A balanced scorecard approach to establish a performance evaluation and relationship model for hot spring hotels based on a hybrid MCDM model combining DEMATEL and ANP

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ABSTRACT

The balanced scorecard approach is an effective technique for performance evaluation. For more accurately reflecting the dependence and feedback problems of each factor in real world situations, here a new model is developed using a balanced scorecard approach for evaluating the performance of hot spring hotel. A DANP hybrid MCDM model is adopted to solve the dependence and feedback problems, while establishing a performance evaluation and relationship model. An empirical case study is presented to demonstrate the effectiveness of the proposed hybrid MCDM model. Based on this study, the perspective between 'learning and growth', 'enterprise's internal processes', and 'customer', all aim for solid financial performance as the ultimate goal, and report a positive influence. This effective performance evaluation model developed by applying the hybrid MCDM enables business managers to understand the appropriate actions and achieve a competitive advantage.

1. Introduction

In general, natural hot springs are comprised of geothermal water, containing minerals, gases, and certain elements that rise from underground via a vent. Hot spring pools, used for bathing, contain a combination of cold and hot water, gases and geothermal elements, and are thought to benefit human health. Taiwan is located in the juncture of the Eurasian Plate and Philippine Plate. The area has abundant hot spring resources, with varying chemical characteristics, scattered across the island. Every hot spring site has unique local features arising from its relationship with the local geology. Hot spring hotels are those hotels located in hot spring resource areas, where visitors can enjoy the hot springs, while having access to lodging, food services and social contact. They differ from ordinary hotels and resorts primarily due to the services associated with the core product of hot spring bathing (Hsieh, 2007). Europe has a long tradition of visiting hotel spas to obtain medical benefits. In recent years, regular hoteliers have rec-

ognized the benefits and increased revenue that a spa facility can bring (Thorsteinsdottir, 2005).

In 2009, the annual number of inbound travellers to Taiwan was around 4.4 million. The major recreation activities of such visitors were shopping (86.81%), visiting night markets (72.75%) and historical sites (57.19%), ecological tourism (29.77%), attending exhibitions (26.33%), visiting lakes (25.74%), and hot spring tourism (24.22%) (Taiwan Tourism Bureau, 2010a). Furthermore, hot spring tourism comprises 4.4% of the leisure activity of domestic tourists (Taiwan Tourism Bureau, 2010b). However, hot spring tourism has recently become fastest growing sector for both domestic and overseas visitors in Taiwan. This has naturally attracted the interest of the hot springs hotel industry. Not only has there been heavy investment in the construction of spa hotels, but also a significant increase in the development of hotel facilities centred on allowing guest to enjoy the hot springs. Taiwan's hot spring hotels have entered a mature stage. However there is still much variety in the operating style and business strategy of hotels in different areas, with spa products mainly as a subsidiary. As a consequence, product homogeneity is too high and market competition intense, which often makes it difficult for management to distinguish themselves from the pack and gain market share.

In recent years, drastic fluctuations in the global economic and financial environment have resulted in changes in the marketplace. As for all companies in the hospitality industry, the sales of hot spring hotels are highly contingent upon market change.

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To grow and become profitable amidst global competition, they have to enhance their performance across the board, addressing key questions such as: What is the current health of the industry and the interrelation between key indicators of performance assessment? If they can identify the major factors that will enhance the performance of the hot spring hotel and develop strategies accordingly, it will be possible to excel in a highly competitive market.

Successful performance results from goal achievement and project implementation (Wu and Hung, 2008). Methods for assessing performance evolve along with advances in technology and growing market demands. The tools which companies use to evaluate their own performance should offer some predictive qualities concerning future performance. Such tools should lead them to the most likely future and help translate strategies into action. Among all the performance assessment indicators, the balanced scorecard approach, proposed by Kaplan and Norton (2004) as a performance management system for strategic mapping, can best translate strategies into tangible goals and measurements. In structure it consists of strategic management tools related to both financial and non-financial indicators. One part of the tool evaluates the results of past efforts; while the other aimed at future assessments. There are many factors that impact the performance of hot spring hotels. These factors can be summarized and classified into different constructs and then condensed into a smaller number. This new list of factors acts as an effective reference for decision-making. Therefore, in this study, the balanced scorecard approach, which has been widely adopted as a performance indicator, is applied to measure the performance of hot spring hotels.

In the management of hot spring hotels, one wants to not only know which factors affect performance, but also understand the degree of influence of each factor, and which sub-factors affect these factors. The purpose of this study is to create a better framework for decision-making for this type of management evaluation. The balanced scorecard approach, developed by Kaplan and Norton (2004), is adopted for this purpose with Multiple Criteria Decision Making (MCDM) employed for the performance evaluation. There is a causal relationship between the four perspectives involved in this approach (Sim and Koh, 2002; Banker et al., 2004; Davis and Albright, 2004; Wu and Hung, 2008). The aim is to determine which sub-factors influence the four perspectives and their corresponding sub-factors, with the goal of establishing a more comprehensive performance evaluation framework for hot spring hotels. The relationship between each factor and its sub-factors is considered. With this methodology we are able to consider multiple criteria at the same time. It also helps the decision maker to estimate the best choice, by sorting a limited number of cases according to their characteristics. The sub-factors for the four perspectives are found by collecting and analyzing data.

The Decision Making Trial and Evaluation Laboratory (DEMATEL) technique is then used to confirm the relationship between various perspectives, to enhance our understanding of the complex issues related to performance. A network-relationship map (NRM) of the performance of the hot spring hotel is prepared, which, combined with the DEMATEL-based Analytic Network Process (DANP) helps to measure the mutual importance of each factor. However, the ANP method deals with normalization in the supermatrix by assuming that each cluster has equal weight. Although this method for normalizing the supermatrix is easy, it seems irrational to assume equal weights, because of the different degrees of influence of the criteria (Ou Yang et al., 2008). Our strategy is to utilize a hybrid MCDM model that combines DEMATEL and ANP to solve the dependence and feedback problems, thus more accurately reflecting real world situations.

With this in mind, we develop a framework to consider these factors by combining the graph-theory based DEMATEL method with an ANP approach (hereafter DANP). An empirical case based on real hot spring hotels is also presented to demonstrate the effectiveness of the hybrid DANP MCDM model. This method offers a more complete decision-making model especially designed to solve performance evaluation problems for hot spring hotels.

2. Literature review

This section discusses the factors utilized for performance evaluation in the past as well as the results of this study. The sub-factors that affect the main factors are identified, and evaluation criteria developed there from.

2.1. Performance evaluation

The performance evaluation is a systematic review process carried out to help an organization reach a certain goal. Making performance evaluation part of the management and control system helps the organization to effectively manage its resources and measure its performance in relation to its goals (Wu and Hung, 2008). Traditional evaluation metrics are most often based only on financial performance and are thus limited in their assessment of overall performance (Booth, 1996). The traditional evaluation of financial performance is not an effective or comprehensive measure, nor is it a holistic evaluation concept. Kaplan and Norton (1992) proposed the balanced scorecard approach in order to overcome these shortcomings.

2.2. Kaplan and Norton's balanced scorecard approach

The balanced scorecard approach takes into consideration the organization's vision and strategies, focusing on both financial and non-financial performance. In short, it monitors short-term financial performance while also highlighting the value of long-term financial metrics and competitiveness (Kaplan and Norton, 1992, 1996, 2001). According to Pinero (2002) the balanced scorecard approach is aimed at helping the organization achieve its goals, while maintaining the traditional financial perspective to measure its tangible assets. It includes three perspectives (i.e., customers, internal processes, and learning and growth) to evaluate intangible assets and intellectual capital. Organizational strategies are examined from both financial and non-financial perspectives, based on actual data for a comprehensive evaluation.

2.3. Causal relationships in performance evaluation

Kaplan and Norton (2004) proposed "there is a causal relationship between the four perspectives of the balanced scorecard approach". If, financial results are the ultimate goal of any business enterprise, learning and growth serve as the foundation. The results from the financial metrics are lagging indicators, whereas the results from learning and growth, internal processes and customers are the leading indicators. Thus, financial performance can be improved by focusing on learning and growth, internal processes and customers (Kaplan and Norton, 2001). Kaplan and Norton (2004) suggest showing the interrelation between the four perspectives can be shown on a strategy map, since financial goals can be attained by making sure that the target customers are satisfied, it is imperative to identify areas of value creation for the customer, ways to generate sales and increase customer loyalty. Internal processes are an important aspect of value creation, and learning and growth is an important intangible component of this. Learning and growth is positively correlated to internal processes.
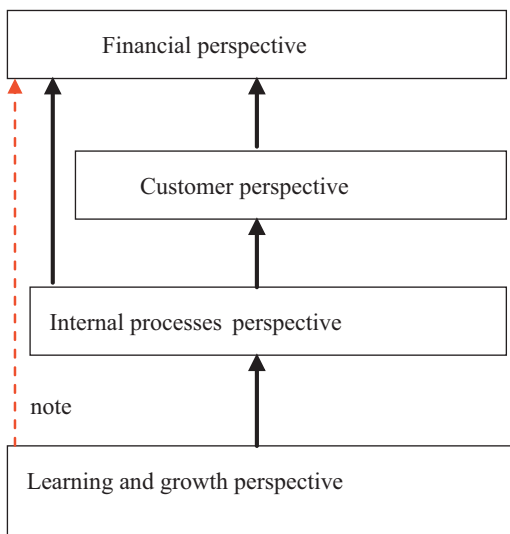
Fig. 1. Strategy maps for the balanced scorecard approach (Kaplan and Norton, 2004) (*Note*: Prieto and Revilla (2006) have suggested that learning capability is directly and positively correlated to finance)

Furthermore, internal processes are positively correlated with customers and finance, and customers are positively correlated with finance (Kaplan and Norton, 2004) (Fig. 1). Although the balanced scorecard approach has become one of the most popular tools used in the hotel industry in the last few years (McPhail et al., 2008; Fisher et al., 2010), some critics question its role in improving performance, because the correlation between non-financial measures and future benefits has not been demonstrated. These relationships are complex and are influenced by the organization's strategies and numerous other factors related to its structure (Anthony and Govindarajan, 1998; Ittner and Larker, 2001; Olve et al., 1999; Sim and Koh, 2002). Prieto and Revilla (2006) for example, argue that an organization's learning capability not only can enhance financial performance but has a direct and positive influence. Many scholars (e.g., Bierley and Chakrabarti, 1996; Ellinger et al., 2002; Tippins and Sohi, 2003; Wu and Hung, 2007) have suggested that learning capability and financial performance are directly and positively correlated with each other. To sum up, the factor of learning and growth has a positive influence on finance. Therefore, a model for performance evaluation can be established by incorporating the influence of learning and growth on finance, as shown in Fig. 1.

This study adopts the DEMATEL technique to explain the relationships between the various assessment criteria. This is a comprehensive method for building and analyzing a structural model involving causal relationships between complex perspectives (Wu and Lee, 2007), and constructing the correlations between perspectives/criteria to build an NRM (Tzeng et al., 2007; Huang et al., 2007; Ou Yang et al., 2008). This technique has been successfully applied for a variety of purposes such as creating marketing strategies and dealing with safety problems (Chiu et al., 2006; Liou et al., 2007). In addition, it has helped to develop the competencies of global managers (Wu and Lee, 2007), enabled socially responsible investment (Tsai et al., 2009) and assisted with cost evaluation in the hotel industry (Tsai et al., 2010).

2.4. Summary of the literature review to find hot spring hotel performance evaluation factors

Based on Kaplan and Norton's balanced scorecard approach, the literature review, expert opinions, brain storming and interviews with management of hot spring hotels, we proposed specific perspectives for evaluating performance, as illustrated in Table 1.

3. Methodology

A hybrid MCDM model is proposed which combines DEMATEL and ANP to confirm the effect of each perspective and criterion, and to measure the importance of each factor.

3.1. Data collection

A list of factors that can enhance the performance of hot spring hotels was collected from the performance dimensions listed in Table 1. The questionnaire was designed to include these. The relative importance criteria were found by asking experts to answer the questionnaire in Stage 1, selecting the important criteria (with a mean of 7.5 and above). Question responses ranged from 0 to 10 with a high score meaning high importance (Fig. 2). In order to ensure effective pair-wise comparisons and good consistency, Saaty (1980) suggests that there should be a limited number of factors in a single construct. In this study we asked three scholars in the tourism industry, six hot spring hotel proprietors and one government official in charge of tourism, to fill in the questionnaire. In Stage 2, importance scales, based on triangular fuzzy numbers (with a mean of 7.5 and above), were compiled. The results are shown in Table 2.

In Stage 2 the results of Stage 1 were applied and the DEMATEL and ANP methods combined and incorporated into the questionnaire design. The questionnaire aimed at comparing paired results of the importance of the criteria. The survey focused on the management of hot spring hotels. The views and thoughts on the assessment criteria were received from the respondents through personal interview and completed surveys. A total of 30 surveys were obtained for the period from October 2009 to December 2009. Each interview conducted with a respondent took about 50–60 min. The surveys were collected at the end of the interview.

3.2. DEMATEL technique for building a network relationship map

To develop a complete decision model we seek to understand whether factors or sub-factors interact or are independent. DEMATEL is commonly used to solve similar problems in MCDM. We use the DEMATEL technique to analyze the component structure of each criterion, as well as the direction and intensity of the direct and indirect relationships that flow between apparently well-defined components. DEMATEL uses matrix calculations to obtain all the direct and indirect causal relationships, as well as the impact strength. It uses a complicated and difficult system to directly compare the interaction between the criteria characteristics. A visual structural matrix and causal diagram is used to show the causal relationship and level of impact between criteria in a complex system. This in turn assists with the decision making process. The end product of the DEMATEL process is a visual representation—an individual map of the mind—by which the respondent organizes his or her own actions in the world. The results of the DEMATEL analysis illustrate the interrelation between components and can be used to discover which are central to the problem, as well as to find which factors or sub-factors affect each other or themselves. This is helpful to develop a complete decision model. DEMATEL is based on directed graphs (also called digraphs), which can separate the involved factors into cause and effect groups to better understand causal relationships. Digraphs are more useful than directionless graphs because they display the directed relationships of the subsystems.

Table 1
Hot spring hotel performance evaluation factors.

Perspective			
Learning and growth	Enterprise's internal processes	Customer	Finance
Criteria			
Employee education	Ability to keep existing customers	Customer satisfaction	Return on assets
Employee satisfaction	Speed of new product launch	Service quality	Personnel cost ratio
Employee professional ability	Time reduction for in handling customer complaint	Hotel image	Revenue growth rate
Employee productivity	Hotel management efficiency enhancement	Customer loyalty	Return on investment
Average employee resignation rate	Ability to respond to emergencies	New customer increase rate	Revenue from new customer ratio
Employee knowledge sharing	Training in environmental hygiene and cleaning operation	Traffic convenience	Group revenue growth rate
Employee ability to use IT products	Hotel product's innovative quality and uniqueness	Market share	Service cost reduction
Employee ability to manage emergencies	Time reduction of operation cycle	Customer relationship management	Net profit ratio
Employee effective use of marketing information	Sales promotion ability enhancement		Peripheral merchandise revenue ratio
	Customer background information compilation		
	Effective problem-solving percentage		

Source: 1. Bierley and Chakrabarti (1996); 2. Denton and White (2000); 3. Suzanne et al. (2001); 4. Ellinger et al. (2002); 5. Tippins and Sohi (2003); 6. Davis and Albright (2004); 7. Banker et al. (2004); 8. Papalexandris et al. (2005); 9. Getz and Brown (2006); 10. Prieto and Revilla (2006); 11. Wu and Hung (2008); 12. McPhail et al. (2008).
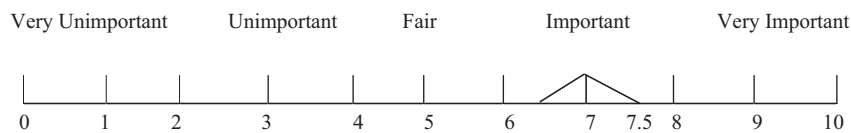

Fig. 2. Rank of importance level

3.3. Combining DEMATEL with ANP to find the important weights

When evaluating performance, businesses must usually consider multiple criteria and determine the relative weights of these criteria. These performance criteria are usually interdependent, and their individual weights are hard to obtain. The DEMATEL technique is not used to confirm the interactions affecting the relationship between the factors, but is aimed at obtaining more accurate weights. ANP is a more appropriate tool for finding the interactions. The ANP is a nonlinear structure that handles dependence within a cluster (inner dependence) and among different clusters (outer dependence), in contrast to the AHP (Analytical Hierarchy Process) which is hierarchical and linear with the goal at the top, and alternatives at lower levels (Saaty, 1999). In other words, the ANP does not require a strictly hierarchical structure so single or numerous networks may be included in an ANP model. The ANP has been applied successfully in many practical decision-making problems, such as green supply-chain management, enterprise risk management (Sarkis, 2003; Yilmaz, 2007), evaluation of hot spring hotel service quality (Hsieh et al., 2008), and innovative culinary development (Hu, 2009). The ANP provides a way to input judgments and measurements to derive ratio scale priorities for the distribution of influence among the criterion and groups of criteria in the

decision making process. Because the process is based on deriving ratio scale measurements, it can be used to allocate resources according to the ratio-scale priorities.

Since performance criteria usually influence one another, both direct and indirect effects are crucial factors when evaluating performance. This study adopts DANP for accurate evaluation of performance. Saaty proposed a method for analysis of ANP by adopting the limiting-process method of the powers of the super-matrix (Sekitani and Takahashi, 2001). Although, theoretically, ANP can be used for treatment of interdependencies, it is wise to first adopt the DEMATEL technique to generate a cause–effect relationship. The treatment of interdependencies in the unweighted supermatrix requires the use of the DEMATEL. It can produce valuable information for making decisions. A hybrid MCDM model, combining the DEMATEL technique with the ANP (DANP) method, can be used to solve the dependence and feedback problems. This combined method has been successfully used in various fields such as for e-learning evaluation (Tzeng et al., 2007), airline-safety measurement (Liou et al., 2007), and preparation of innovation policy portfolios for Taiwan's silicon/semiconductor intellectual property mall (SIP Mall) (Huang et al., 2007). To gain valuable decision making information, the DEMATEL is first used to draw a relationship diagram for hot spring hotel performance evaluation. The ANP is

Table 2
Criteria with a mean of 7.5 and above.

| Perspective			
Learning and growth	Enterprise's internal processes	Customer	Finance
Criteria			
Employee education	Ability to keep existing customers	Customer satisfaction	Return on assets
Employee professional ability	Hotel management efficiency enhancement	Service quality	Revenue growth rate
Employee productivity	Customer background information compilation	Hotel image	Net profit ratio
Employee ability to manage emergencies	Effective problem-solving percentage	Customer loyalty	
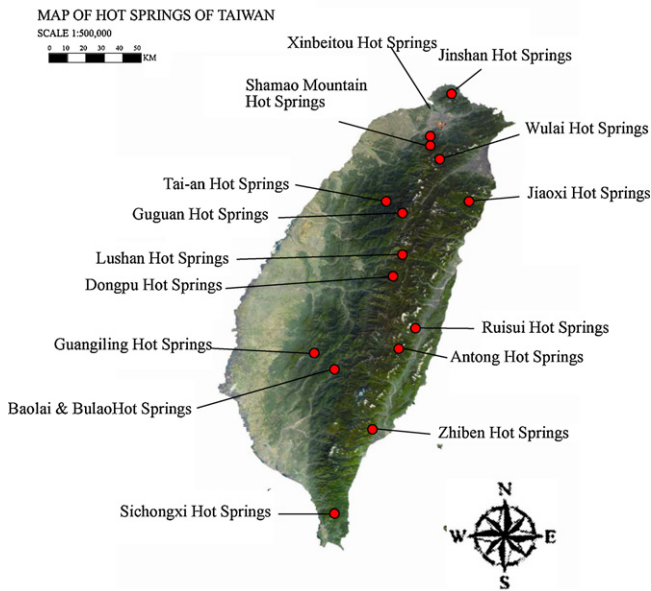
Fig. 3. Taiwan's primary hot spring map

Fig. 4. Structure of perspectives for the empirical case

then utilized to determine the weights of the evaluation criteria and prioritize them accordingly.

4. Results and discussion

This section includes an analysis of hot spring hotel performance and the measurement of the relationships among the performance evaluation criteria. We use this framework to find the key criteria illustrating the modes of performance evaluation based on an interview/questionnaire filled out by the proprietors of hot spring hotels.

4.1. Background and problem description

Taiwan's hot spring resources are fairly diverse and include cold springs (below 30 °C), muddy springs, sulfur springs, and carbonate springs. At present, 121 hot spring spots have been identified, distributed in almost every region in Taiwan. Ilan County has 19 (15.7%), the highest proportion (Water Resources Agency, 2010). The Jiaoxi hot springs, located in Ilan County, has very good hot springs resources. The development of hot spring recreation has a long history and is part of a rich cultural landscape. The Jiaoxi site is a very important and popular site for hot spring bathing in Taiwan, and the area has attracted a large number of spas with heavy investment in the construction of hot springs hotels. A map of Taiwan's primary hot springs is shown in Fig. 3. The Jiaoxi area, in Ilan County, is one of the most popular for hot springs tourism among overseas visitors and is the location of majority of large, modern hot springs leisure facilities in Taiwan. Furthermore, Jiaoxi near the Taipei City, so is a major hot springs tourism area for domestic tourists as well. With 30 hot spring hotels, this area is a decision-making leader, and thus selected for use with the optimum performance evaluation model for the management of hot spring hotels.

4.2. Analysis of results

Traditional strategy setting concepts do not consider interactions and multiple perspectives nor do they consider the interactive relationships among these criteria. In the real world, independence of the perspectives and criteria does not exist. It is important to find
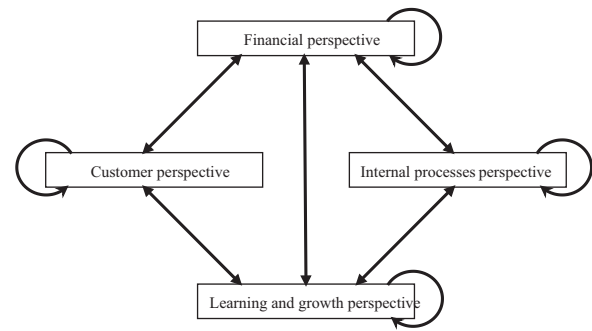
not only the key factors for evaluating performance but also the relationships among these criteria. In the DEMATEL formulation, respondents indicate the degree of direct influence on a scale of 0, 1, 2, 3 and 4, "No influence", "Low influence", "Medium influence", "High influence" and "Very high influence", respectively. The total influence matrix T and the NRM of the relationship between the perspectives found are shown in Table 3 and Fig. 4. The total influence matrix T for the criteria is shown in Table 4. It can be seen that all aspects are interdependent.

Tables 4–6 present the causal diagram of the total relationship presented in Fig. 5. Some criteria have positive values of $d_i - r_i$ and thus greatly influence the other criteria. These criteria are called dispatchers; others have negative values of $d_i - r_i$ and thus are greatly influenced by the other criteria. These are called receivers. The value of $d_i + r_i$ indicates the degree of relationship of each criterion with the other criteria. Criteria having higher values of $d_i + r_i$ have stronger relationships with the other criteria, while those having lower values of $d_i + r_i$ have a weaker relationship with the others. A significantly positive value of $d_i - r_i$ represents the fact that the criterion affects other criteria much more than those other criteria affect it, implying it should be a priority for improvement. In terms of managerial implications, the findings of the DEMATEL can provide some insights that allow enterprises to improve their performance based on the criterion that most significantly influences the performance of other criteria (Tsai et al., 2009). It can be seen in the middle panel (perspective) of Fig. 5, that C (Customer) is the first in the index of strength of influence given and received (4.255 in total sum $(d_C + r_C)$); A (Learning and growth) is next; and B (Enterprise's internal processes) is the third. In other words, the Customer (C) is the most important influencing factor. On the other hand, the Finance component (D) affects the other factors the least (3.617 in total sum $(d_D + r_D)$).

Hot spring hotels are a part of the service industry. As such they need to focus on encouraging customer satisfaction and repeat business. Therefore the Customer (C) perspective has the strongest relationships with the other perspectives. Kaplan and Norton (2004) also argue that "by making sure target customers are satisfied can the financial goals be attained." In addition, the values of $d_i - r_i$ for the B and A perspectives are positive, meaning that they affect other factors in the perspective.

If the values of $d_i - r_i$ for C and D are negative, it means that these criteria are influenced by other criteria. Similarly, in the Finance (D) panel of Fig. 5, it can be seen that d_2 (revenue growth rate) is the first in terms of the index of strength of influence given and received, d_3 (net profit ratio) is next, and d_1 (return on assets) is the third. In addition, if the values of $d_i - r_i$ of d_3 (net profit ratio) and d_1 (return on assets) are positive, they affect other factors in Finance D, whereas if the values of $d_i - r_i$ of d_2 (revenue growth rate) are negative, it shows that these criteria are influenced by other criteria. In the Customer (C) panel of Fig. 5, it can be seen that c_2 (service quality) is first in terms of the index of strength of influence

Table 3
Total-influence matrix T: four perspectives.

Perspectives	A	B	C	D	Row sum (d_i)	Column sum (r_i)	$d_i + r_i$	$d_i - r_i$
A	0.505	0.492	0.555	0.474	2.026	1.988	4.014	0.038
B	0.496	0.459	0.534	0.460	1.949	1.897	3.847	0.052
C	0.540	0.518	0.564	0.499	2.120	2.135	4.255	−0.015
D	0.446	0.429	0.483	0.413	1.771	1.846	3.617	−0.075

Table 4
Total-influence matrix T: fifteen criteria.

Criteria	a_1	a_2	a_3	a_4	b_1	b_2	b_3	b_4	c_1	c_2	c_3	c_4	d_1	d_2	d_3
a_1	0.471	0.562	0.490	0.532	0.505	0.542	0.439	0.509	0.579	0.593	0.561	0.530	0.470	0.503	0.470
a_2	0.561	0.507	0.512	0.547	0.523	0.566	0.456	0.529	0.593	0.609	0.581	0.550	0.487	0.516	0.487
a_3	0.495	0.525	0.401	0.489	0.467	0.512	0.409	0.470	0.528	0.546	0.512	0.495	0.449	0.475	0.445
a_4	0.526	0.541	0.477	0.449	0.493	0.520	0.423	0.502	0.559	0.576	0.544	0.517	0.454	0.484	0.453
b_1	0.511	0.536	0.464	0.501	0.435	0.523	0.443	0.479	0.552	0.568	0.540	0.524	0.463	0.493	0.458
b_2	0.533	0.549	0.489	0.517	0.508	0.476	0.445	0.499	0.570	0.580	0.550	0.528	0.479	0.504	0.475
b_3	0.446	0.465	0.406	0.437	0.440	0.453	0.332	0.417	0.487	0.500	0.473	0.455	0.400	0.427	0.402
b_4	0.531	0.548	0.476	0.525	0.495	0.532	0.434	0.437	0.568	0.580	0.545	0.527	0.465	0.492	0.464
c_1	0.554	0.578	0.503	0.551	0.536	0.563	0.469	0.517	0.524	0.613	0.582	0.556	0.491	0.520	0.486
c_2	0.567	0.590	0.512	0.555	0.539	0.571	0.470	0.527	0.602	0.545	0.590	0.555	0.491	0.530	0.494
c_3	0.552	0.580	0.506	0.550	0.539	0.570	0.468	0.528	0.598	0.619	0.514	0.556	0.495	0.529	0.498
c_4	0.514	0.537	0.477	0.516	0.510	0.534	0.445	0.498	0.565	0.584	0.551	0.465	0.475	0.500	0.474
d_1	0.448	0.462	0.418	0.441	0.434	0.470	0.379	0.422	0.486	0.499	0.471	0.456	0.360	0.451	0.421
d_2	0.462	0.476	0.428	0.445	0.443	0.474	0.381	0.438	0.497	0.508	0.483	0.469	0.430	0.390	0.429
d_3	0.448	0.468	0.421	0.439	0.434	0.471	0.374	0.425	0.486	0.503	0.476	0.460	0.424	0.451	0.360

Table 5
Row sum and column sum of criteria.

Perspective	Learning and growth (A)				Enterprise's internal processes (B)				Customer (C)				Finance (D)			Row sum
Criteria	a_1	a_2	a_3	a_4	b_1	b_2	b_3	b_4	c_1	c_2	c_3	c_4	d_1	d_2	d_3	
a_1	0.471	0.562	0.490	0.532												2.055
a_2	0.561	0.507	0.512	0.547												2.127
a_3	0.495	0.525	0.401	0.489												1.909
a_4	0.526	0.541	0.477	0.449												1.993
b_1					0.435	0.523	0.443	0.479								1.880
b_2					0.508	0.476	0.445	0.499								1.928
b_3					0.440	0.453	0.332	0.417								1.641
b_4					0.495	0.532	0.434	0.437								1.899
c_1									0.524	0.613	0.582	0.556				2.276
c_2									0.602	0.545	0.590	0.555				2.292
c_3									0.598	0.619	0.514	0.556				2.287
c_4									0.565	0.584	0.551	0.465				2.164
d_1													0.360	0.451	0.421	1.232
d_2													0.430	0.390	0.429	1.249
d_3													0.424	0.451	0.360	1.235
Column sum	2.052	2.135	1.880	2.017	1.878	1.985	1.653	1.832	2.289	2.362	2.236	2.131	1.214	1.292	1.211	–

Table 6
Sum of influences given and received on criteria.

| Perspectives (i)/criteria (i)	Row sum (d_i)	Column sum (r_i)	$d_i + r_i$	$d_i - r_i$
A. Learning and growth	**2.026**	**1.988**	**4.014**	**0.038**
a_1 Employee education	2.055	2.052	4.107	0.003
a_2 Employee professional ability	2.127	2.135	4.262	−0.009
a_3 Employee productivity	1.909	1.880	3.789	0.029
a_4 Employee ability to manage emergencies	1.993	2.017	4.011	−0.024
B. Enterprise's internal processes	**1.949**	**1.897**	**3.847**	**0.052**
b_1 Ability to keep existing customers	1.880	1.878	3.758	0.003
b_2 Hotel management efficiency enhancement	1.928	1.985	3.913	−0.057
b_3 Customer background information compilation	1.641	1.653	3.294	−0.012
b_4 Effective problem-solving percentage	1.899	1.832	3.730	0.067
C. Customer	**2.120**	**2.135**	**4.255**	**−0.015**
c_1 Customer satisfaction	2.276	2.289	4.565	−0.013
c_2 Service quality	2.292	2.362	4.654	−0.070
c_3 Hotel image	2.287	2.236	4.523	0.050
c_4 Customer loyalty	2.164	2.131	4.295	0.033
D. Finance	**1.771**	**1.846**	**3.617**	**−0.075**
d_1 Return on assets	1.232	1.214	2.446	0.018
d_2 Revenue growth rate	1.249	1.292	2.541	−0.043
d_3 Net profit ratio	1.235	1.211	2.466	0.025
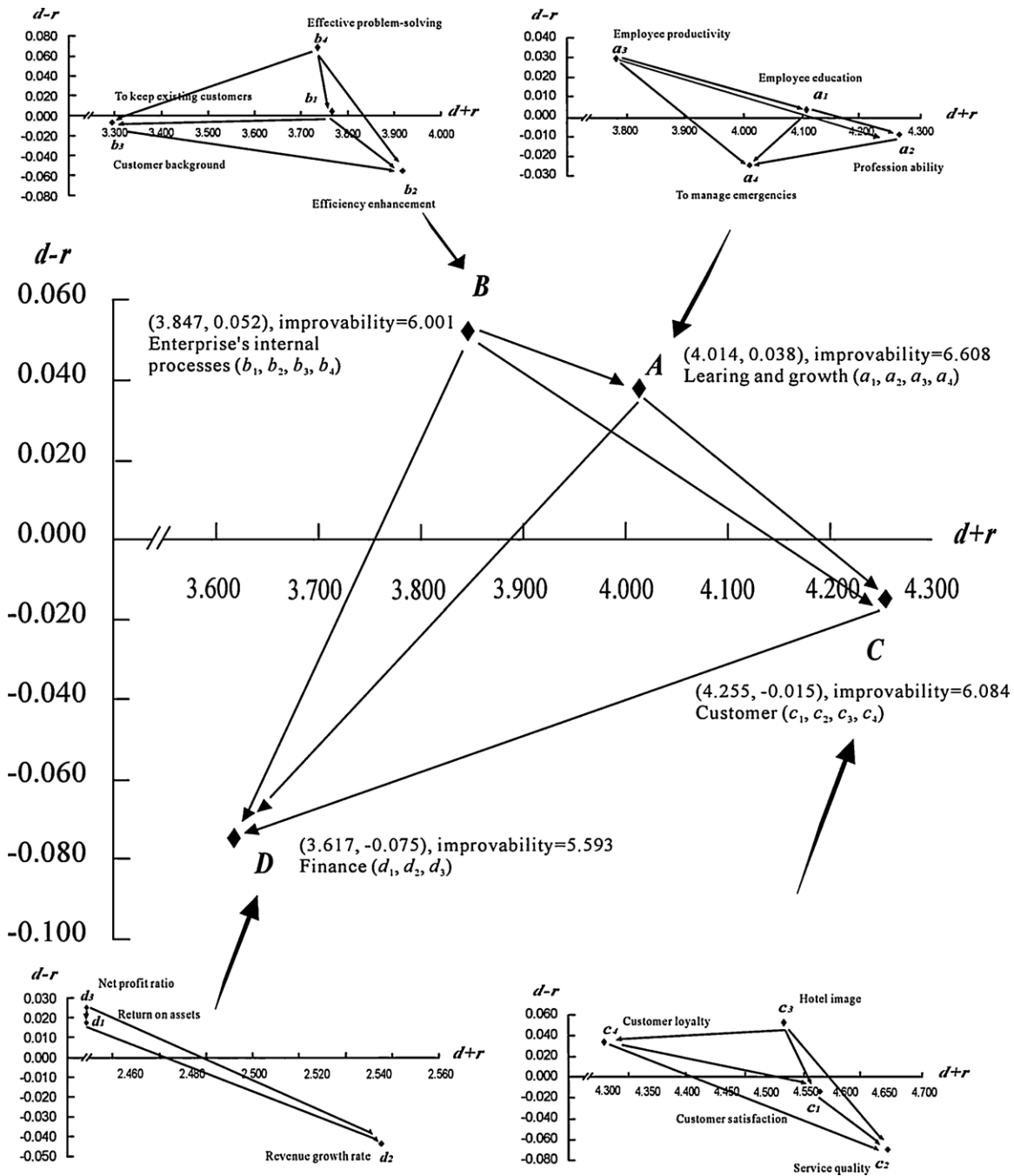
Fig. 5. Causal diagram of total relationships

given and received, c_1 (customer satisfaction) is next, and c_3 (hotel image) is the third. In the 'Learning and growth' (A) panel of Fig. 5, a_2 (employee professional ability) is the first in terms of the index of strength of influence given and received, a_1 (employee education) is next, and a_4 (employee ability to manage emergencies) is the third. Finally in the Enterprise's internal processes (B) panel of Fig. 5, b_2 (hotel management efficiency enhancement) is the first in terms of the index of strength of influence given and received, b_1 (ability to keep existing customers) is next, and b_4 (effective problem-solving percentage) is the third.

Table 6 shows the extent of the impact of each criterion, and whether it directly or indirectly affects other criteria. Service quality (c_2) is the most important consideration ($d_{c_2} + r_{c_2} = 4.654$) in

total sum; on the other hand, return on assets (d_1) is the criteria with the least impact on the other criteria ($d_{d_1} + r_{d_1} = 2.446$) in total sum. The findings are consistent with Hsieh et al. (2008), who stated that "to stand out in the hot spring industry, good service quality has become the most important issue for competitiveness".

The $d_{b_4} - r_{b_4}$ for the maximum effective problem-solving percentage (b_4), shows that this criterion has the greatest direct impact on others ($d_{b_4} - r_{b_4} = 0.067$) in total difference; whereas service quality (c_2) is the criterion most easily influenced by other criteria ($d_{c_2} - r_{c_2} = -0.070$) in total difference. Furthermore, it can be seen in the middle panel (perspective) of Fig. 5 that there exists a significant causal relationship between the four performance perspectives and that they influence each other. Perspective

A (Learning and growth) exhibits a positive influence on the perspective, *D* (Finance). Perspective (*B*) has a positive influence on perspectives (*A*) and (*C*). The perspectives of 'enterprise's internal processes' (*B*) and 'customer' (*C*), have a positive influence on the perspective of 'finance' (*D*). This means that the final aim of all perspectives is financial performance and they have a positive influence on financial results. The survey of hot spring hotel proprietors indicates that past financial performance has been poor (as shown by the lagging indicator of Kaplan and Norton). Their top priority is not on financial metrics. Rather, the focus is on driving financial performance through learning and growth, internal processes and customers (leading indicators according to Kaplan and Norton). In addition, according to $d_i + r_i$ and $d_i - r_i$, the finance criterion has the lowest degree of influence of all others. The findings of this study are largely consistent with the structure proposed by Kaplan and Norton (2004) regarding the performance management system and strategy maps obtained using the balanced scorecard approach. For example, the perspective of 'enterprise's internal processes' (*B*) has a positive influence on the perspectives of 'customer' (*C*) and 'finance' (*D*). The perspective of 'customer' (*C*) has a positive influence on the perspective of 'finance' (*D*). Other findings indicate that the perspective of 'learning and growth' (*A*) has a positive influence on the perspective of 'finance' (*D*). This is in line with Prieto and Revilla's (2006) findings.

In this study important indicators are obtained using the combined DEMATEL with ANP, and integrate the data from our survey of the management of hot spring hotels. The dynamic relationship between the indicators can be understood by mapping their degree of importance in an unweighted supermatrix. By considering the extent of the impact of various dimensions we prepare a weighted super-matrix. The limits of the super-matrix are used to obtain the weights of various factors (global weights), as shown in Table 7. The ANP approach allows us to derive the local weights of the assessment factors, their respective hierarchical levels, and also the global weights. All of this helps to understand the overall absolute weights of individual criteria. Properties are then arranged according to their global weights. The purpose is to determine the primary criteria that hot spring hotel operators must consider when seeking improving performance. The results are shown in Table 7.

Table 7 shows that among the 15 criteria, hot spring hotel proprietors believe that service quality should be the first priority, with a weight of 0.075, followed by customer satisfaction (0.073). The 3rd to 10th factors in order of importance from greatest to least, are employee's professional ability (0.072), hotel image (0.071), enhancement of hotel management efficiency (0.070), customer loyalty (0.0684), employee education (0.0682), employee's ability to manage emergencies (0.067), ability to keep existing customers (0.0653), and revenue growth rate (0.0649). Among the top 10 criteria, there are 3 included under the perspective of 'learning and growth', 2 under the perspective of 'enterprise's internal processes', 4 under the perspective of 'customer', and 1 under the perspective of 'finance'. As indicated in Table 7 the 'finance' criterion is less important. The ANP results show that finance is a lagging indicator, which is consistent with DEMATEL analysis. In addition, the management of hot spring hotels was rated from 0 to 10 to indicate future improvability of criteria, with 0 being the lowest score, meaning future improvability is expected to be very small, and 10 the highest score, indicating future improvability is likely to be very large. The results are shown in Table 7. The majority of hot spring hotel managers think that 'learning and growth' has a greater impact on improvement (total score of 6.608), and 'finance' lower (total score 5.593). This finding suggests that most managers believe that it is easier to improve employee's learning and growth than other factors. The results are largely consistent with the ANP results.

4.3. Discussion

This study finds a causal relationship between the four perspectives, that they influence each other and are also ultimately linked to the perspective of 'finance'. This is why they all have a positive influence on financial performance. In other words, improvement of any of the perspectives can enhance the achievement of financial goals. Improvement of overall performance will eventually enhance financial results. The ANP method finds that among the top 10 criteria, there are 3 under the perspective of 'learning and growth', 2 under the perspective of 'enterprise's internal processes', 4 under the perspective of 'customers' and only 1 under the perspective of 'finance'. This is consistent with Kaplan and Norton's findings (1996), that financial performance (as a lagging indicator) can be improved by focusing on leading indicators such as learning and growth, internal processes and customer. Therefore, hot spring hotel proprietors should not only focus on financial management, but also emphasize the other metrics. The better the performance of other constructs, the better the financial results.

As far as the performance criteria are concerned, Daniel (1961) notes in Management Information Crisis the three to six key factors leading to success in most industries. This paper utilizes the top six criteria (based on the ANP rankings) as the key factors that can enhance the performance of hot spring hotels. It is hoped that this list can serve as a reference for hotels in their strategic planning so that they can be successful in the face of tough competition and a changing marketplace. The following recommendations are proposed for hot spring hotels to enhance their performance:

1. Service quality: operators should consider the physical facilities, interior styling, convenience of parking, privacy of accommodation and bathing areas, hygiene and safety of the overall environment, promptness of service and the timely problem solving abilities of their service personal. They should also pay attention to whether service personnel are able to provide first-aid, the convenience of the reservation procedure and convenience of the traffic route/shuttle, in order to offer better quality services.

2. Customer satisfaction: visitors to hot spring hotels tend to complain if there is a gap between their expectations and the actual experience. Such a gap might alter their choice of leisure preferences. Hotels can conduct surveys to gauge customer satisfaction and gain an understanding of what the customer thinks. These surveys can become core resources, serving both as a reference for image creation and as an aid for developing a business model that meets the needs of customers.

3. Employee professional ability: the professional ability of employees tends to be influenced by work motives, skills, competencies and role awareness. If employees are happy with their job, they are more willing and more highly motivated to work and as a result, their efficiency and performance will improve. Training and education can enhance the professional ability of employees and create a good work atmosphere, improve job satisfaction and assist in the effective utilization of human resources to better work the performance of employees.

4. Hotel image: proprietors should adhere to the management policy of "we treat our customers with respect", strengthen the hotel's resources and improve the quality of service. This will help to create a positive image, promote goodwill and enhance the popularity of the hotel, attracting more customers.

5. Hotel management efficiency enhancement: it is necessary to deploy the most comprehensive internal processes to shorten the internal operating time, reduce the number of complaints from customers and create a safe leisure environment. Operators

Table 7
Weights and ranking for the empirical case.

Perspective/criteria	Local weights	Global weights (ranks)	Improvability
Learning and growth (A)	**0.269**		**6.608**
Employee education (a_1)	0.253	0.068(7)	6.600
Employee professional ability (a_2)	0.266	0.072(3)	6.667
Employee productivity (a_3)	0.232	0.062(12)	6.167
Employee ability to manage emergencies (a_4)	0.249	0.067(8)	6.976
Enterprise's internal process (B)	**0.256**		**6.001**
Ability to keep existing customers (b_1)	0.256	0.065(9)	5.767
Hotel management efficiency enhancement (b_2)	0.272	0.070(5)	5.733
Customer background information compilation (b_3)	0.220	0.056(15)	6.033
Effective problem-solving percentage (b_4)	0.252	0.064(11)	6.500
Customer (C)	**0.288**		**6.084**
Customer satisfaction (c_1)	0.254	0.073(2)	6.200
Service quality (c_2)	0.261	0.075(1)	6.400
Hotel image (c_3)	0.247	0.071(4)	5.967
Customer loyalty (c_4)	0.237	0.068(6)	5.733
Finance (D)	**0.187**		**5.593**
Return on assets (d_1)	0.327	0.061(13)	5.667
Revenue growth rate (d_2)	0.347	0.065(10)	5.800
Net profit ratio (d_3)	0.326	0.061(14)	5.300
Average	**–**	**1.000**	**6.112**

should launch innovative products and services to cater to the various needs of their customers.

6. Customer loyalty: hot spring hotels have to improve the capability of employees to prepare for, entertain and keep customers informed, to meet the needs of customers, whether those needs are for an informative and mentally stimulating experience or for other specific services or products that will attract the customer to revisit the hotel. Connecting product sales and customer service through information technology will enhance the quality of customer service. It is essential to constantly expand and develop the efficient provision of customer service so that it will add to the core competitiveness of the hotel.

Key performance evaluation criteria are the main reasons for the success of an enterprise. Hot spring hotels can refer to the key factors when they develop corporate strategies to create a competitive advantage. This study establishes a strategy map for hot spring hotels based on the key performance evaluation criteria ranked by the ANP weights and the causal links and strategy maps as proposed by Kaplan and Norton (2004). As shown in Fig. 6, to achieve sustainable operations, the mission of the hot-spring hotels is "to be a venue where people can unwind and relax". The vision is "to become a synonym for leisure and the first choice for a relaxing trip." To achieve this mission and vision, it is possible to follow the strategy map in Fig. 6 to enhance performance.
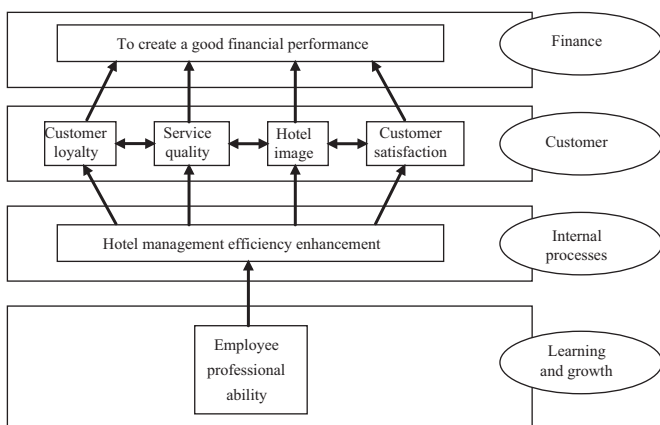

Fig. 6. Strategy map for enhancement of the performance of hot spring hotels (based on ANP ranking of the top six criteria)

In the causal relationships and strategy map proposed by Kaplan and Norton (2004), it is the vision and mission of the company that link individual factors and they have an influence on each other. None of the top six key performance evaluation criteria discussed in this paper are associated with the perspective of 'finance'. Here, the goal of this perspective in the strategy map for performance improvement is the creation of good financial performance. Among the top six criteria, four fall under the perspective of 'customer'. In other words, hot spring hotels should consider the 'customer' as the top priority. Continuous education and training of employees to improve their level of professionalism and emergency response abilities can contribute to the core competitiveness and effectively enhance the internal processes of an enterprise. In this way, service quality, hotel image, customer loyalty and customer satisfaction can be improved. The willingness of customers to revisit, and the arrival of new customers will result in improved financial performance.

5. Conclusions and remarks

As noted above, in this stage of maturity, hot spring hotels at many hot spring sites are faced with increasing market competition. Due to restriction on development in hot spring areas, mostly such hotels are small or medium sized. They are often at a disadvantage in comparison to large hotel chains in terms of products, pricing and promotions. Large fluctuations in the economic and financial environment can make it difficult to make a profit or achieve growth. The balanced scorecard approach discussed in Section 2.2 proposes four performance evaluation perspectives, but it does not explain the relative weight of the sub-factors, the degree of influence of each factor and which sub-factors will affect these factors. It is advantageous for the management of hot spring hotels to realise the relative weights of the factors and sub-factors for performance evaluation. Therefore, in this study, we develop a performance evaluation and interrelation model for hot spring hotels. Analysis of survey results is utilized to provide and prioritize the factors necessary to improve and to develop a strategy map that can be used as a reference for the industry. According to the results of DANP, the top six criteria or key factors that can enhance the performance of hot spring hotels are defined. Based on the strategy map developed by Kaplan and Norton (2004), we formulate a strategy map designed to enhance performance. It is hoped that this can assist hot spring hotels to maintain competitiveness.

Appendix A. A hybrid MCDM model combined with DEMATEL and ANP

A.1. DEMATEL

The DEMATEL method is used to construct the interrelations between criteria to build an NRM. The method can be summarized as follows:

Step 1: *Calculate the direct relation average matrix*. Respondents are asked to propose the degree of direct influence that each perspective/criterion i exerts on each perspective/criterion j, which is denoted by d_{ij}, using the assumed scales. An average matrix $\boldsymbol{D}$ is then derived through the mean of the same perspective/criteria in the various direct matrices of the respondents. The average matrix $\boldsymbol{D}$ is shown by the following equation:

$$\boldsymbol{D} = \begin{bmatrix} d_{11} & \cdots & d_{1j} & \cdots & d_{1n} \\ \vdots & & \vdots & & \vdots \\ d_{i1} & \cdots & d_{ij} & \cdots & d_{in} \\ \vdots & & \vdots & & \vdots \\ d_{n1} & \cdots & d_{nj} & \cdots & d_{nn} \end{bmatrix} \tag{1}$$

Step 2: *Calculate the initial direct influence matrix*. The initial direct influence matrix $\boldsymbol{X}$ (i.e., $\boldsymbol{X} = [x_{ij}]_{n \times n}$) can be obtained by normalizing the average matrix $\boldsymbol{D}$. In addition, the matrix $\boldsymbol{X}$ can be obtained through Eqs. (2) and (3), in which all principal diagonal criteria are equal to zero.

$$\boldsymbol{X} = s \cdot \boldsymbol{D} \tag{2}$$

$$s = \min \left[\frac{1}{\max_i \sum_{j=1}^{n} |d_{ij}|}, \frac{1}{\max_j \sum_{i=1}^{n} |d_{ij}|} \right] \tag{3}$$

Step 3: *Derive the total influence matrix*. A continuous decrease of the indirect effects of problems along the powers of $\boldsymbol{X}$ e.g., $\boldsymbol{X}^2, \boldsymbol{X}^3, \ldots,$ $\boldsymbol{X}^k$ and $\lim_{k \to \infty} \boldsymbol{X}^k = [0]_{n \times n}$, where $\boldsymbol{X} = [x_{ij}]_{n \times n}$, $0 \le x_{ij} < 1$, $0 < \sum_i x_{ij} \le 1$, $0 < \sum_j x_{ij} \le 1$ and at least one column sum $\sum_j x_{ij}$ or one row sum $\sum_i x_{ij}$ equals 1. The total influence matrix is listed as follows.

$$\boldsymbol{T} = \boldsymbol{X} + \boldsymbol{X}^2 + \cdots + \boldsymbol{X}^k = \boldsymbol{X}(I - \boldsymbol{X})^{-1} \tag{4}$$

where $\boldsymbol{T} = [t_{ij}]_{n \times n}$, for $i, j = 1, 2, \ldots, n$ and $(\boldsymbol{I} - \boldsymbol{X})(\boldsymbol{I} - \boldsymbol{X})^{-1} = \boldsymbol{I}$. In addition, the method presents each row sum and column sum of matrix $\boldsymbol{T}$.

$$d = (r_i)_{n \times 1} = \left[\sum_{j=1}^{n} t_{ij} \right]_{n \times 1} \tag{5}$$

$$r = (c_j)_{n \times 1} = (c_j)'_{1 \times n} = \left[\sum_{i=1}^{n} t_{ij} \right]' \tag{6}$$

where d_i denotes the row sum of the ith row of matrix T and shows the sum of direct and indirect effects of perspective/criterion i on the other perspective/criterion. Similarly, r_j denotes the column sum of the jth column of matrix $\boldsymbol{T}$ and shows the sum of direct and indirect effects that perspective/criterion j has received from the other perspective/criterion.

Step 4: Based on the influence matrix $\boldsymbol{T}$, each criterion t_{ij} of influence matrix $\boldsymbol{T}$ can show network information how degree of criterion i affects criterion j and the NRM can be obtained. The influ-
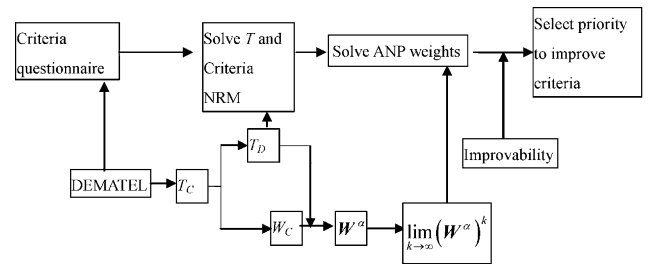

Fig. A1. The integrated approach of DANP.

ence matrix $\boldsymbol{T}$ can be divided into T_D based on dimensions and T_C based on criteria.

$$\boldsymbol{T}_C = \begin{bmatrix} \boldsymbol{T}_C^{11} & \cdots & \boldsymbol{T}_C^{1j} & \cdots & \boldsymbol{T}_C^{1n} \\ \vdots & & \vdots & & \vdots \\ \boldsymbol{T}_C^{i1} & \cdots & \boldsymbol{T}_C^{ij} & \cdots & \boldsymbol{T}_C^{in} \\ \vdots & & \vdots & \ddots & \vdots \\ \boldsymbol{T}_C^{n1} & \cdots & \boldsymbol{T}_C^{nj} & \cdots & \boldsymbol{T}_C^{nn} \end{bmatrix} \tag{7}$$

A.2. Based on DEMATEL technique to find ANP weights

ANP and AHP are traditional methods used to solve certain problems. The complexity of questionnaires surveys can mean that they are difficult to understand and therefore not easy to fill out. When making pair-wise comparisons of ANP and AHP, ANP is used for the establishment of an unweighted supermatrix for assigning importance weightings using the conditions of AHP. If we use a traditional ANP survey questionnaire, it will be too complex and difficult to understand. In order to overcome the difficulties of conducting ANP and AHP surveys, our study proposes a novel/new DANP method, employing a modified DEMATEL survey questionnaire, using the concept of Saaty's (1980) ANP values for transposition in order to obtain the influence weights. This novel/new method focuses on how to improve the gap for achieving the aspired level in each criterion and we suggest elements which we should be given priority for improvement. So the procedures of DANP can be shown as Fig. A1.

In procedures of DANP, the step is to compare the criteria in the whole system to form an unweighted supermatrix by pair-wise comparisons. Then the weighted supermatrix is derived by transforming the sum of each column exactly to unity (1.00). Each element in a column is divided by the number of clusters so the sum of each column will be exactly unity. For a normalized $\boldsymbol{T}_C$ with importance criteria with total degree of effect to obtain $\boldsymbol{T}_C^\alpha$. Take for example,

$$\boldsymbol{T}_C^\alpha = \begin{bmatrix} \boldsymbol{T}_C^{\alpha 11} & \cdots & \boldsymbol{T}_C^{\alpha 1j} & \cdots & \boldsymbol{T}_C^{\alpha 1n} \\ \vdots & & \vdots & & \vdots \\ \boldsymbol{T}_C^{\alpha i1} & \cdots & \boldsymbol{T}_C^{\alpha ij} & \cdots & \boldsymbol{T}_C^{\alpha in} \\ \vdots & & \vdots & \ddots & \vdots \\ \boldsymbol{T}_C^{\alpha n1} & \cdots & \boldsymbol{T}_C^{\alpha nj} & \cdots & \boldsymbol{T}_C^{\alpha nn} \end{bmatrix} \tag{8}$$

sub-matrix $\boldsymbol{T}_C^{12}$ (Eq. (9)) from matrix $\boldsymbol{T}_C$ to normalize into $\boldsymbol{T}_C^{\alpha 12}$ as shown as Eq. (9).

$$
\boldsymbol{T}_c^{12} =
\begin{array}{c}
c_{11} \\ \vdots \\ c_{1i} \\ \vdots \\ c_{1m_1}
\end{array}
\begin{bmatrix}
c_{21} & \cdots & c_{2j} & \cdots & c_{2m_2} \\
t_{11}^{12} & \cdots & t_{1j}^{12} & \cdots & t_{1m_2}^{12} \\
\vdots & & \vdots & & \vdots \\
t_{i1}^{12} & \cdots & t_{ij}^{12} & \cdots & t_{im_2}^{12} \\
\vdots & & \vdots & & \vdots \\
t_{m_1 1}^{12} & \cdots & t_{m_1 j}^{12} & \cdots & t_{m_1 m_2}^{12}
\end{bmatrix}
\begin{array}{l}
\rightarrow t_1^{12} = \sum_{j=1}^{m_2} t_{1j}^{12} \\
\vdots \\
\rightarrow t_i^{12} = \sum_{j=1}^{m_2} t_{ij}^{12} \\
\vdots \\
\rightarrow t_{m_1}^{12} = \sum_{j=1}^{m_2} t_{m_1 j}^{12}
\end{array}
$$

$$(9)$$

where $t_i^{12} = \sum_{j=1}^{m_2} t_{c\,ij}^{12}, \quad i = 1, 2, \ldots, m_1$

$$
\boldsymbol{T}_c^{\alpha 12} =
\begin{array}{c}
c_{11} \\ \vdots \\ c_{1i} \\ \vdots \\ c_{1m_1}
\end{array}
\begin{bmatrix}
c_{21} & \cdots & c_{2j} & \cdots & c_{2m_2} \\
t_{11}^{12}/t_1^{12} & \cdots & t_{1j}^{12}/t_1^{12} & \cdots & t_{1m_2}^{12}/t_1^{12} \\
\vdots & & \vdots & & \vdots \\
t_{i1}^{12}/t_i^{12} & \cdots & t_{ij}^{12}/t_i^{12} & \cdots & t_{im_2}^{12}/t_i^{12} \\
\vdots & & \vdots & & \vdots \\
t_{m_1 1}^{12}/t_{m_1}^{12} & \cdots & t_{m_1 j}^{12}/t_{m_1}^{12} & \cdots & t_{m_1 m_2}^{12}/t_{m_1}^{12}
\end{bmatrix}
$$

$$
=
\begin{bmatrix}
t_{11}^{\alpha 12} & \cdots & t_{1j}^{\alpha 12} & \cdots & t_{1m_2}^{\alpha 12} \\
\vdots & & \vdots & & \vdots \\
t_{i1}^{\alpha 12} & \cdots & t_{ij}^{\alpha 12} & \cdots & t_{im_2}^{\alpha 12} \\
\vdots & & \vdots & & \vdots \\
t_{m_1 1}^{\alpha 12} & \cdots & t_{m_1 j}^{\alpha 12} & \cdots & t_{m_1 m_2}^{\alpha 12}
\end{bmatrix}
$$

$$(10)$$

Step 5: *The unweighted supermatrix is formed by comparing the criteria for the whole system.* The first step of the ANP is to use pair-wise comparisons with the criteria. The general form of the supermatrix can be described by $\boldsymbol{W}^{21} = (\boldsymbol{T}_c^{\alpha 12})'$, where $'$ denotes the transposition, i.e., $\boldsymbol{W}^{21}$ is transposed by the normalized matrix $\boldsymbol{T}_c^{\alpha 12}$.

$$
\boldsymbol{W} = \left(T_c^{\alpha}\right)' =
\begin{array}{c}
C_1 \begin{array}{c} c_{11} \\ c_{12} \\ \vdots \\ c_{1m_1} \end{array} \\
C_i \begin{array}{c} c_{i1} \\ c_{i2} \\ \vdots \\ c_{im_i} \end{array} \\
C_n \begin{array}{c} c_{n1} \\ c_{n2} \\ \vdots \\ c_{nm_n} \end{array}
\end{array}
\begin{array}{c}
\overset{\displaystyle C_1}{\scriptstyle c_{11}..c_{1m_1}} \quad \overset{\displaystyle C_i}{\scriptstyle c_{i1}..c_{im_i}} \quad \cdots\cdots \quad \overset{\displaystyle C_n}{\scriptstyle c_{n1}..c_{nm_n}} \\
\begin{bmatrix}
W_{11} & \cdots & W_{1j} & \cdots & W_{1n} \\
\vdots & & \vdots & & \vdots \\
W_{i1} & \cdots & W_{ij} & \cdots & W_{in} \\
\vdots & & \vdots & \ddots & \vdots \\
W_{n1} & \cdots & W_{nj} & \cdots & W_{nn}
\end{bmatrix}
\end{array}
$$

$$(11)$$

$$
\boldsymbol{W}_{21} =
\begin{array}{c}
c_{21} \\ \vdots \\ c_{2j} \\ \vdots \\ c_{2m_2}
\end{array}
\begin{bmatrix}
c_{11} & \cdots & c_{1j} & \cdots & c_{1m_1} \\
t_{11}^{\alpha 12} & \cdots & t_{i1}^{\alpha 12} & \cdots & t_{m_1 1}^{\alpha 12} \\
\vdots & & \vdots & & \vdots \\
t_{1j}^{\alpha 12} & \cdots & t_{ij}^{\alpha 12} & \cdots & t_{m_1 j}^{\alpha 12} \\
\vdots & & \vdots & & \vdots \\
t_{1m_2}^{\alpha 12} & \cdots & t_{im_2}^{\alpha 12} & \cdots & t_{m_1 m_2}^{\alpha 12}
\end{bmatrix}
$$

$$(12)$$

where C_n denotes the nth cluster, c_{nm} denotes the mth criterion in the nth cluster, and $\boldsymbol{W}^{ij}$ is the principal eigenvector of the influ-

ence of the criteria in the jth cluster compared to the ith cluster. In addition, if the jth cluster has no influence on the ith cluster, then $\boldsymbol{W}^{ij} = [0]$.

Step 6: *Obtain the weighted supermatrix by multiplying the normalized matrix, which is derived according to the DEMATEL technique.* Ou Yang et al. (2008) proposed a hybrid method which adopted the DEMATEL technique to solve this problem. First, the DEMATEL technique is used to derive the total influence matrix T_C (Step 3) for n dimensions.

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

$$(13)$$

Therefore, the normalized total influence matrix is represented as $\boldsymbol{T}_D$, and $\sum_{j=1}^{n} t^{ij} = t^i, \quad i = 1, 2, \ldots, n$.

$$
\boldsymbol{T}_D^{\alpha} =
\begin{bmatrix}
t_{11}/t_1 & \cdots & t_{1j}/t_1 & \cdots & t_{1n}/t_1 \\
\vdots & & \vdots & & \vdots \\
t_{i1}/t_i & \cdots & t_{ij}/t_i & \cdots & t_{in}/t_i \\
\vdots & & \vdots & & \vdots \\
t_{n1}/t_n & \cdots & t_{nj}/t_n & \cdots & t_{nn}/t_n
\end{bmatrix}
$$

$$
=
\begin{bmatrix}
t_{11}^{\alpha D} & \cdots & t_{1j}^{\alpha D} & \cdots & t_{1n}^{\alpha D} \\
\vdots & & \vdots & & \vdots \\
t_{i1}^{\alpha D} & \cdots & t_{ij}^{\alpha D} & \cdots & t_{in}^{\alpha D} \\
\vdots & & \vdots & & \vdots \\
t_{n1}^{\alpha D} & \cdots & t_{nj}^{\alpha D} & \cdots & t_{nn}^{\alpha D}
\end{bmatrix}
$$

$$(14)$$

Next, $\boldsymbol{T}_D$ (hereafter referred to as 'the normalized matrix') and the unweighted supermatrix $\boldsymbol{W}$ are processed using Eq. (11) to obtain the weighted supermatrix $\boldsymbol{W}^{\alpha}$ for normalization.

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

$$(15)$$

Step 7: *Calculate the overall priorities with the limiting process method, as in Eq. (14).* The weighted supermatrix can be raised to limiting powers until it has converged and become a long-term stable supermatrix to obtain the global priority vectors or called the ANP weights.

$$
\lim_{h \to \infty} (\boldsymbol{W}^{\alpha})^h
$$

$$(16)$$

The overall weights are calculated using the above steps to derive a stable limiting supermatrix. Therefore, a model combining the DEMATEL with ANP methods can deal with the problem of interdependence and feedback.

Table A1
Group consensuses of 29 respondents on degree of influence among criteria, unit: %.

$\{|d_{ij}^{29} - d_{ij}^{28}| / d_{ij}^{29}\} \times 100\%$	a_1	a_2	a_3	a_4	b_1	b_2	b_3	b_4	c_1	c_2	c_3	c_4	d_1	d_2	d_3
a_1		0.33	0.52	1.30	2.13	1.01	1.85	0.13	0.33	0.33	0.12	0.88	0.28	0.65	0.28
a_2	0.37		0.00	1.27	0.77	0.16	1.98	0.16	0.19	0.23	0.30	0.26	1.21	1.00	1.07
a_3	0.73	0.19		2.23	1.90	0.08	1.75	0.73	2.21	1.11	2.11	2.17	0.68	0.57	0.93
a_4	0.16	2.39	0.88		2.17	0.65	1.65	0.23	0.12	0.30	0.00	0.95	1.79	1.98	1.82
b_1	0.63	0.17	1.93	0.87		0.95	0.22	2.00	0.17	0.04	0.08	0.12	0.74	0.41	0.53
b_2	0.00	1.08	1.01	2.23	2.26		0.69	0.52	0.08	1.11	0.31	0.46	0.36	0.92	0.81
b_3	1.28	0.53	1.72	1.90	0.92	1.93		1.69	0.36	0.98	0.52	0.63	0.06	0.33	0.18
b_4	0.16	2.42	2.07	2.47	0.48	0.98	1.93		1.34	1.30	0.31	1.11	2.03	0.48	0.48
c_1	0.00	0.23	2.19	0.23	0.16	1.19	0.98	2.15		1.46	1.39	1.24	0.65	0.69	0.43
c_2	0.40	0.50	0.98	0.16	1.19	1.24	0.81	2.28	0.27		0.40	0.95	0.28	0.95	0.57
c_3	0.31	0.16	2.17	0.00	0.16	0.16	0.81	1.11	0.19	0.50		1.08	0.69	1.05	0.88
c_4	2.03	2.13	2.07	2.26	1.19	1.01	0.85	2.28	0.00	0.30	0.46		0.46	0.85	2.26
d_1	1.90	1.82	0.38	1.87	0.33	0.36	0.06	0.13	0.65	2.17	2.05	2.11		1.27	1.01
d_2	0.61	2.00	1.00	1.69	0.43	0.74	1.46	2.03	0.81	0.74	0.80	0.46	0.22		0.26
d_3	1.85	1.98	1.07	1.72	1.93	0.41	0.84	0.00	0.87	0.52	0.74	0.63	0.17	1.22	
Average gaps							0.243% < 1%								

Note: Average $gaps = 1/n(n-1)\sum_i\sum_j (|\bar{d}_{ij}^{29} - \bar{d}_{ij}^{28}| / \bar{d}_{ij}^{29}) \times 100 = 0.243\%$, d_{ij}^{28} and d_{ij}^{29} denote the average scores of sample 28 and 29 respondents.

Table A2
Group consensuses of 30 respondents on degree of influence among criteria, unit: %.

$\{|d_{ij}^{30} - d_{ij}^{29}| / d_{ij}^{30}\} \times 100\%$	a_1	a_2	a_3	a_4	b_1	b_2	b_3	b_4	c_1	c_2	c_3	c_4	d_1	d_2	d_3
a_1		0.31	0.48	1.22	2.03	0.96	1.75	0.12	0.31	0.31	0.11	0.83	0.27	0.75	1.25
a_2	0.34		0.00	1.20	0.73	0.15	1.88	0.15	0.18	0.22	0.28	0.25	1.12	0.92	0.99
a_3	0.64	0.18		2.12	1.81	0.08	1.66	0.64	2.10	2.23	0.61	0.73	0.64	0.53	0.86
a_4	0.15	1.15	0.83		2.07	0.61	1.57	0.22	0.11	0.28	0.00	0.89	1.64	1.88	1.72
b_1	0.58	0.16	1.83	0.80		0.89	0.20	1.90	0.16	0.04	0.08	0.11	0.69	0.38	0.49
b_2	0.00	0.16	0.96	2.12	0.89		2.03	0.00	0.07	0.12	0.29	0.43	0.89	0.86	0.76
b_3	0.31	0.49	1.63	1.81	0.86	1.83		1.60	0.34	0.29	0.80	0.58	0.06	0.31	0.16
b_4	1.22	2.31	1.97	2.36	0.99	0.93	1.83		0.22	0.15	0.93	1.04	0.45	0.45	0.45
c_1	1.12	0.22	2.09	0.22	1.22	1.12	0.93	0.69		0.38	1.32	1.17	0.61	0.65	1.90
c_2	1.38	0.46	2.17	0.15	0.00	1.17	0.76	2.17	0.25		1.38	0.89	0.27	0.89	0.53
c_3	0.93	0.15	2.07	0.00	1.22	1.22	0.76	1.04	0.18	0.46		1.01	0.65	2.20	0.83
c_4	1.93	0.65	1.97	0.34	1.12	0.96	0.80	2.17	0.00	0.28	0.04		0.43	0.80	2.16
d_1	1.81	1.72	0.36	1.78	0.31	0.34	0.06	0.12	0.75	2.07	1.95	2.01		1.20	0.25
d_2	1.99	0.41	0.92	1.60	0.41	0.69	0.61	0.45	0.76	0.69	0.75	0.83	0.99		0.25
d_3	1.75	1.88	0.99	1.63	0.27	0.38	2.76	0.00	0.57	0.80	0.65	0.73	1.01	1.15	
Average gaps							0.212% < 1%								

Note: Average $gaps = 1/n(n-1)\sum_i\sum_j (|\bar{d}_{ij}^{30} - \bar{d}_{ij}^{29}| / \bar{d}_{ij}^{30}) \times 100 = 0.212\%$, d_{ij}^{29} and d_{ij}^{30} denotes the average scores of samples 29 and 30 respondents.

Appendix B.

In the questionnaires, a scale of 0, 1, 2, 3, 4, and 5 represents the range from "no influence" to "very high influence" for respondents to indicate the degree of direct influence that each perspective/criterion exerts on another perspective/criterion (30 questionnaires were returned; group consensuses are listed in Tables A1 and A2, with consensus values of less than 1%).

The first step questionnaire

> ## A Balanced Scorecard Approach to Establish A Performance Evaluation and Relationship Model for Hot Spring Hotels
>
> Good day! This is an academic research about "**A Balanced Scorecard Approach to Establish a Performance Evaluation and Relationship Model of Hot Spring Hotels**". The purpose is to explore hot spring hotel's dimension of performance evaluation, evaluation index, and key factors related to performance evaluation.
>
> As we are greatly impressed by your company's outstanding achievement in this field, if we could have the honor of obtaining your precious opinions, the result and credibility of this research will be tremendously benefited. All the information provided will be used for academic statistical analysis only, and will not be separately announced to the outside or transferred to other applications. Therefore, please feel at ease in filling out the answers.
>
> Your support will be very crucial to the successful completion of this research. We sincerely hope that you would spend some time to express your opinions to be taken as reference for this research. Please accept our most sincere appreciation. Thank you and wish you all the best.

1. Instructions for filling out the questionnaire

This questionnaire is divided into four parts: 1) instructions for filling out; 2) standard description; 3) method for filling out; 4) comparison of the impact of the four dimensions; 5) comparison of the impact of the 37 standards; 6) personal data.

2. Descriptions of dimension and standard

Perspective	Criteria	Description
Learning and growth perspective	Employee education	Carry out employee training and education to enhance their quality
	Employee satisfaction	Employee's satisfaction level to the hot spring hotel and current position
	Employee professional ability	Employee's professional knowledge and ability in running the business of a hot spring hotel
	Employee productivity	Service or product produced by each employee
	Average employee resignation rate	Number of resigned employee within a time period/the total number of employee

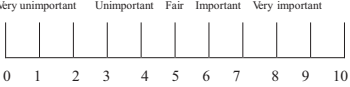| | Employee knowledge sharing | Knowledge and resource sharing among employees to achieve new product development and customer service |
	Employee ability to use IT products	Employee's ability to accurately apply real time information to understand the relationship between individual customer and the hot spring hotel
	Employee ability to manage emergencies	Employee's ability in responding to and managing emergencies when they occur
	Employee effective use of marketing information	Employee's use of real time marketing information to attract customer's visit
Enterprise's internal processes perspective	Ability to keep existing customers	Products provided in the hot spring hotel are able to attract customer to revisit the hotel
	Speed of new product launch	The speed to launch new products or services provided by the hot spring hotel accords with customer's current and future needs
	Time reduction in handling customer complaint	Consistent reduction of time required to respond and handle customer's complaint to the hot spring hotel
	Hotel management efficiency enhancement	Provide hotel products and services to customers in a timely and highly efficient manner
	Ability to respond to emergencies	Hotel's ability in responding to and managing any emergency or incident as it occurs
	Training in environmental hygiene and cleaning operation	The level of cleanliness in terms of the hot spring hotel's environmental hygiene
	Hotel product's innovative quality and uniqueness	Hot spring hotel's innovative and unique design in environmental landscape and products to attract customers
	Time reduction of operation cycle	Reduce the amount of time required for each process to provide products and services in the fastest manner
	Sales promotion ability enhancement	Hotel's ability to launch products and services that attract customers and fulfill their needs
	Customer background information compilation	Understand customer's background information to provide tailor-made products and services
	Effective problem-solving percentage	Percentage of successful resolution of all kinds of problems in the hot spring hotel
Customer perspective	Customer satisfaction	Customer's satisfaction level to products and services provided by the hot spring hotel
	Service quality	Customer's evaluation of the services provided by the hot spring hotel

	Hotel image	Hotel image construction and customer's trust to such brand
	Customer loyalty	Customer will revisit the hotel in the future for certain specific services or products
	New customer increase rate	New customer increate rate of the hotel
	Traffic convenience	Hotel location's traffic convenience
	Market share	Hotel's revenue compared to the overall revenue of the industry
	Customer relationship management	Connect product sales and customer service together through IT to enhance the quality of customer service
Finance perspective	Return on assets	Current period net income or loss/Total assets
	Personnel cost ratio	Personnel costs/Total operating costs
	Revenue growth rate	(Current period revenue-revenue of the same period last year)/Revenue of the same period last year
	Return on investment	Current period net income or loss/Investment amount
	Revenue from new customer ratio	Revenue from new customers/Revenue income
	Group revenue growth rate	(Current period group revenue-group revenue of the same period last year)/Group revenue of the same period last year
	Service cost reduction	Reduce all kinds of service cost of the hotel
	Net profit ratio	Current period net profit/Revenue income
	Peripheral merchandise revenue ratio	Peripheral merchandise (local specially developed agricultural products such as hot spring mochi, coffee, etc) revenue income/Revenue income

3. Method for filling out

Examples for filling out the level of importance and improvability: Method for filling out the survey is described below with illustration. Evaluate the level of importance and improvability of each standard at the left, and enter the scale specified for importance and improvability respectively.
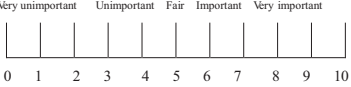
Example: The level of importance and improvability of the performance evaluation standard

Survey of the level of importance and improvability of the performance evaluation standard

Perspective	Criteria	Level of Importance	Level of Improvability
1	A	Considering the importance of A, fill in 0-10 11 scales Very unimportant Unimportant Fair Important Very important 0 1 2 3 4 5 6 7 8 9 10	Considering the improvability of A, fill in 0-10 11 scales Very small Small Fair Large Very large 0 1 2 3 4 5 6 7 8 9 10

Example:

Survey of the level of importance and improvability of the performance evaluation standard

Perspective	Criteria	Level of Importance	Level of Improvability
		Considering the importance of the standard, fill in 0-10 11 scales Very unimportant Unimportant Fair Important Very important 0 1 2 3 4 5 6 7 8 9 10	Considering the improvability of the standard, fill in 0-10 11 scales Very small Small Fair Large Very large 0 1 2 3 4 5 6 7 8 9 10
Finance	Net profit ratio	10	5

Indicate the impact of "Net profit ratio" on overall performance evaluation is "extremely important"; while the level of improvability (room to improve) in the future is "fair".

Please fill out the level of importance and future improvability of the standard at the left in the following table.

Perspective	Criteria	Level of Importance Considering the importance of the standard, fill in 0-10 11 scales Very unimportant　Unimportant　Fair　Important　Very important 0　1　2　3　4　5　6　7　8　9　10	Level of Improvability Considering the improvability of the standard, fill in 0-10 11 scales Very small　　Small　　Fair　　Large　　Very large 0　1　2　3　4　5　6　7　8　9　10
Learning and growth perspective	Employee education		
	Employee satisfaction		
	Employee professional ability		
	Employee productivity		
	Average employee resignation rate		
	Employee knowledge sharing		
	Employee ability to use IT products		
	Employee ability to manage emergencies		
	Employee effective use of marketing information		
Enterprise's internal processes perspective	Ability to keep existing customers		
	Speed of new product launch		
	Time reduction in handling customer complaint		
	Hotel management efficiency enhancement		
	Ability to respond to emergencies		
	Training in environmental hygiene and cleaning operation		
	Hotel product's innovative quality and uniqueness		
	Time reduction of operation cycle		
	Sales promotion ability enhancement		
	Customer background information compilation		
	Effective problem-solving percentage		

Customer perspective	Customer satisfaction		
	Service quality		
	Hotel image		
	Customer loyalty		
	New customer increase rate		
	Traffic convenience		
	Market share		
	Customer relationship management		
Finance perspective	Return on assets		
	Personnel cost ratio		
	Revenue growth rate		
	Return on investment		
	Revenue from new customer ratio		
	Group revenue growth rate		
	Service cost reduction		
	Net profit ratio		
	Peripheral merchandise revenue ratio		

4. Basic personal data

1. Gender: □Male □Female   2. Education Level: □College □University □Master □PhD

3. Service Unit: _____   4. Service Dept.: _____   5. Job Title:

6. Age: □Under 30 years old (including) □30~35 years old (including) □35~40 years old (including) □40~50 years old (including) □Over 50 years old

The second step questionnaire

A Balanced Scorecard Approach to Establish A Performance Evaluation and Relationship Model of Hot Spring Hotels

Good day! This is an academic research about "**A Balanced Scorecard Approach to Establish a Performance Evaluation and Relationship Model of Hot Spring Hotels**". The purpose is to explore hot spring hotel's dimension of performance evaluation, evaluation index, and key factors related to performance evaluation.

As we are greatly impressed by your company's outstanding achievement in this field, if we could have the honor of obtaining your precious opinions, the result and credibility of this research will be tremendously benefited. All the information provided will be used for academic statistical analysis only, and will not be separately announced to the outside or transferred to other applications. Therefore, please feel at ease in filling out the answers.

Your support will be very crucial to the successful completion of this research. We sincerely hope that you would spend some time to express your opinions to be taken as reference for this research. Please accept our most sincere appreciation. Thank you and wish you all the best.

1. Instructions for filling out the questionnaire

This questionnaire is divided into four parts: 1) instructions for filling out; 2) standard description; 3) method for filling out; 4) comparison of the impact of the four dimensions; 5) comparison of the impact of the 15 standards; 6) personal data.

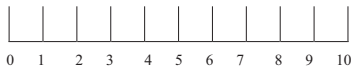**2. Descriptions of dimension and standard**

Perspective	Criteria	Description
Learning and growth perspective	Employee education	Carry out employee training and education to enhance their quality
	Employee professional ability	Employee's professional knowledge and ability in running the business of a hot spring hotel
	Employee productivity	Service or product produced by each employee
	Employee ability to manage emergencies	Employee's ability in responding to and managing emergencies when they occur
Enterprise's internal processes perspective	Ability to keep existing customers	Products provided in the hot spring hotel are able to attract customer to revisit the hotel
	Hotel management efficiency enhancement	Provide hotel products and services to customers in a timely and highly efficient manner
	Customer background information compilation	Understand customer's background information to provide tailor-made products and services
	Effective problem-solving percentage	Percentage of successful resolution of all kinds of problems in the hot spring hotel
Customer perspective	Customer satisfaction	Customer's satisfaction level to products and services provided by the hot spring hotel
	Service quality	Customer's evaluation of the services provided by the hot spring hotel
	Hotel image	Hotel image construction and customer's trust to such brand
	Customer loyalty	Customer will revisit the hotel in the future for certain specific services or products
Finance perspective	Return on assets	Current period net income or loss/Total assets
	Revenue growth rate	(Current period revenue-revenue of the same period last year)/Revenue of the same period last year
	Net profit ratio	Current period net profit/Revenue income

3. Method for filling out

Examples for filling out the level of importance and improvability: Method for filling out the survey is described below with illustration. Evaluate the level of importance and improvability of each standard at the left, and enter the scale specified for importance and improvability respectively.
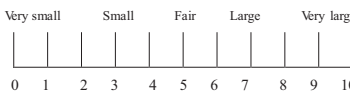
Example: The level of importance and improvability of the performance evaluation standard

Survey of the level of importance and improvability of the performance evaluation standard

Perspective	Criteria	Level of Importance	Level of Improvability
1	A	Considering the importance of A, fill in 0-10 11 scales Very unimportant Unimportant Fair Important Very important 0 1 2 3 4 5 6 7 8 9 10	Considering the improvability of A, fill in 0-10 11 scales Very small Small Fair Large Very large 0 1 2 3 4 5 6 7 8 9 10

Example:

Survey of the level of importance and improvability of the performance evaluation standard

Perspective	Criteria	Level of Importance	Level of Improvability
		Considering the importance of the standard, fill in 0-10 11 scales Very unimportant Unimportant Fair Important Very important 0 1 2 3 4 5 6 7 8 9 10	Considering the improvability of the standard, fill in 0-10 11 scales Very small Small Fair Large Very large 0 1 2 3 4 5 6 7 8 9 10
Finance	Net profit ratio	10	5

Indicate the impact of "Net profit ratio" on overall performance evaluation is "extremely important"; while the level of improvability (room to improve) in the future is "fair".

Please fill out the level of importance and future improvability of the standard at the left in the following table.

Perspective	Criteria	Level of Importance Considering the importance of the standard, fill in 0-10 11 scales Very unimportant Unimportant Fair Important Very important 0 1 2 3 4 5 6 7 8 9 10	Level of Improvability Considering the improvability of the standard, fill in 0-10 11 scales Very small Small Fair Large Very large 0 1 2 3 4 5 6 7 8 9 10
Learning and growth perspective	Employee education		
	Employee professional ability		
	Employee productivity		
	Employee ability to manage emergencies		
Enterprise's internal processes	Ability to keep existing customers		
	Hotel management efficiency enhancement		
	Customer background information compilation		
	Effective problem-solving percentage		
Customer perspective	Customer satisfaction		
	Service quality		
	Hotel image		
	Customer loyalty		
Finance perspective	Return on assets		
	Revenue growth rate		
	Net profit ratio		

4. Comparison of the impact of the four dimensions

Instructions for filling out the index: **0. No impact**; **1. Low impact**; **2. Medium impact**; **3. High impact**; **4. Very high impact**

Example: The impact of A on B is very high, so "4" is filled out at the corresponding position.

	A	B	C	D	E
A	■	4 ◯			
B		■			

Real case description

1. **The impact of learning and growth dimension** on **the enterprise's internal processes dimension** is **"Very high"**, therefore **4** is filled out in the box

2. **The impact of enterprise's internal processes dimension** on **the finance dimension** is **"high"**, therefore **3** is filled out in the box

perspectives	Learning and growth	Enterprise's internal processes	Customer	Finance
Learning and growth	■	4		
Enterprise's internal processes		■		3
Customer			■	
Finance				■

Please fill out the compared level of 4 perspectives in the following table

perspectives	Learning and growth	Enterprise's internal processes	Customer	Finance
Learning and growth	■			
Enterprise's internal processes		■		
Customer			■	
Finance				■

Instructions for filling out the index: **0. No impact**; **1. Low impact**; **2. Medium impact**; **3. High impact**; **4. Very high impact.**

5. Comparison of the impact of the 15 criterions **(Please fill out the compared level of 15 criterions in the following table)**

Criteria	Employee education	Employee professional ability	Employee productivity	Employee ability to manage emergencies	Ability to keep existing customers	Hotel management efficiency enhancement	Customer background information compilation	Effective problem-solving percentage	Customer satisfaction	Service quality	Hotel image	Customer loyalty	Return on assets	Revenue growth rate	Net profit ratio
Employee education	■														
Employee professional ability		■													
Employee productivity			■												
Employee ability to manage emergencies				■											
Ability to keep existing customers					■										
Hotel management efficiency enhancement						■									
Customer background information compilation							■								
Effective problem-solving percentage								■							
Customer satisfaction									■						
Service quality										■					
Hotel image											■				
Customer loyalty												■			
Return on assets													■		
Revenue growth rate														■	
Net profit ratio															■

Instructions for filling out the index: **0. No impact**; **1. Low impact**; **2. Medium impact**; **3. High impact**; **4. Very high impact**

6. Basic personal data

1. Gender: □Male □Female   2. Education Level: □College □University □Master □PhD

3. Service Unit: _____   4. Service Dept.: _____   5. Job Title:

6. Age: □Under 30 years old (including)   □30~35 years old (including)   □35~40 years old (including) □40~50 years old (including) □Over 50 years old

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