services.

Dimensions/criteria	Local weights	Global weights	Business A	Business B	Business C
Online reputation (D_1)	0.414		6.137	5.613	5.156
Centralized reputation systems (C_1)	0.442	0.183 (5)	8.467	7.733	8.667
Distributed reputation systems (C_2)	0.558	0.231 (1)	2.533	3.933	4.133
Reputation management (D_2)	0.586		7.924	8.040	7.654
Customer relationships (C_3)	0.316	0.185 (4)	7.400	7.467	6.467
Employees (C_4)	0.343	0.201 (2)	9.133	8.867	8.600
Social responsibility (C_5)	0.341	0.200 (3)	7.533	7.400	7.800
Total performances			7.184	7.035	6.620

Example: Calculating total performance by global weights: $0.183 * 8.467 + 0.231 * 2.533 + 0.185 * 7.400 + 0.201 * 9.133 + 0.200 * 7.533 = 7.184$.
Calculating total performance by local weights: $0.414 * 6.137 + 0.586 * 7.924 = 7.184$.

construction of the influence network by DEMATEL (Fig. 2). The empirical results show that experts put more attention on distributed reputation systems (C_2) and employees (C_4); however, less on customer relationships (C_3) and centralized reputation systems (C_1). The outcomes reveal that the level of importance is much higher in distributed reputation systems, employees, and customer relationships. Specifically, distributed reputation systems get the highest influential weight of 0.190, followed by employees (0.201), and social responsibility (0.200). Furthermore, the level of importance of customer relationships and centralized reputation systems is relatively lower averaging 0.184. When comparing criteria within dimension, experts consider distributed reputation systems as the most significant criterion in the dimension of online reputation (D_1). Besides, employees are regarded by experts as the most important criterion in the dimension of reputation management (D_2). The findings present that experts suggest distributed reputation systems is the last criterion for professional services of marketing should neglect when implementing ORM. In the standpoint of dimensions, experts are much concerned with dimension of online reputation (D_1) in that the mean (0.207) of its criteria is much higher than the other (0.195). In addition, Table 8 presents the integrated values calculated to acquire the total performances. The results display the total performance is highest in Business A, one of professional services of marketing selected in Taiwan, followed by Businesses B and C. Consequently, according to the decision model provided by this study, professional services of marketing are suggested to take Business A as an example when improving their services based on ORM.

4.5. Implications and discussions

Discussions of empirical findings and innovation strategies for improving ORM are provided as follows. Firstly, NRM established by DEMATEL reveals the influential relationships within ORM suggesting what professional services of marketing should improve first is online reputation (D_1) for enhance their service quality. When making entire scores publicly available for distributed reputation systems (C_2) and receiving reputation scores for centralized reputation systems (C_1), reputation management (D_2) can get following influences: customers can access to suitable information, promoting good news and amended bad ones, about products and services of companies for consolidating customer relationships (C_3); the effects of social responsibility (C_5) can be enlarged to make the reputation of companies more remarkable; employees (C_4) can adjust their way of administering corporate reputation by feedback from customers. Secondly, the most important criterion obtained by DANP when implementing ORM is distributed reputation systems (C_2), whose influential weight equals 0.231. When it comes to ORM, a critical procedure for professional services of marketing to consider is that favorable information must be delivered by online and traditional media in the times of information technology. If information of products and services are not distributed rapidly and extensively, consumers cannot access to the information of companies, which will make the performances of professional services of marketing decay. Hence, professional services of marketing should use online forums, blogs, social media, traditional media, the technique of search engine optimization (SEO), and so forth as marketing tools. Thirdly, the influential weight of employees (C_4) is 0.201 ranked second among the five criteria of ORM. Once consumers receive the information of products and services, the next important issue for professional services of marketing is let employees to monitor whether the information is positive or negative. Anyone can spread comments on internet about products or services. If the information is positive for companies, it will help build good reputation online. However, negative information disseminate especially fast, which

will cause great damage to companies, if employees cannot provide correct and positive information immediately. Therefore, employees should be trained to respond the negative and fake information to make companies keep good reputation online. Lastly, the performances of three businesses evaluated by experts reveal that Business A is the optimal example for improving professional services of marketing.

The proposed hybrid MCDM model based on ORM can be utilized in worldwide professional services of marketing. They can adjust the influential weights of the five criteria according to the situations of different countries to obtain valuable information of decision making when implementing ORM. Moreover, they can select the businesses of professional services of marketing to evaluate and improve ORM.

5. Conclusions and remarks

ORM is used in the field of internet marketing as an important tool for professional services of marketing. It has been just developed for several years and investigated that two dimensions of online reputation and reputation management have impacts on it. Also, it is vague how the criteria influence on the two dimensions. Though the understanding of the importance of the criteria can be valuable for professional services of marketing when implementing ORM, the influential weights of criteria are seldom examined.

By using DEMATEL, the criteria of ORM are proved having interrelations and self-feedback relationships. Furthermore, DANP is utilized to acquire influential of the five criteria. Empirical findings display that distributed reputation systems is the most important criterion, followed by centralized reputation systems, customer relationships, social responsibility, and employees. Experts suggest that professional services of marketing put the most emphasis on distributed reputation systems, although they must completely take criteria into consideration when making decisions of ORM. As for evaluating ORM, the highest integrated scores of criteria is Business A, followed by Businesses B and C. Hence, experts indicate that ORM of Business A is an optimal example when implementing ORM for professional services of marketing to achieve the greatest benefit of internet marketing.

Preceding studies pay little attention to introducing ORM and indentifying the criteria that influence it. Moreover, few researches are concerned about the interrelationship among criteria, the weights of criteria, and the evaluation of professional services of marketing. This study thus proposes a hybrid MCDM model and examines the perspectives of experts for investigating these issues. Associating preceding theoretical researches with the experts of practical experience makes OMR more beneficial to improve professional services of marketing, which is not provided by previous researches. In short, this study uses a hybrid MCDM model based on ORM to investigate the subject for evaluating and improving professional services of marketing, and further studies can take more comprehensive factors or sub-factors into consideration to make the research of ORM more mature.

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