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Evaluating the influence of E-marketing on hotel performance by DEA and grey entropy

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ABSTRACT

This study evaluated the hotels' websites in Taiwan from an Internet marketing perspective. Content analysis was used to analyze and compare the marketing practice on Internet. DEA and grey entropy were used to analyze the impact of Internet marketing on hotel performance. The result showed that Internet marketing can affect the operating performance of tourist hotels. Hoteliers should adopt a more strategic Internet approach to increase business success.

1. Introduction

The recent growth of the Internet has considerably changed the operating environment of the hotel industry. The Internet has become an innovative marketing tool in offering travel information and online transactions (Doolin, Burgess, & Cooper, 2002). The information-based nature of tourism products means that the Internet, which offers global reach and multimedia capability, is an increasingly important means of promoting and distributing tourism services. Today, hotels' web presence is no longer exclusive to large hotels. Internet marketing tool is not just for big hotel chains. The websites that are well-designed and easy to navigate provide independent hotels with an inexpensive and effective platform for marketing and advertising, which potentially increase their competitiveness in the marketplace (Lituchy & Rail, 2000; Merono-Cerdan & Soto-Acosta, 2007).

The website marketing can potentially provide distinct value to the hotels. These come from the offering of information online, the possibility of establishing communications and exchange of information and the conducting of transactions online. The rapid adoption of Internet marketing by hotels has yielded myriad studies of hospitality Internet adoption and its impact on hotel operation. (Hashim, Murphy, Purchase, & O'Connor, 2010; Scaglione, Schegg, & Murphy, 2009). The website marketing is particularly useful for dealing with intangible nature of the hotel service, and to gain a competitive advantage (Baloglu & Pekcan, 2006). For tourism organizations, the website content allows them to engage customers' interest and participation, to capture information about their preferences, and to use that information to provide personalized services (Doolin et al., 2002). Chung and Law (2003) indicated that well designed hotel websites with useful information can help increase sales volume and improve the reputation of a hotel. Scaglione et al. (2009) analyzed revenue per available room before and after hotels adopted websites. They found that website adoption related positively to hotel performance. Merono-Cerdan and Soto-Acosta (2007) evaluated 228 Spanish firms and found a positive relationship between external web content and firm performance. Additionally, e-information was found as critical for enabling e-transaction to impact upon firm performance. Despite these findings, other research has produced mixed results concerning the relationship between Internet marketing orientation and performance. Shang, Hung, Lo, and Wang (2008) found that there are no significant differences in efficiency owing to different e-commerce adoption status. Sigala, Airey, Jones, and Lockwood (2004) employed data envelopment analysis (DEA) to analyze information and communication technologies (ICT) productivity impact and found ICT adoption does not always increase hotel productivity. They pointed out that ICT integration is more important for realizing productivity benefits than ICT availability.

In most cases these studies use univariate analyzes which limits exploring relationships among the independent variables. In this paper we will try to explore whether or not hotel Internet marketing tools can influence operation performance using the data envelopment analysis (DEA) and grey entropy method. This study first utilizes web content analysis to analyze the Internet marketing tools of the tourist hotels websites in Taiwan in terms of site orientations (information, communication, and transaction) and

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its impact on hotel performance. The aim is to identify the best performers in a sample of hotels using DEA. Secondly, by using grey relation entropy linking the Internet-marketing orientation to efficiency ratio results in a test of the link between Internet marketing tools and hotel performance.

This paper consists of six sections and is structured as follows. The next section presents a review of the relevant literature. Following this, the methodology used for the sample selection and the data collection is discussed. Then, the data analysis and the empirical results are examined. Finally, the paper concludes with a discussion of research findings, limitations, and contributions from both research and managerial perspectives.

2. Literature review

2.1. Website marketing in the hotel industry

The information intensive nature of the tourism industry suggests an important role for the Internet technology in the marketing destinations. Researchers and practitioners in hospitality and tourism have examined various factors contributing to the success of a hotel website (Au Yeung & Law, 2004; Baloglu & Pekcan, 2006; Chung & Law, 2003; Doolin et al., 2002; Schmidt, Cantallops, & dos Santos, 2008). The advantages of using the Internet have been well-documented in the existing literature. Wan (2002) evaluates the web sites of international tourist hotels and tour wholesalers in Taiwan. The results showed that the use of the Internet in Taiwan's tourism/hospitality industry is primarily for advertising, not marketing. Schmidt et al. (2008) evaluates hotels' website characteristics and relates those characteristics to website performance. The results indicate that small and medium size hotels in the Balearic Islands in Spain and in the South of Brazil are using their websites as mass media tools; ignoring the potential for interactivity and one-to-one communication. Baloglu and Pekcan (2006) utilized content analysis to analyze the websites of four and five star hotels in Turkey in terms of site design characteristics and site marketing practices on the Internet. The findings showed that the hotels in Turkey are not utilizing the Internet to its full potential and effectively e-marketing their hotels regardless of the hotel type. With the increasing popularity of the Internet, the detection of relevant tourism information in multiple languages becomes more important (Lituchy & Barra, 2008). Li and Law (2007) indicated that international customers viewed reservation information as the most important dimension, and room rates as the most important attribute.

In Table 1, the content categories for the web site analysis are identified and classified according to the mentioned hotel e-marketing orientations. The conceptual framework to assess Internet marketing tools in this study was built upon the work of Merono-Cerdan and Soto-Acosta (2007), and complemented by other similar works and literature in trade and academic journals covering effective hotel site design and e-marketing (Angehrn, 1997; Baloglu & Pekcan, 2006; Chung & Law, 2003; Doolin et al., 2002; Schmidt et al., 2008; Yeung et al., 2004).

2.2. Performance measurement in the hotel industry

Performance measurement refers to the relationship between inputs and outputs. Evaluating the efficiency of organizational units is usually a difficult problem, especially when the multiplicity of inputs (resources, costs) and outputs (services, products) is required to be considered (Cook & Seiford, 2009; Wu, 2006). The data envelopment analysis (DEA) is a nonparametric method to empirically measure relative efficiencies of multiple decision-making units (DMUs), which has been recognized as a valuable analytical instrument and a practical decision support tool for dealing with the task of business performance assessment. Especially, DEA has no need to explicitly specify a mathematical form for the production function, and it can analyze and quantify the inefficiency of every DMU.

DEA has been applied extensively to evaluate the performance for a wide variety of industries and has also been extensively adopted for evaluating hotel performance in recent years (Chen, 2007; Hwang & Chang, 2003). Barros (2005) used DEA to analyze the hotel technical efficiency and allocative efficiency. Sigala, Jones, Lockwood, and Airey (2005) extended current DEA applications by developing a stepwise approach, and the productivity of hotel room division was measured. Botti, Briec, and Cliquet (2009) found

Table 1
Internet marketing features considered in previous research.

Marketing Features	Category	Items	References
Information	1. Hotel information	Location map of hotel, hotel descriptions, photos of hotel features, links to other related businesses, virtual tours, flash animation, links to other related businesses, availability of price info	Liu, Arnett, Capella, and Beatty (1997), Wan (2002), Doolin et al. (2002), Chung and Law (2003), Au Yeung and Law (2004), Baloglu and Pekcan (2006), Zafiropoulos and Vrana (2006), Li and Law (2007), Shang et al. (2008) and Schmidt et al. (2008)
	2. Hotel features	Restaurants, guest room facilities, meeting facilities	Chung and Law (2003), Law and Hsu (2005), Baloglu and Pekcan (2006), Zafiropoulos and Vrana (2006), Li and Law (2007), Shang et al. (2008) and Schmidt et al. (2008)
	3. Hotel Environment	Transportation, main attractions of the city, local tour information, shuttle bus	Chung and Law (2003), Baloglu and Pekcan (2006), Law and Hsu (2005), Zafiropoulos and Vrana (2006) and Li and Law (2007)
	4. Promotion	Any promotion mentioned, up-to-date information on the site, banner advertisement	Baloglu and Pekcan (2006), Wan (2002) and Doolin et al. (2002)
Communication	1. Interaction with guests	E-mail address, E-mail hyperlink, online comment, feedback form, frequent guest program, fax number, newsletter, search capabilities	Doolin et al. (2002), Baloglu and Pekcan (2006), Law and Hsu (2005), Zafiropoulos and Vrana (2006), Schmidt et al. (2008) and Vermeulen and Daphne (2009)
	2. Multilingual Capabilities	English, Japanese, simplified Chinese, others	Lituchy and Barra (2008) and Li and Law (2007)
Transaction		Online room reservation, online dining reservation, online payment	Wan (2002), Liu et al. (1997), Doolin et al. (2002), Baloglu and Pekcan (2006), Law and Hsu (2005) and Shang et al. (2008)

that plural form networks are on average more efficient than strictly franchised and wholly owned chains. Chiang, Tsai, and Wang (2004) observed that not all franchised or managed hotels preformed more efficiently than the independent ones. However, to authors' best knowledge, few studies have employed DEA to investigate the relationship between online marketing and hotel performance.

Grey relation analysis can be used to evaluate the original data directly and does not need additional interactions during the process. This method has been widely used in many applications concerning performance evaluations and multi-criteria decision-making (Chou & Tsai, 2009; Tung & Lee, 2009; Wang, 2009; Zhai, Khoo, & Zhong, 2009). Because the grey entropy method is an objective weighting technique without rigorous statistical requirements and assumptions, this study employs the grey entropy method of Wen, Chang, and You (1998) to compute the relative importance among DEA inputs.

3. Research method

In this section, some essential definition of the super efficiency DEA and grey entropy are briefly described.

3.1. Data envelopment analysis

From a managerial viewpoint, the hotel's performance is the aggregated efforts of different departments. Data envelopment analysis (Charnes, Cooper, & Rhodes, 1978) is a nonparametric approach that does not require any assumptions about the functional form of the production function. There are several famous DEA models such as: CCR model, BCC model, super-efficiency model, and so on. In the last decade, ranking efficient units has become the interests of many researchers and a variety of DEA models were developed to use (Li, Jahanshahloo, & Khodabakhshi, 2007). Among these DEA models, the super-efficiency DEA model (Andersen & Petersen, 1993) allows of an efficiency score above one for ranking the efficient units, and assigns an efficiency score less than one to inefficient units. That is, the efficiency scores of the efficient units can be greater than or equal to one, when using the super-efficiency DEA model (Banker & Chang, 2006; Nahra, Mendez, & Alexander, 2009). Obviously, the super-efficiency DEA model is a better method to handle the efficiency measurement in practice. Thus, this study adopts the super-efficiency DEA model of Andersen and Petersen (1993) to estimate the relative efficiency of 48 hotels.

3.1.1. CCR model

The DEA CCR model (Charnes et al., 1978) assumed that there are n decision-making units (DMUs), with m inputs and p outputs, while the efficiency evaluation model of DMU can be defined as following:

$$Max S_k = \sum_{r=1}^{p} u_r y_{rk} \tag{1}$$

$$s.t. \quad \sum_{r=1}^{p} u_r y_{rk} - \sum_{i=1}^{m} v_i x_{ik} \leqslant 0, \quad k = 1,2,\ldots,n; \tag{2}$$

$$\sum_{i=1}^{m} v_i x_{ik} = 1, \quad k = 1,2,\ldots,n; \tag{3}$$

$$\begin{aligned} u_r &\geqslant \varepsilon \geqslant 0, \quad r = 1,2,\ldots,p \\ v_i &\geqslant \varepsilon \geqslant 0, \quad i = 1,2,\ldots,m, \end{aligned} \tag{4}$$

where, x_{ik} is the ith input value for kth DMU, y_{rk} is the rth output value for the kth DMU, u_r and v_i are the virtual multiplier of the output and input, respectively, and ε is a very small positive value. Where S_k is the efficiency value for kth DMU. DEA does not use common weight, as do multiple criteria decision models.

3.1.2. The super-efficiency model

The super-efficiency model of Andersen and Petersen (1993) is used to score hotels that were included in the CCR-Efficient set. The super-efficiency model involves executing the standard DEA models, but under the assumption that the hotel being evaluated is excluded from the reference set. This allows the determination of the hotel's relative placement regardless of whether the hotel is efficient or not. Because inefficient hotels do not contribute to the span of the production frontier, even when included in the comparison set, the super-efficiency modification will not impact the technical score of inefficient hotels. The technical efficiency scores for the efficient hotels will be greater than or equal to one using the super-efficiency DEA. In the input-oriented case, the model provides a measure of the proportional increase in the inputs for a hotel that could take place without destroying the efficient status of that hotel relative to the frontier created by the remaining hotels. For the super-efficiency DEA, the linear programming model follows:

$$Max\ E_k = \sum_{r=1}^{p} u_{rk} y_{rk}, \tag{5}$$

$$s.t. \quad \sum_{\substack{r=1 \\ r\neq k}}^{p} u_{rk} y_{rk} - \sum_{\substack{i=1 \\ i\neq k}}^{m} v_{ik} x_{ik} \leqslant 0, \quad k = 1,2,\ldots,n; \tag{6}$$

$$\sum_{i=1}^{m} v_{ik} x_{ik} = 1, \quad k = 1,2,\ldots,n; \tag{7}$$

$$\begin{aligned} u_{rk} &\geqslant \varepsilon \geqslant 0, \quad r = 1,2,\ldots,p; \\ v_{ik} &\geqslant \varepsilon \geqslant 0, \quad i = 1,2,\ldots,m. \end{aligned} \tag{8}$$

3.2. Grey entropy

Grey system theory was initiated in 1980s by Deng (1982), which can deal with systems or objects having well-defined external boundaries but internal uncertainty or vagueness. Grey system theory considers that there are three kinds of systems, including the white system for which the relevant information is completely known, the black system for which the relevant information is completely unknown, and the grey system for which the relevant information is not completely known (Guo, 2005). Conventional statistical methods require a bigger sample size and a typical distribution of samples, but allow small variable factors to use. Unlike conventional statistical methods, grey system theory enable us to analyze the data which involving uncertainty, multi-input, discrete data, small sample size, as well as unknown distribution of samples. Therefore, the grey system theory is an effective method used to solve uncertainty problems with discrete data (Tseng, 2009), provides a multidisciplinary approach to analyze and model such a problem for which the information is limited, incomplete and characterized by random uncertainty.

According to Wang, Lin, and Hu (2007), the entropy weighting method is an objective weighting technique that can calculate the relative importance among all attributes through comparing the entropy value for each attribute. However, for weighting analysis, traditional entropy method based on the continuous type of entropy is not suitable to handle a practical problem with discrete data (Wen et al., 1998). To overcome this issue, Wen et al. (1998) propose the grey entropy based on the discrete type of entropy in order to properly conduct weighting analysis. In this sense, Chou and Tsai (2009) further suggest a weighting method that integrates the concept of Shannon entropy into a grey relational analysis model.

Grey relational analysis is part of grey system theory, which is suitable for solving problems with complicated interrelationships between multiple factors. For a multiple attributes decision making problem, grey relation can combine the entire range of performance attribute values being considered for every alternative into one single value. Therefore, alternatives with multiple attributes can be compared easily after the grey relational analysis (Kuo, Yang, & Huang, 2008).

Referring to Wen et al. (1998) and Wang et al. (2007), a procedure of the grey entropy weighting includes seven steps is as following:

1. Let X be a factor set of grey relation, one sequence can be denoted as:

$$x_i = (x_i(1), x_i(2), x_i(3), \ldots, x_i(k)) \in X, \tag{9}$$

where $i = 0, 1, 2, \ldots, m;\ k = 1, 2, \ldots, n,$,

2. Compute the summation of each attribute's value for all sequences, D_k:

$$D_k = \sum_{i=1}^{m} x_i(k). \tag{10}$$

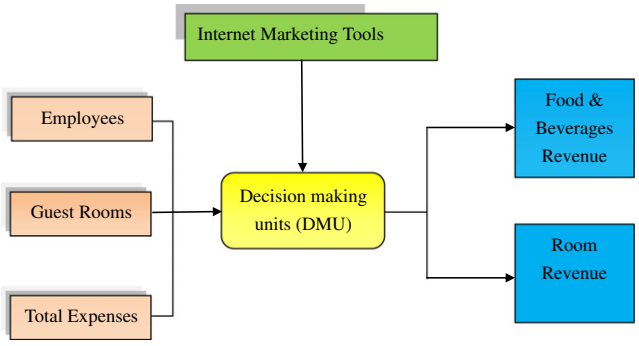

Fig. 1. Evaluation model.

3. Compute the normalization coefficient K:

$$K = \frac{1}{(e^{0.5} - 1)n}, \tag{11}$$

where n represents the number of attributes.

4. Find the entropy for the specific attribute, e_k:

$$e_k = K \sum_{i=1}^{m} W_e(z_i), \tag{12a}$$

where

$$W_e(z_i) = z_i e^{(1-z_i)} + (1 - z_i)e^{z_i} - 1, \tag{12b}$$

$$z_i = \frac{x_i(k)}{D_k}. \tag{12c}$$

5. Compute the total entropy value E:

$$E = \sum_{k=1}^{n} e_k. \tag{13}$$

6. Determine the relative weighting factor λ_k:

$$\lambda_k = \frac{1}{n - E}(1 - e_k). \tag{14}$$

7. The normalized weight of each attribute can be calculated as:

$$\beta_k = \frac{\lambda_k}{\sum_{i=1}^{n} \lambda_i}. \tag{15}$$

4. Research design and data collection

For the E-marketing evaluation, a structured form, consisting of 32 checkpoints, was developed to access the contents of the web sites for all international tourism hotels in Taiwan. In this study, each web site element was measured using a binary variable, representing whether or not a hotel web site has the particular marketing feature.

For the hotel operation performance measurement, the data used in this study were obtained from the 2006 and 2007 survey of international tourist hotels conducted by Taiwan Tourism Bureau (2007), Taiwan Tourism Bureau (2008). After discarding hotels due to incomplete data, 48 international tourist hotels were available to be evaluated. Inputs were defined as items that hotels

Table 2
Hotel web content results.

Web content	Percentage	N	Web content	Percentage	N
Information			Communication		
Basic Information			*Interaction with customers*		
Location map of Hotel	93.75	45	E-mail	60.42	29
Hotel descriptions	93.75	45	Online comment	6.25	3
Photos of hotel features	25.00	12	Feedback form	4.17	2
Chain hotel links	45.83	22	Frequent guest program	85.42	41
3D Virtual tours	8.33	4	Fax number	87.50	42
Related businesses link	58.33	28	Newsletter	45.83	22
Price information	100.00	48	Keyword search	6.25	3
Hotel facilities			*Multilingual capabilities*		
Restaurants	97.92	47	English	93.75	45
Guest room facilities	100.00	48	Japanese	79.17	38
Hotel features	87.50	42	Simplified Chinese	14.58	7
Meeting facilities	95.83	46	Other languages	6.25	3
Environment					
Transportation	83.33	40	Transaction		
Attractions of the city	79.17	38	Online dining reservation	35.42	17
Local tour information	52.08	25	Online room reservation	95.83	46
Shuttle bus information	45.83	22	Electronic payment	83.33	40
Promotion					
Promotion mentioned	97.92	47			
Up-to-date information	87.50	42			
Banner advertisement	47.92	23			

Table 3
ANOVA test for Internet marketing tools and hotel efficiency.

	2006	2007
Information	0.654	0.375
	(0.525)	(0.69)
Communication	3.123*	3.339**
	(0.054)	(0.045)
Transaction	2.186	3.671**
	(0.103)	(0.019)
Total effect	6.276**	8.450**
	(0.004)	(0.001)

* $p < 0.10$.
** $p < 0.005$.

use to produce revenue. Three inputs were selected: (1) the number of guest rooms in a hotel; (2) number of full-time employees; and (3) operating expenses (employee salaries, food and beverage costs, room costs, utilities, maintenance fees, and other relevant operating costs). Outputs were defined as the revenues produced by the hotel. The two primary sources of revenue for international tourist hotels in Taiwan were accommodation and meals, which together constitute about 85% of overall hotel operating revenue. Therefore two outputs were selected: (1) total revenue generated from rooms, and (2) total revenue generated from food and beverages.

For a test of the link between Internet marketing tools and hotel performance, grey relation entropy was utilized to represent the relations between hotel performance and Internet marketing characteristics. Therefore, we added the "Internet marketing tools" as the other input for evaluation. Among these input or output variables, only the Internet marketing tools is not quantitative variable. The qualitative variable "Internet marketing tools" is a composed variable that contains seven groups in terms of functions or services demonstrated by a hotel website.

These seven groups of Internet marketing tools are: (1) "Basic Information" group with seven measuring items (location map of hotel, hotel descriptions, photos of hotel features, virtual tours, chain hotel links, related businesses link, price information); (2)

Table 4
Grey entropy weighting for Internet marketing and hotel performance.

DMU	Inp1	Inp2	Inp3	Output 1	Output 2	IMT	Score1 (%)	Score2 (%)
U1	912	873	2348922190	1110840080	1366496222	23	114.11	141.08
U2	739	569	1426452817	1083059791	785872962	25	118.77	125.59
U3	858	686	2223260561	1127782429	899473278	21	92.34	115.33
U4	707	420	1776731410	842101565	836015735	22	114.23	125.33
U5	812	606	1278642519	634618811	628621840	22	78.42	82.34
U6	447	288	1165714972	569454520	501853326	29	100.35	100.35
U7	503	432	914242889	683246354	395742933	26	98.39	98.39
U8	614	402	1071494471	519551121	424533147	22	72.31	72.31
U9	464	343	668227370	314254103	460734607	22	101.23	101.23
U10	495	250	659793356	455233827	194238884	16	95.28	95.28
U11	219	220	622923644	142764598	162288765	18	51.85	51.85
U12	360	268	640526659	385273752	244489582	29	79.20	79.20
U13	227	388	348208497	205494711	359427308	26	137.85	137.85
U14	271	202	376368616	200553759	241820630	23	94.27	94.27
U15	293	209	434371883	224153678	217943587	24	79.86	79.86
U16	273	336	434817326	183638268	200351917	21	61.31	61.31
U17	226	287	262064795	89626117	177081298	18	66.06	68.21
U18	170	215	215928586	113531120	125830771	21	76.67	76.67
U19	152	243	159754819	34300410	155753640	19	94.45	94.45
U20	97	201	133033373	71538483	93402946	16	82.33	82.33
U21	64	97	44345770	8871749	34912642	11	76.27	76.27
U22	734	436	1409612089	815125688	422216019	26	96.06	96.06
U23	539	592	1047419681	469341269	359657824	22	60.66	60.66
U24	362	457	642435003	397497759	237374314	26	81.45	81.45
U25	234	283	398210661	194316442	194060809	22	69.18	69.18
U26	167	302	193153258	73953366	132541726	23	66.48	66.48
U27	117	274	140352282	39952065	97813056	29	67.52	67.52
U28	271	354	485153688	264581089	237024156	29	75.25	75.25
U29	436	222	663649325	162019454	122986751	21	37.78	37.78
U30	277	404	346964325	206992079	116843565	23	78.48	78.48
U31	184	155	261470984	158841734	125205121	22	81.41	81.41
U32	192	226	221779607	129781300	94778457	20	77.17	77.17
U33	403	381	484633650	165129749	335733563	24	79.87	82.20
U34	288	343	341703814	109761347	208003258	22	62.23	63.36
U35	115	221	194820640	96163726	81545860	27	67.24	67.24
U36	148	270	176597303	92335670	75973325	21	70.74	70.74
U37	305	405	423762132	137524516	298192827	18	73.71	87.01
U38	268	250	352029059	128420290	293785405	20	104.09	104.09
U39	158	224	216742910	61917632	110082827	22	51.30	51.30
U40	132	107	202521551	112836564	32843681	22	73.27	73.27
U41	133	201	140061802	42518759	56415615	21	46.71	46.71
U42	53	50	87445403	29637477	39799449	17	64.25	64.25
U43	374	257	721658028	371100193	260551728	26	75.16	75.16
U44	233	208	295404891	135000706	171552657	23	74.98	74.98
U45	185	390	181498657	76294380	143096277	16	76.38	76.38
U46	372	315	590989486	326114209	248411595	24	73.41	73.41
U47	214	276	272055349	104188199	137463863	20	58.82	58.82
U48	192	152	235100506	179084238	48330372	22	100.32	100.32
Mean	333.1	318.5	581938596	293339982.2	274774377.5	22	79.78	81.67

"Hotel Facilities" group with four measuring items (restaurants, guest room facilities, hotel features, meeting facilities); (3) "Environment" group with four measuring items (transportation information, main attractions of the city, local tour information, shuttle bus information); (4) "Promotion" group with three measuring items (any promotion mentioned, up-to-date information on the site, banner advertisement); (5) "Communication" group with seven measuring items (e-mail, online comment, feedback form, frequent guest program, fax number, newsletter and keyword search); (6) "Multilingual capability" group with four measuring items (English, Japanese, simplified Chinese, other language); (7) "Online Transaction" group with three measuring items (online dining reservation, online room reservation, online payment).

In other words, the "Internet marketing tools" includes 32 measuring items for checking whether a hotel website provides certain functions or services or not. Each measuring item is assigned one point. Totally, the highest score is 32 points for the "Internet marketing tools" of a hotel website.

For the purpose of investigating the research question regarding that whether Internet marketing tools advance hotel performances, data analysis is performed through the DEA and the paired-sample *t*-test as well as the grey entropy. First, the super-efficiency DEA model is employed to calculate the relative efficiency of 48 hotels for two scenarios. The scenario A consists of three inputs (employees, guest rooms, total expense) and two outputs (food and beverages revenue, room revenue), while the scenario B comprises four inputs (employees, guest rooms, total expense, Internet marketing tools) and the same two outputs. Next, the paired-sample *t*-test is used to test the difference efficiency between scenario A and scenario B. Finally, the grey entropy is utilized to compute the weighting for those four inputs. Because the grey entropy method is an objective weighting technique without rigorous statistical requirements and assumptions, this study employs the grey entropy method of Wen et al. (1998) to compute the relative importance among four inputs (employees, guest rooms, total expense, Internet marketing tools) for 48 hotels. The evaluation model is shown in Fig. 1.

5. Results and discussions

Online marketing results are reported in Table 2. The most often available information, of all analyzed web sites, was guest room facility information and price information with 100% of hotels containing this feature. With regard to communication tools, about 60% of hotel sites provided an e-mail for requesting information. In order to receive information from customers, surveys and online comments constitute an effective instrument. However, it was found that only 6.25% of the hotel web sites included this feature. Another important aspect found was that 98% of the hotels had promotion information, which implies an intention of establishing business links with customers. Considering e-transaction features, 35% contained dining reservation, 96% included online room reservation and 83% of the hotel web sites allowed electronic payment. Overall, the results showed that hotels use their web sites primarily to provide information and transaction, rather than for interacting with customers.

In order to test whether hotel performance is influenced by Internet marketing tools, statistical techniques of group difference were employed. The one-way ANOVA test was applied. As presented in Table 3. Results showed that hotel performance were influenced significantly by the e-communication and e-transaction on year 2007. The fact that for the e-information influence was not significant could be interpreted in a way that a merely informative presence on the Internet does not produce a notable impact on hotel performance.

To calculate the relative efficiency based the super-efficiency DEA model, the data analysis is performed. As shown in Table 4, the Score1 is for the scenario A while the Score2 is for the scenario B. Next, the software SPSS is used to test the difference between the Score1 and the Score2. The result of the paired-sample t-test reached the statistical significance level of 0.05 (t value = −2.351, degrees of freedom = 47, two-tailed significance = 0.023), and indicates that there was a significant difference between the means of the two scenarios (Score1 = 79.78%, Score2 = 81.67%). This reveals that the relative efficiency of scenario B is higher than that of scenario A, and we may believe that Internet marketing tools can advance hotel performances. Further, the result of the grey entropy weighting using the Matlab Toolbox for Grey System Theory (Wen, Changchien, Ye, Won, & Lin, 2007) shows that Internet marketing tools (IMT) has the highest weight (0.4087), followed by Inp2 (0.3155), Inp1 (0.2295), Inp3 (0.0463).

Despite the probable existence of a time lag between hotel Internet marketing improvement and the impact upon hotel performance, the results showed a positive relationship between online marketing tool and firm performance.

6. Conclusions

We have examined the relationship between website marketing and operational performance of international tourist hotels in Taiwan. This study provides an important implication for hotel managers. The results suggest that Internet marketing tool is positively associated with firm performance. Furthermore, not only a positive relationship between Internet marketing tool and firm performance was found but complementarities among the web site orientations were observed. The Internet has enabled a new era of user-generated content. Given the increasing popularity of Internet usage worldwide, managers should take advantage of full range of features of the Internet for both site interactivity and functionality. As a result, hotel managers should avoid a simple presence on the Internet (merely informational) and instead pursue a more interactive presence directed to interaction with potential customers and build a new business model for providing free content-sharing services. On the other side, there is still room for improvement. The Internet marketing tools on hotels' web sites were reviewed at one point, and then compared with historical data on hotel performance. It is likely that during the time period, the hotel had different web presence to the one evaluated. Thus a longitudinal study could enrich the findings.

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