

銘傳大學 98 學年度研究所博士班招生考試

管理研究所博士班

第一節

管理文獻評論試題

(第 ~~一~~ 頁共 4 頁) (限用答案本作答)

☐ 可使用計算機 ☐ 不可使用計算機

請閱讀所附論文(論文中之數學規劃模式可以忽略)後回答

以下問題：

1. 說明論文之研究目的及研究問題為何？(本題占 25 分)
2. 依據所附論文之內容，請提出本論文研究觀念性架構圖(Conceptual Framework)，您所提出之觀念性架構圖必須對應到本論文所涉及的構念(Construct)、操作性定義(Operational Definition)、變數(Variable)。(本題占 30 分)
3. 說明論文中所進行的統計檢定有那些？(本題占 20 分)
4. 試說明您的專長為何？再就您目前之專長，提出一個管理問題，並提出如何對該管理問題進行研究？又您擬到本校博士班進修與您目前工作有何關聯性？(本題占 25 分)

作答注意事項：

1. 把握時間，可擇重點論述。眾所周知之常識無須浪費筆墨及時間。
2. 評分重心在於創意、思考方式、邏輯。
3. 盡量使用圖、表、數式之陳述方式。

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Using data envelopment analysis to measure hotel managerial efficiency change in Taiwan

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Abstract

In the face of a highly competitive environment, it has long been considered important for a hotel to formulate a marketing competition strategy, strengthen corporate operations and upgrade quality of service. In formulating competition strategies, one must first measure the comparative performance of the entire industry, before one may understand one's advantages and disadvantages. This paper uses data envelopment analysis (DEA), developed by Charnes et al. (*Eur. J. Oper. Res.* 2(6) (1978) 429), and the Malmquist productivity index expressed by Färe et al. (*J. Product Anal.* 3(1) (1992) 85), to measure the managerial performance of 45 hotels in 1998 and the efficiency change of 45 Hotels from 1994 to 1998. The results revealed that there was a significant difference in efficiency change due to difference in sources of customers and management styles. In addition, this paper showed that the managerial efficiency of international tourist hotels in Taiwan is related to the level of internationalization of hotels. Moreover, the entire industry can be partitioned into six clusters based on relative managerial efficiency and efficiency change. Effective management strategies are developed specifically to each of the six clusters of hotel. It was expected this study can provide useful information for future hotel management needs.

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Keywords: International tourist hotel; Managerial efficiency; Performance evaluation; Data envelopment analysis

1. Introduction

Since the end of cold war, reconciliation has gradually replaced confrontation. Barriers to international travel have gradually been removed. With the growing popularity of free trade, international exchange has increased tremendously symbolized by a relaxation of visa arrangements around the world. This has prompted the rapid growth of tourism industries. Tourism has not only become one of the largest sources of income for many countries but also has an effective means to stimulate global economic development. Since Taiwan entered the martial law in 1949, the development of international tourism industries in Taiwan has encountered significant limitations. With the lifting of this law in 1985, tourist activities have grown and the number of tourist arrivals increased from 1.3 million in 1985 to 2.41 million in 1998. Revenues from travel and foreign

currencies increased from US\$919 million to US\$3,776 billion in 1998.

With the lifting of martial law in Taiwan, hotels have mushroomed nationwide. International hotel numbers have increased from 44 in 1985 to 54 in 1998. Ordinary hotels have increased from 2973 hotels in 1985 to 3424 in 1998. However, because the rapid expansion of the hotels exceeded market demand, many hotels subsequently closed, partly due to mismanagement. Over the last 5 years, 8 international hotels and 443 ordinary hotels have closed. Facing a highly competitive environment, the formulation of marketing strategy, strengthening corporate operations and upgrading the quality of service has become essential for survival. In formulating competition strategies, one major problem is the measurement of management performance of the entire industry, prior to an assessment of one's advantages and disadvantages. Another problem encountered is to determine the factors which affect managerial efficiency.

This paper adopted data envelopment analysis (DEA), developed by Charnes, Copper, and Rhodes (1978), using multiple inputs and outputs to measure the relative managerial efficiency of 45 international hotels

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in Taiwan. At the same time, the paper used the Malmquist productivity approach expressed by Färe, Grosskopf, Lindgren and Ross (1992) to measure the managerial efficiency change of 45 international hotels. By comparing annual changes in the managerial efficiency of individual hotels, it is possible to identify general trends in the efficiency of the hotel industry as a whole and to identify individual hotel exhibiting patterns of change in efficiency that differ from the rest of the industry. A further analysis of the results should help managers to understand the factors that determine the managerial efficiency in Taiwanese hotels. Moreover, based on the measurement of managerial efficiency and efficiency change, a management decision matrix was developed to serve as a basis for an assessment of the competition strategy of 45 international hotels in Taiwan.

2. Problem

2.1. Background

Tourist hotels in Taiwan can be divided into international tourist hotels and ordinary tourist hotels. Hotel grading is with a plum mark which is issued by Taiwan Tourism Bureau. International hotels are four or five plums tourist hotels. Ordinary hotels are two or three plums tourist hotels. Currently, there are 52 international hotels in Taiwan. Of these, 45 have been established for more than 5 years, of which 33 are city and 12 are resort hotels. These hotels range from a maximum of 873 rooms to a minimum of 50 rooms. Based on patterns of operation, hotels are classified into two large groups: independent operations and international chain operations. International chain operations are further subdivided into franchise chain, management contract and membership (as shown in Table 1).

Independent operation refers to investors who do not rely on foreign management. They operate hotels on their own and are responsible for their own management decisions. The Grand Hotel and Howard Plaza Hotel are independently operated and managed by themselves. Franchise-chains refer to hotels which have entered into a cooperative management contract with worldwide chain hotel consortiums, which clearly specify their respective rights and responsibilities under the cooperative management contract. The subsidiary company pays a specific amount of royalties to the parent company in exchange for the company's standard operation process and management knowledge. Lai Lai Sheraton Hotel joined US Sheraton, Rebar joined Holiday Inn Crowne becoming a Franchise chain hotel. Management contract refers to hotels wherein investors formulate management contract and entrust interna-

tional chain hotels to manage the hotel on its behalf. Hotel ownership and management are entirely separated. For example, Singapore consortium commissioned the Hyatt Hotel Groups to operate the Grand Hyatt Hotel, the Tuntex Group commissioned the Regent Group to operate Grand Formosa Regent on its behalf. A Hotel joins a reputable world organization as a member after passing a strict qualification evaluation. As a member hotel, it enjoys the prestige of being part of a world's organization as well as sharing and exchange of information with member hotels to ensure operational quality. The Sherwood Hotel is for example, a member of Preferred Hotels system.

Based on its market positioning, each tourist hotel has its unique primary source of customer. Customers of Gloria Hotel are mostly Japanese tourist whereas Grand Hotel caters to Japanese, North American and European tourists.

2.2. Issues

443 ordinary tourist hotels and 8 4-plum international tourist hotels went out of business due to mismanagement in the last five years. The Mirama Hotel Taipei attracted many Japanese customers since its opening in 1978. In recent years, the number of business travelers has decreased and newly operated hotels, such as the Sherwood Hotel and the Westin Taipei, have entered into the market, leading to the excess supply of rooms. Amid fierce competition, the older hotels like the Grand Hotel, Ambassador Hotel, Mandarin Crown Hotel were refurbished to retain and attract new customers. Some independent hotels have joined international franchise-chains to promote their managerial capabilities. For example, the Gloria Prince Hotel joined Meridien and the Imperial Hotel became part of the Inter-continental franchise-chains. Because Mirama Hotel Taipei failed to respond to these changes, it eventually closed down in 1998. The President Hotel and Fortune Hotel followed suit due to their unsatisfactory management. In addition, Asia World Plaza Hotel had a large number of rooms so it required more manpower and operational work than competition but unfortunately its allocation of resources was not very efficient. The 1990 Gulf War and the Asian Financial Crisis resulted in a decline in the number of visiting tourists to Taiwan, which caused the low occupancy rate. Failing to allocate resources in an efficient way and slowly adjusting the management meant that the Asia World Plaza Hotel at one stage suffered from financial difficulties.

Generally speaking, Taiwan's hotels adopt two ways to respond to competition. First, by targeting international travelers and domestic tourists so as to increase the sources of customers. Second, some hotels joined franchise-chains, outsourced management and acquired

Table 1
The basic information of international tourist hotels in Taiwan

Types	No	Hotel	Area	Rooms	Management style	Source of visitors
City hotel	H1	Grand Hotel Taipei	1	530	A	F
	H2	Ambassador Hotel	1	477	B1	F
	H3	Magnolia Hotel	1	351	A	F
	H4	Imperial Hotel	1	336	B3	F
	H5	Gloria Hotel	1	220	A	F
	H6	Emperor Hotel	1	97	A	F
	H7	Riverview Hotel	1	201	A	F
	H8	Hilton International Hotel	1	500	B1	F
	H9	Golden China Hotel	1	240	A	F
	H10	Miramar Hotel	1	584	A	F
	H11	Brother Hotel	1	282	A	F
	H12	Santos Hotel	1	304	A	F
	H13	Ritz Hotel	1	283	A	F
	H14	United Hotel	1	248	A	F
	H15	Lai Lai Sheraton Hotel	1	705	B1	F
	H16	Fortuna Hotel	1	304	A	F
	H17	Asia World Hotel	1	720	A	F
	H18	Royal Hotel	1	203	B1	F
	H19	Howard Plaza Hotel	1	606	A	F
	H20	Rebar Holiday	1	246	B1	F
	H21	Grand Hyatt Taipei	1	873	B2	F
	H22	Sherwood Taipei	1	570	B2	F
	H23	Grand Formosa Regent	1	345	B3	F
	H24	Far Eastern	1	422	B2	F
	H25	Holiday Inn	6	391	B1	F
	H26	Park	3	124	A	D
	H27	Evergreen Laurel	3	354	A	D
	H28	Hotel National	3	404	A	D
	H29	Plaza Int'l	3	226	A	D
	H30	Kingdom Hotel	2	302	A	D
	H31	Holiday Garden	2	313	A	D
	H32	Royal Hotel	2	211	A	D
	H33	Grand Hotel Kaohsiung	2	108	A	D
	H34	Ambassador Kaohsiung	2	457	A	D
	H35	Tainan Hotel	6	226	A	D
	H36	Marshal Hotel	4	303	A	D
	H37	Hotel Astar	4	168	A	D
	H38	China Trust Hotel Hualien	4	237	A	D
	H39	China Yangmingshan Hotel	5	50	A	D
	H40	Ta Shee Resort Hotel	5	208	A	D
Resort hotel	H41	Caesar Park Hotel Kenting	5	250	B3	D
	H42	China Trust Resort Hotel	5	108	A	D
	H43	La Mi Di Hotel	5	245	A	D
	H44	Royal Chihpen Resort Hotel	5	183	A	D
	H45	Parkview Hotel	5	343	A	D

Note: Area: 1: Taipei, 2: Kaohsiung, 3: Taichung, 4: Hualien, 5: Scenic Area, 6: Others.

Management style: A: Independent; B: International chains (B1: Franchise B2: Management Contract B3: Membership).

Source of visitors: D: Domestic visitors, F: Foreign visitors.

membership in international hotel associations to introduce international management systems and promoting managerial capacities. What kind of strategy is more effective in the highly competitive environment? When formulating any strategy, is it necessary to have a sound knowledge of relative managerial efficiency of a given hotel relative to the entire industry? What are the factors that affect managerial efficiency in the industry? Which hotels serve as positive examples? All of these help evaluate one's strengths and weaknesses in

formulating strategies. Therefore, this paper discusses two issues:

- (1) What is the relative managerial efficiency of international tourist hotels today? Will managerial efficiency differ in different market conditions, sources of customers, room size and management style?
- (2) What are the managerial efficiency changes in international tourist hotels in recent years? Which

hotels have an increasingly improved managerial efficiency and become a benchmark for other hotels?

To answer the above questions and to formulate competitive strategy, it is important to determine input output factors and to measure the relative managerial efficiency and efficiency change.

2.3. *Related literature*

Performance evaluation is a necessary part of management control. Not only can it be used as reference in decision-making, but also the basis of any improvements. Therefore, how to measure efficiency becomes an important and broad-scope subject. Managers, economists and others researches have attempted to accurately measure the efficiency of the hotel industry for many years. Conventionally, research uses average occupancy rates and average room/rates as indicators of performance. Kimes (1989) recommends the basic concept of perishable asset revenue management, which determines the optimal trade-off between average daily rates and occupancy rates. Wassenaar and Stafford (1991) advocate the use of a lodging index indicator for the hotel/motel industry. The lodging index is defined as the average revenue realized from each room, vacant or occupied, within a region or city during a given time period. Wijesinghe (1993) suggests a method for calculating breakeven room occupancy that provides accurate calculations together with a system of efficiency can be used to analyze the source of loss and, therefore, give a better control of the business.

However, Anderson, Fish, Xia, and Michello (1999) pointed out that it is difficult to draw any conclusions about the relative productivity of the hotel industry without considering the mix and nature of services provided. Moreover, efficiency is often hard to evaluate because it is difficult to determine an efficient amount of resources. Recently, new techniques have been developed that have the ability to compare the efficiency of similar service organizations by explicitly considering their use of multiple inputs to produce output. These techniques include data envelopment analysis (DEA), the stochastic frontier approach, the thick frontier approach, and the distribution-free technique (Anderson et al., 1999).

Especially, DEA is a popular technique in the literature because it does not require an assumption about functional form and it can readily handle multiple inputs and outputs (Charnes et al., 1978, Charnes and Cooper 1985). For example, Morey and Dittman (1995) gathered input-output data for 54 hotels of a national chain from a geographically dispersed area. They found that managers were operating at 89%

efficiency. Tsaur (2000) and Tsaur and Tsai (1999) also used DEA to measure the operating efficiency of international tourist hotels in Taiwan. But one cannot identify a general trend in the efficiency of the hotel industry without measuring the annual change in efficiency. Few researchers have applied DEA to measure the efficiency change of hotels. Therefore, this paper uses data envelopment analysis (DEA), developed by Charnes et al. (1978), and the Malmquist productivity index expressed by Färe et al. (1992), to measure the managerial efficiency of 45 hotels in 1998 and the efficiency change of 45 hotels from 1994 to 1998.

3. Methodology

3.1. *Defining input-output factors*

Managerial efficiency is a management control system. Any selection of input output factors is dependent upon the objectives of a management system. From a system perspective, organizational activities refer to conversion of inputs in various resources to output. Output is a concrete measurement that an organization reached its objectives. As such, if an organization has established its organizational objectives, it could immediately establish evaluation criteria and select input-output factors. In real practice, input-output factors are determined by experience in formulating and implementing operating plans as well as availability of data.

Input resources for tourist hotels management include input material, staff, capital and equipment. These resources produce tangible and intangible services through front office and back office operations (Yasin, Andrew, & Jeffrey, 1996).

There were two primary revenues for tourist hotels in Taiwan: accommodation and meals. These constitute more than 80% of total revenues of hotels. Other revenues include revenues from laundry, lease of store space, night clubs, service fee, all of which do not exceed 20% of total revenues.

Among input factors, numbers of employees are used to represent input manpower, total floor area of room numbers and dining department is used to represent capital investments of hotel and operating expenses are used to represent cost of input changes.

In summary, indicators used by the Taiwan Tourism Bureau for input-output factors are as follows:

Output factors:

- Room Revenue: refers to revenues from lease of rooms.
- Food and Beverages Revenue: refers to income derived from sale of food, snacks, alcohols, beverages

in dining room, coffee room, banquet and night clubs.

- Other Revenues: refers to revenues other than the two items mentioned above. It includes operating revenues from lease of store spaces, laundry, swimming pool, ball courts, barber-shop, beauty salons and bookstores.

Input factors:

- Number of full-time Employees: refers to hired employees.
- Guest Rooms: refers to number of guest rooms in the hotel.
- Total Area of Meal Department: measured by total floor area.
- Operating Expenses: including salary, cost of meals, utility, fuel, insurance and other relevant operating costs.

3.2. Measurement of relative managerial efficiency and efficiency change

Efficiency is a concept derived from physical and engineering science and refers to the relationship between inputs and outputs. The DEA approach developed by Charnes et al. (1978) represents a method by which non-commensurate multiple inputs and outputs of an entity can be combined objectively onto an overall measure of organizational efficiency. For present purposes, its principal strength lies in its ability to combine multiple inputs and outputs into a single summary measure without requiring prespecified weights.

Charnes et al. (1978) propose that the efficiency, g_0 , of a decision making unit (DMU), j_0 , can be obtained by solving the following output-oriented CCR model:

$$1/g_0 = \min \sum_{i=1}^m v_i x_{ij_0} \quad (1)$$

$$\begin{aligned} \text{s.t. } & \sum_{j=1}^n u_r y_{rj_0} = 1, \\ & \sum_{j=1}^n u_r y_{rj} - \sum_{j=1}^n v_i x_{ij} \leq 0, \end{aligned}$$

$$u_r, v_i \geq \varepsilon > 0, \quad i = 1, \dots, m, \quad r = 1, \dots, s, \quad j = 1, \dots, n,$$

where x_{ij} is the amount of input i to unit j ; y_{rj} the amount of output r from unit j ; u_r the weight given to output r ; v_i the weight given to input i ; n the number of units; s the number of outputs; m the number of inputs; and ε a small positive number.

For computational convenience, the efficiency of any DMU, j_0 , can be solved by the dual of (1). The dual

of (1) can be written as follows:

$$1/g_0 = \max \theta + \varepsilon \left(\sum_{i=1}^m s_{ij_0}^- + \sum_{r=1}^s s_{rj_0}^+ \right) \quad (2)$$

$$\text{s.t. } \sum_{j=1}^n \lambda_j x_{ij} + s_{ij_0}^- = x_{ij_0},$$

$$\sum_{j=1}^n \lambda_j y_{rj} - \theta y_{rj_0} - s_{rj_0}^+ = 0,$$

$$\lambda_j, s_{ij_0}^-, s_{rj_0}^+ \geq 0, \quad i = 1, \dots, m,$$

$$r = 1, \dots, s, \quad j = 1, \dots, n$$

$$\theta \text{ unconstrained.}$$

The necessary and sufficient conditions for any DMU, j_0 , to reach efficiency are $g_0 = \theta^* = 1$, $s_{ij_0}^- = s_{rj_0}^+ = 0$, where a star superscript to a variable is used to denote its optimal solution (Charnes et al., 1978). For efficient DMUs, their efficiency value is 1, which forms the efficient frontier. The target benchmark for an inefficient DMU, j_0 , can be derived from $x'_{ij_0} = x_{ij_0} - s_{ij_0}^-$ and $y'_{rj_0} = \theta^* y_{rj_0} + s_{rj_0}^+$, where the slacks $s_{ij_0}^-$ imply input surpluses and slacks, $s_{rj_0}^+$, imply output shortfalls. Besides, (2) identifies a reference set of corresponding efficient DMUs that is said to form a peer group for each inefficient DMU. Peer units are associated with basic λ_j . Since the efficiency value is 1 for all efficient DMUs on the efficient frontier, Anderson and Peterson (1993) proposed a modified model of (2) to increase the discrimination power for every efficient DMU by adding a constraint, $j \neq j_0$.

The method for measuring an organization's efficiency can be extended to measure the change of an organization's efficiency with the combination of the Malmquist productivity approach (Caves, Christensen and Diewert, 1982). As shown in Fig. 1, F_t represents the efficient frontier at period t , and F_{t+1} the efficient frontier at period $t+1$. $A_t(x_t, y_t)$ and $A_{t+1}(x_{t+1}, y_{t+1})$ represent the inputs–outputs vector of a DMU A at period t and $t+1$, respectively. To propose the method for measuring the efficiency change from the time

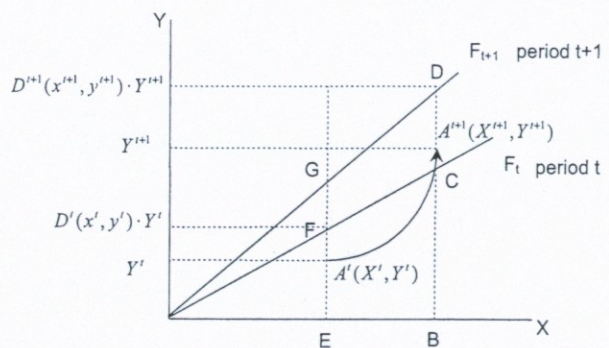


Fig. 1. The output based measurement of efficiency change.

periods t to $t+1$, the efficiency distance functions $D^{t+1}(x^t, y^t)$ are defined (which use the efficient frontier period $t+1$ as the reference set for measuring the efficiency of a certain DMU A at period t), as the following linear programming problem:

$$D^{t+1}(x^t, y^t) = \text{Max } \theta \quad (3)$$

$$\begin{aligned} \text{s.t. } & \sum_{j=1}^n \lambda_j^{t+1} x_{ij}^{t+1} \leq x_{ij}^t, \\ & \sum_{j=1}^n \lambda_j^{t+1} y_{rj}^{t+1} \geq \theta y_{rj}^t, \\ & \lambda_j^{t+1} \geq 0, \quad i = 1, \dots, m, \\ & r = 1, \dots, s, \quad j = 1, \dots, n, \\ & \theta \text{ unconstrained.} \end{aligned}$$

Similarly, $D^t(x^{t+1}, y^{t+1})$ may be defined, which use the efficient frontier period t as the reference set for measuring the efficiency of a certain DMU A at period $t+1$, as the following linear programming problem:

$$D^t(x^{t+1}, y^{t+1}) = \text{Max } \theta \quad (4)$$

$$\begin{aligned} \text{s.t. } & \sum_{j=1}^n \lambda_j^t x_{ij}^t \leq x_{ij}^{t+1}, \\ & \sum_{j=1}^n \lambda_j^t y_{rj}^t \geq \theta y_{rj}^{t+1}, \\ & \lambda_j^t \geq 0, \quad i = 1, \dots, m, \\ & r = 1, \dots, s, \quad j = 1, \dots, n, \\ & \theta \text{ unconstrained.} \end{aligned}$$

Obviously, both $D^t(x^t, y^t)$ and $D^{t+1}(x^{t+1}, y^{t+1})$ are an output-oriented CCR model as (2). From the geometric meaning of aforementioned distance function in Fig. 1, we know that:

$$\begin{aligned} D^t(x^t, y^t) &= EF/EA^t, \\ D^{t+1}(x^{t+1}, y^{t+1}) &= BD/BA^t, \\ D^t(x^{t+1}, y^{t+1}) &= BC/BA^t, \\ D^{t+1}(x^t, y^t) &= EA^t/EG. \end{aligned}$$

According to the Malmquist productivity index expressed by Färe et al. (1992) following Caves et al. (1982), the shift in efficiency (SIE) from period t to period $t+1$ can be described by BD/BC and EG/EF . The geometric average of BD/BC and EG/EF can be used to measure the SIT, as represented by (5)

$$SIE_{t,t+1} = \left[\frac{BD}{BC} \frac{EG}{EF} \right]^{1/2} = \sqrt{\frac{D^{t+1}(x^{t+1}, y^{t+1}) D^{t+1}(x^t, y^t)}{D^t(x^{t+1}, y^{t+1}) D^t(x^t, y^t)}} \quad (5)$$

Also the catching-up in efficiency (CIE) from period t to period $t+1$ can be represented by (6), which represents

the ratio between the relative efficiency of a DMU at period $t+1$ against that at period t .

$$\begin{aligned} CIE_{t,t+1} &= \frac{BA^{t+1}/BD}{EA^t/EF} \\ &= \left[\frac{D^{t+1}(x^{t+1}, y^{t+1})}{D^t(x^t, y^t)} \right]^{-1} \\ &= \frac{D^t(x^t, y^t)}{D^{t+1}(x^{t+1}, y^{t+1})} \end{aligned} \quad (6)$$

$CIE_{t,t+1} \times SIE_{t,t+1}$ can be used to measure the total efficiency change (TEC) from the time period t to period $t+1$; that is

$$\begin{aligned} TEC_{t,t+1} &= CIE_{t,t+1} \times SIE_{t,t+1} \\ &= \frac{D^t(x^t, y^t)}{D^{t+1}(x^{t+1}, y^{t+1})} \sqrt{\frac{D^{t+1}(x^{t+1}, y^{t+1}) D^{t+1}(x^t, y^t)}{D^t(x^{t+1}, y^{t+1}) D^t(x^t, y^t)}} \\ &= \sqrt{\frac{D^t(x^t, y^t) D^{t+1}(x^t, y^t)}{D^t(x^{t+1}, y^{t+1}) D^{t+1}(x^{t+1}, y^{t+1})}} \end{aligned} \quad (7)$$

(7) is the same as Malmquist productivity index, that is Malmquist productivity index is used as a measure for efficiency change.

4. Results

4.1. Relative managerial efficiency

Based on (2) CCR model and the Andersen and Petersen model, an evaluation of input–output information published in the Taiwan Tourism Ministry “Analytical Report on Management of International Tourist Hotels” was conducted in 1998 (Taiwan Tourism Bureau, 1994). Results, in order of relative managerial efficiency, relative efficiency, reference set and frequency which DMU is in reference set, are shown in Table 2. Hotels with the value of 1 means that relative efficiency of hotels are all located at the efficient frontier of all 45 hotels. Reference groups of hotels with the value of less than 1 are hotels with the most relative efficiency, thus are all located in efficient frontiers. For example, the reference groups of Emperor Hotel include Sherwood Hotel and Evergreen Laurel.

The reference set stakes out the efficiency frontier that any particular hotel is aiming for as a benchmark. The higher the frequency a relative efficiency hotel has been referred to by other hotels, the higher is its chance of being a benchmark. The results showed that there were 11 hotels with value of 1, namely Sherwood Hotel, Grand Formosa Regent, Howard Plaza Hotel, Grand Hyatt Hotel, Evergreen, Far East Hotel, Royal Chihpen Resort Hotel, Ambassador Hotel, Taoyuan, Tainan and Imperial hotel. Among these hotels, 10 are business

Table 2
Efficiency analysis for international tourist hotels in 1998

No	Hotel	CCR Efficiency	Reference groups	A & P Efficiency	Frequency	Rank
H22	Sherwood Taipei	1.0000	H22	1.4073	30	1
H19	Howard Plaza Hotel	1.0000	H19	1.3465	16	2
H27	Evergreen Laurel	1.0000	H27	1.2541	27	3
H23	Grand Formosa Regent	1.0000	H23	1.2267	8	4
H21	Grand Hyatt Taipei	1.0000	H21	1.2165	4	5
H24	Far Eastern	1.0000	H24	1.1245	1	6
H44	Royal Chihpen Resort Hotel	1.0000	H44	1.1161	2	7
H2	Ambassador Hotel	1.0000	H2	1.0895	2	8
H25	Holiday Inn	1.0000	H25	1.0568	2	9
H35	Tainan Hotel	1.0000	H35	1.0481	1	10
H4	Imperial Hotel	1.0000	H4	1.0478	2	11
H6	Emperor Hotel	0.9768	H22, H27	0.9768	0	12
H39	China Yangmingshan Hotel	0.9753	H19, H22, H27	0.9753	0	13
H42	China Trust Resort Hotel	0.9623	H22, H27	0.9623	0	14
H43	La Mi Di Hotel	0.9471	H22, H38	0.9471	0	15
H12	Santos Hotel	0.9177	H22, H27	0.9177	0	16
H41	Caesar Park Hotel Kenting	0.9019	H22, H25	0.9019	0	17
H17	Asia World Hotel	0.8999	H22, H27, H4	0.8999	0	18
H15	Lai Lai Sheraton Hotel	0.8634	H23, H19, H27	0.8634	0	19
H8	Hilton International Hotel	0.8541	H19, H22, H27	0.8541	0	20
H18	Royal Hotel	0.8422	H23, H22, H27	0.8422	0	21
H45	Parkview Hotel	0.8169	H21, H22, H38	0.8169	0	22
H26	Park	0.8142	H22, H27	0.8142	0	23
H20	Rebar Holiday	0.8032	H23, H22, H27	0.8032	0	24
H7	Riverview Hotel	0.7822	H22	0.7822	0	25
H10	Miramar Hotel	0.7416	H22, H27	0.7416	0	26
H29	Plaza Int'l	0.7317	H19, H22, H27	0.7317	0	27
H13	Ritz Hotel	0.7198	H19, H22, H27	0.7198	0	28
H40	Ta Shee Resort Hotel	0.7197	H21, H23, H19	0.7197	0	29
H38	China Trust Hotel Hualien	0.7146	H22, H27, H21	0.7146	0	30
H11	Brother Hotel	0.7098	H23, H19, H27	0.7098	0	31
H9	Golden China Hotel	0.6706	H19, H22	0.6706	0	32
H14	United Hotel	0.6656	H22, H27	0.6656	0	33
H28	Hotel National	0.6536	H19, H22, H27	0.6536	0	34
H31	Holiday Garden	0.6532	H22, H27	0.6532	0	35
H37	Hotel Astar	0.6001	H22, H27	0.6001	0	36
H5	Gloria Hotel	0.5887	H19, H22, H27	0.5887	0	37
H34	Ambassador Kaohsiung	0.5749	H22, H2	0.5749	0	38
H36	Marshal Hotel	0.5610	H22, H27	0.5610	0	39
H1	Grand Hotel	0.5544	H23, H19, H22, H27	0.5544	0	40
H30	Kingdom Hotel	0.5207	H19, H22, H27	0.5207	0	41
H3	Magnolia Hotel	0.5071	H23, H22, H27	0.5071	0	42
H33	Grand Hotel Kaohsiung	0.4935	H19, H27	0.4935	0	43
H16	Fortuna Hotel	0.4742	H22, H27	0.4742	0	44
H32	Royal Hotel	0.4083	H19, H27	0.4083	0	45

hotels and 1 resort hotel. The primary sources of customers for 8 hotels are foreign tourists and the remaining 3, local tourists. Eight hotels are members of an international chain and 3 hotels are independently managed and operated. Some excel in output, while some have appropriate management of input resources. Sherwood Hotel, Grand Formosa Regent, Grand Hyatt Hotel and Imperial hotel are part of an international alliance reservation organization and have excellent performance in terms of room revenues. The Meals revenues of Sherwood Hotel, Grand Hyatt Hotel and Howard Plaza Hotel are higher than room revenues. It can be said that their efficiencies are outstanding.

Meanwhile, Royal Chihpen Resort Hotel and Sherwood Hotel have efficiently utilized input resources such as human resources and equipment. Thus, they were all located at the efficient frontier.

Hotels which have relatively poor efficiency values include Ambassador Hotel Kaohsiung, Fortuna Hotel and Huang tung, with a value of less than 0.5. Inasmuch as operating expenses, number of employees and number of visitors are far greater than other hotels, their efficiency for the current period is relatively poor. Ambassador Hotel Kaohsiung invested an excessively high amount on operating expenses and has poorly utilize its human resources which explains its poor

Table 3
Difference verification of the efficiency for the 45 international hotels in Taiwan

Classification		Sample size	Relative efficiency	Std. Dev.	F-statistic (P-value)
Market condition	City hotels	38	0.7710	0.0934	3.246
	Resort hotels	7	0.9033	0.1882	(0.078)*
Sources of customers	Foreign visitors	25	0.8512	0.1767	4.101
	Domestic visitors	20	0.7437	0.1831	(0.049)**
Room sizes	Below 200	8	0.8527	0.1492	
	201–500	29	0.7512	0.1254	2.113
	Above 500	8	0.8765	0.1639	(0.134)
Management style	Independent	34	0.7457	0.1841	10.612
	International chain	11	0.9332	0.0812	(0.002)**

Note: *Denotes significance at the 0.1 level.

**Denotes significance at the 0.05 level.

efficiency. Fortuna Hotel's output efficiency indicator performance is far lower than the standards of industrial peers and revenues from rooms and meals are not ideal. The reason why Huang Tung performs poorly is due to the fact that it has a poor room efficiency. Average room occupancy is about 33% only. Also, fixed expenses for meals are higher than its competition.

Generally speaking, the overall results show an average efficiency value of 0.7916, a standard deviation of 0.1830; there were 11 hotels with an efficiency value of 1.

This study further classified tourist hotels in accordance with different market conditions, sources of visitors, room size, management style and ranking to study the difference on managerial efficiency of different types of hotels, as shown in Table 3. Results of ANOVA analysis revealed there were no significance in managerial efficiency due to room sizes. However, there were significant difference in managerial efficiency due to differences in market conditions, sources of customers and management style. The managerial efficiency of resort hotels that target leisure markets were greater than business hotels which primarily offer accommodation. The managerial efficiency of international hotels that cater mostly to foreign tourists were greater than hotels that cater to local tourists. Again, the managerial efficiency of hotels which join international chains operations were greater than local independently managed hotels. Of the 3 operating methods for international chains, efficiency value is highest on hotels which commissioned a professional hotel group to manage a hotel on its behalf through means of a management contract.

4.2. Change of managerial efficiency

The model for measuring the efficiency change, as mentioned previously in this paper, is used to examine the managerial efficiency change of international tourist hotels over the years from 1994 to 1998. The Results are

listed in Table 4 in order of the value of efficiency change.

The results indicate there were 20 hotels with an efficiency change greater than 1. This means that over the past 4 years, managerial efficiency of 20 hotels has been improving, with Evergreen leading. There were 25 hotels with an efficiency change of less than 1. This means that managerial efficiency of 25 hotels has been declining, with Ambassador Hotel Kaoshiung having the poorest record.

The correlation coefficients between efficiency change and the following items: relative efficiency in 1994, relative efficiency in 1998, shift in technology in 1994 to 1998 and catch up efficiency in 1994 to 1998 are listed in Table 5. It showed that the efficiency change of 45 international hotels between 1994 and 1998 in Taiwan are positively correlated with relative efficiency in 1998, shift in technology and catching up efficiency. However, the efficiency change is negatively correlated with relative efficiency in 1994. This signifies that between 1994 and 1998, those who have made great improvements in efficiency were those with poor relative efficiency in 1994. For example Far Eastern Hotel, Rebar Holiday Inn Crowne and Parkview Hotel have a lagging relative efficiency in 1994 but made great improvements over the past 4 years. Tainan, United Hotel and Taoyuan have a good relative efficiency in 1994 but little efficiency change in the past 4 years. The relationships among the relative efficiency in 1994, the relative efficiency in 1998 and the efficiency change between 1994 and 1998 are shown in Fig. 2.

An ANOVA analysis has been conducted on the relationship between efficiency change and market conditions, sources of customers and management style. The results indicate that there is a significant difference in efficiency change due to difference in sources of customers and management style as are shown in Table 6.

The above analysis is sufficient to answer the second question and serve as a reference for the formulation of a marketing strategy plan. The values of relative

Table 4
Efficiency change in year 1994 to 1998, 45 Taiwan Hotels

No	Hotels	$D^{1994}(1994)$	$D^{1998}(1998)$	$D^{1994}(1998)$	$D^{1998}(1994)$	CIE	SIE	TEC
H27	Evergreen Laurel	1.1977	1.0000	0.6074	1.7841	1.1977	1.5660	1.8757
H24	Far Eastern	1.9459	1.0000	1.0138	0.8871	1.9459	0.6706	1.3049
H20	Rebar Holiday	1.5845	1.2450	0.8342	1.0872	1.2727	1.0119	1.2879
H45	Parkview Hotel	2.0764	1.2241	0.8954	0.8621	1.6962	0.7534	1.2779
H10	Miramar Hotel	1.3245	1.3484	0.8067	1.2871	0.9823	1.2745	1.2519
H23	Grand Formosa Regent	1.0000	1.0000	0.6548	0.9854	1.0000	1.2267	1.2267
H28	Hotel National	1.2574	1.5300	1.2053	2.0156	0.8218	1.4265	1.1723
H19	Howard Plaza Hotel	1.0000	1.0000	0.4212	0.7851	1.0000	1.1658	1.1658
H42	China Trust Resort Hotel	1.1862	1.0392	0.7747	0.9012	1.1415	1.0095	1.1524
H4	Imperial Hotel	1.4162	1.0000	0.7356	0.6815	1.4162	0.8088	1.1455
H44	Royal Chihpen Resort Hotel	1.0000	1.0000	0.7156	0.8746	1.0000	1.1055	1.1055
H2	Ambassador Hotel	1.0723	1.0000	0.7119	0.8054	1.0723	1.0271	1.1014
H43	La Mi Di Hotel	1.3656	1.0559	1.0264	0.9613	1.2933	0.8510	1.1006
H18	Royal Hotel	1.1715	1.1874	1.1390	1.3716	0.9866	1.1048	1.0900
H6	Emperor Hotel	1.0500	1.0238	0.9038	1.0063	1.0256	1.0419	1.0686
H26	Park	1.0655	1.2282	0.7849	1.0264	0.8676	1.2277	1.0651
H22	Sherwood Taipei	1.0000	1.0000	0.5793	0.6548	1.0000	1.0631	1.0631
H21	Grand Hyatt Taipei	1.0000	1.0000	0.6001	0.6548	1.0000	1.0446	1.0446
H17	Asia World Hotel	1.0000	1.1112	0.5139	0.6215	0.8999	1.1593	1.0432
H13	Ritz Hotel	1.1320	1.3893	0.6245	0.8215	0.8148	1.2706	1.0353
H39	China Yangmingshan Hotel	1.2960	1.0253	1.0494	0.8265	1.2640	0.7894	0.9978
H40	Ta Shee Resort Hotel	1.2686	1.3895	1.0654	1.0625	0.9130	1.0451	0.9542
H11	Brother Hotel	1.0000	1.4088	0.6684	0.8511	0.7098	1.3394	0.9507
H41	Caesar Park Hotel Kenting	1.0000	1.1088	0.8964	0.8964	0.9019	1.0530	0.9497
H1	Grand Hotel	1.6388	1.8038	1.0175	0.9395	0.9086	1.0081	0.9159
H8	Hilton International Hotel	1.0000	1.1708	0.8887	0.8287	0.8541	1.0449	0.8924
H25	Holiday Inn	1.0000	1.0000	1.2356	0.9562	1.0000	0.8797	0.8797
H14	United Hotel	1.0000	1.5024	0.7154	0.8214	0.6656	1.3134	0.8742
H15	Lai Lai Sheraton Hotel	1.0455	1.1582	0.7665	0.6460	0.9027	0.9662	0.8722
H12	Santos Hotel	1.1551	1.0897	1.1288	0.7779	1.0601	0.8063	0.8547
H31	Holiday Garden	1.3187	1.5309	1.2879	1.0486	0.8614	0.9722	0.8375
H5	Gloria Hotel	1.1317	1.6987	1.0841	1.0636	0.6663	1.2135	0.8085
H29	Plaza Int'l	1.2223	1.3667	0.9755	0.7073	0.8944	0.9004	0.8053
H3	Magnolia Hotel	1.4039	1.9720	1.3796	1.1808	0.7119	1.0964	0.7806
H9	Golden China Hotel	1.0794	1.4912	1.0489	0.8713	0.7239	1.0712	0.7754
H16	Fortuna Hotel	1.3501	2.1088	1.4681	1.1654	0.6402	1.1135	0.7129
H38	China Trust Hotel Hualien	1.1349	1.3994	1.2224	0.7482	0.8110	0.8688	0.7046
H35	Tainan Hotel	1.0000	1.0000	1.6235	0.8044	1.0000	0.7039	0.7039
H36	Marshal Hotel	1.2492	1.7825	1.2129	0.8562	0.7008	1.0036	0.7034
H30	Kingdom Hotel	1.1315	1.9205	1.0226	0.8581	0.5892	1.1934	0.7031
H7	Riverview Hotel	1.0610	1.2784	1.3155	0.7732	0.8299	0.8415	0.6984
H32	Royal Hotel	1.2893	2.4492	1.1159	0.8723	0.5264	1.2185	0.6415
H37	Hotel Astar	1.2362	1.6664	1.2796	0.5431	0.7419	0.7564	0.5611
H33	Grand Hotel Kaohsiung	1.1289	2.0263	1.1544	0.6204	0.5571	0.9822	0.5472
H34	Ambassador Kaohsiung	1.0035	1.7394	1.1966	0.3469	0.5769	0.7089	0.4090
						0.9432	1.0378	0.9580

Note: CIE means catching-up in efficiency, SIE means shift in efficiency, TEC means total efficiency change, all are defined as Section 3.2.

Table 5
Correlation coefficients between efficiency change and efficiency of the 45 international hotels in Taiwan

Efficiency	Correlation coefficients with efficiency change
Relative efficiency in 1994	-0.5054
Relative efficiency in 1998	0.6878
Shift in technology (SIT) in 1994 to 1998	0.3815
Catching-up in efficiency (CIE) in 1994 to 1998	0.6829

efficiency for measuring the competitiveness are represented on the horizontal axis. A smaller value represents a hotel with less competitiveness. A larger value represents a hotel with more competitiveness. The vertical axis measures efficiency changes for the period 1994–1998. A smaller value indicates a hotel with a slower pace of progress over the past 4 years, which is regarded as a hotel with poor strategy and poor management. A larger value indicates a hotel with faster pace of progress over the past 4 years. The scatter is shown in Fig. 3. Based on the demand for and rate of

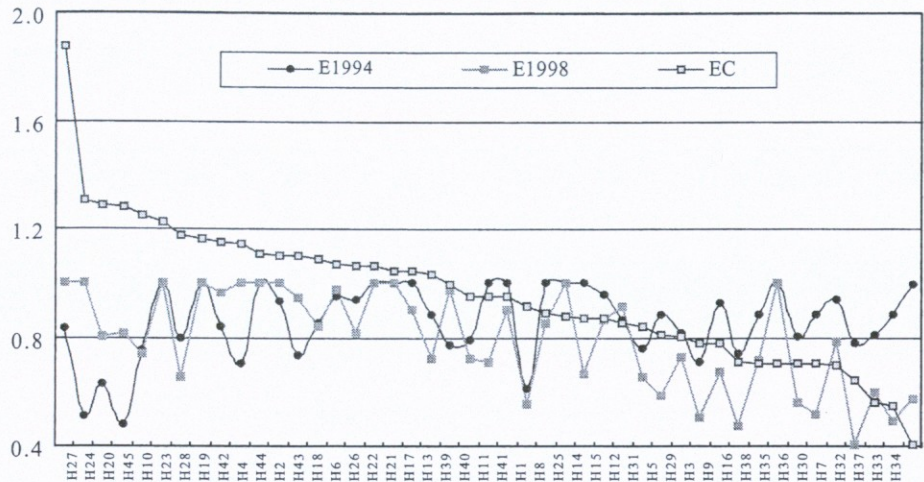


Fig. 2. Diagram of relative efficiency and efficiency change of the 45 international hotels in Taiwan.

Table 6
Difference verification of the efficiency change for the 45 international hotels in Taiwan

Classification		Sample size	Efficiency	Std. Dev.	F-statistic (P-value)
Market condition	City hotels	38	0.9361	0.2704	1.803
	Resort hotels	7	1.0768	0.1190	(0.186)
Sources of customers	Foreign	25	1.0544	0.2659	5.5969
	Domestic	20	0.8808	0.2263	(0.023)**
Management style	Independent	34	0.9222	0.1068	3.183
	International chain	11	1.0687	0.1579	(0.091)*

Note: *Denotes significance at the 0.1 level.
**Denotes significance at the 0.05 level.

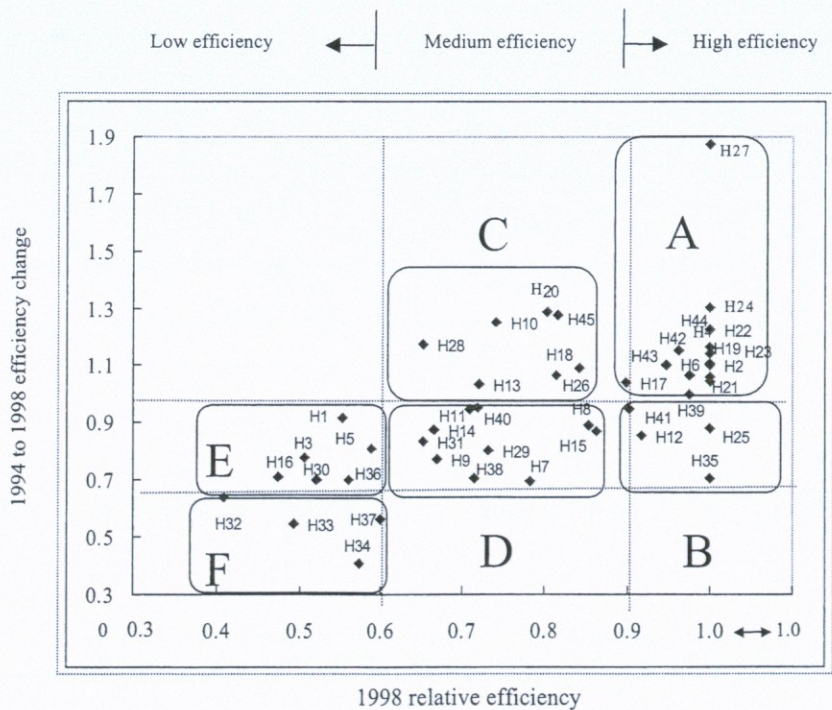


Fig. 3. The matrix of management decision for the 45 international hotels in Taiwan.

progress of improvement, the 45 hotels in Taiwan can be classified into 6 categories as follows:

A. Hotels with high competitiveness and a fast pace of progress: These include Evergreen Laurel, Far Eastern Hotel, Sherwood Hotel, Imperial Hotel, Howard Plaza Hotel, Royal Chihpen Resort Hotel, Ambassador Hotel, Emperor Hotel, Grand Hyatt Hotel, Grand Formosa Regent, China Trust Resort Hotel (Sun Moon Lake), La Midi Hotel, Asia World Plaza Hotel. These hotels have a relative efficiency of above 0.9 and an efficiency change above 1.0. Currently, these hotels have excellent managerial efficiency. Over the past 4 years, these hotels have improved rapidly. This signifies that they are on the right track. They should maintain its competition advantage and seek to find further improvements.

B. Hotels with high competitiveness but a slower pace of progress: China Taoyuan, Tainan, Caesar Park Hotel Kenting and Santos Hotel have a relative efficiency greater than 0.9 and an efficiency change between 0.6 and 1. Currently, these hotels still enjoy a good managerial efficiency, albeit no further progress has been observed over the past 4 years. There is a need for these hotels to pursue new breakthroughs to be able to maintain a secure competitive advantage.

C: Hotels with medium competitiveness but a fast pace of progress: These include Rebar Holiday Inn Crowne, Parkview Hotel, Miramar Hotel, Royal Taipei, Park Hotel, and Ritz Hotel. These hotels have a relative efficiency of more than 0.6 but less than 0.9 and an efficiency change of more than 1. Currently, these hotels have a medium managerial efficiency. However, they have experienced rapid efficiency change for the past 4 years. This means that the competitive advantage of these hotels is gradually increasing.

D: Hotels with medium competitiveness but a slow pace of progress: These include Lai Lai Sheraton Hotel, Hilton Hotel, Brother Hotel, Ta hsi hotel, United Hotel, Holiday Garden, Golden China Hotel, Riverview Hotel, Plaza International. China Trust Hotel Hualien. These hotels have a relative efficiency of more than 0.6 but less than 0.9, efficiency change is between 0.6 and 0.9. Currently, these hotels have a medium managerial efficiency. Over the past 4 years, there has been a slight decline in efficiency change in these hotels. There is a need for these hotels to improve and catch up with other hotels.

E: Hotels with low competitiveness but a slow pace of progress: These include Magnolia Hotel, Taipei Grand Hotel, Gloria Hotel, Kingdom Hotel, Marshal Hotel and Fortuna Hotel. These hotels have a relative efficiency of less than 0.6 and an efficiency change between 0.6 and 0.9. Currently, the competitiveness of these hotels are clearly lagging behind others. Over the past 4 years, managerial efficiency has been declining.

F: Hotels with low competitiveness and worse pace of progress: The managerial efficiency of Huang Tung, Astar Hotel, Grand Hotel Kaoshiung and Ambassador Hotel Kaoshiung is less than 0.6 and efficiency change is less than 0.7. Currently, competitiveness of these hotels is clearly lagging behind other hotels. Over the past 4 years, managerial efficiency of these hotels is getting worse.

4.3. Marketing strategy

From the above analysis, an understanding is derived about the relative managerial efficiency of hotels and input–output ratios. At the same time, it was discovered that the quality of managerial efficiency of international hotels in Taiwan significantly differ due to market conditions, sources of customers and management style. With reference to management style, the managerial efficiency of international tourist hotels in Taiwan is closely related to their level of internationalization of hotels. It can be said that the international links of tourist hotels bestow an important competitive advantage in industrial development. To summarize, managerial efficiency is a function of

1. Market condition. According to market conditions, hotels can be categorized into two types: urban and leisure hotels. ANOVA results indicate that leisure hotels are better managed than their urban counterparts as far as international tourist hotels are concerned. This is partly due to better occupancies at weekends. Moreover, foreign travelers stress the importance of leisure and travel information. While, the potential of the domestic travel and conference market should not be overlooked. If local consumers can be successfully persuaded to patronize international tourist hotels with high prices, then they will become an important source of customers. A hotel's resources and features also determine product design and service strategies. While to develop a low-season market is a means of increasing efficiency. Some hotels, such as Hotel Royal Chihpen, Caesar Park Hotel Kenting and Hotel Landis China Yangmingshan, have achieved positive results by using "greater discounts" to attract customers in the low season while also further developing the "conference market" and "domestic travel" market.

2. Sources of customers: According to the analysis, hotels in Taiwan whose customers are mainly foreigners achieve better efficiency than those only servicing local customers. Hotels having foreign customers are mainly located in the Taipei metropolitan area. Their target market is clear. They are urban hotels, which service travelers attending business exhibitions or conferences. Foreign travelers can be further divided into two groups: foreign individual (FIT) and group travelers. Since an essential part of FIT is business travelers, their duration of travel is normally longer and the average

price paid for a room is higher. The source of this type of travelers is stable and unlikely to be affected by seasonal factors. They also have higher brand loyalty. Thus, the higher the proportion of FIT customers, the easier the image of high quality service is created.

Large-size international tourist hotels have more rooms so they have to service customers other than FIT in order to promote the overall occupancy efficiency. Service procedures, room decoration and circulation planning have to be distinguished so as to meet demands from different customers. Small-size international hotels have fewer rooms so a differentiation strategy can be adopted to signify a measure of “uniqueness” their delicate nature. Due to this, hotels like the Ritz Landis Taipei Hotel and the Sherwood Hotel have targeted European and US FIT. Their professional service is specially designed for business travelers and not extended to groups. Rooms featuring European or US style, circulation planning, business center, international conference facilities and service innovation are unique characters of this type of hotel.

3. Management style: “Internationalization” is the direction that international tourist hotels have to pursue. This trend shows that the key to the successful operation of domestic hotels lies with world-class quality service and acquisition of foreign travelers. ANOVA results in this study demonstrate that hotels belonging to international franchise-chains have better efficiency than independent hotels. Compared to those independently operated local hotels, international franchise-chains hotels have sounder reputation, better brand image, internet marketing, efficient reservation system and economy of scale. Although some local hotels’ management and service quality are no worse than that of international hotels, it is still difficult for them to build worldwide reputation and attraction. Therefore, in the future it will be more and more difficult for independent hotels to survive. Franchise chains or membership in hotel associations will be the trend.

Independent hotels having no international support have to differentiate themselves from their competitors and transform these differentiations into competitive advantages. For example, Hotel Tainan utilizes its geographical segment to capture international business travelers in south Taiwan. Again, the Emperor Hotel is a small-size business hotel located in Taipei, providing specialized service for Japanese travelers. It also adopts a middle range price strategy to create a segment differing from international business hotels and it has achieved a good result. Santos Hotel services groups to achieve market segmentation. It also vertically integrates upstream and downstream industries, such as airlines, travel agencies and cross-industry co-operation. The Lemidi Hotel is located in Hsitou region. It fully utilizes local geographical features and introduces

innovative facilities and recreation, which help achieve good management efficiency.

5. Conclusion

The main objective of measuring efficiency is to gain an insight of how a DMU being evaluated can improve efficiency with its current resource base or change resource allocation. This is especially important in the management of hotels under a perfect competition environment. The major problem in measuring lies on the incommensurability of different output measurements as well as input measurements. This problem is solved in the path breaking work of Charnes et al. (1978) by the DEA approach.

This paper adopted DEA to measure the relative managerial efficiency of 45 international hotels in Taiwan. At the same time, the Malmquist productivity approach expressed by Färe et al. (1992) was used to measure changes in efficiency. By comparing relative efficiency and the rate of efficiency change of the hotel industry, an individual hotel’s competitiveness and pace of progress can be identified. A further analysis of the DEA results help managers to understand factors determining the management performance. In this paper, the linkage between efficiency measurement and strategy formulation are illustrated by 45 international hotels in Taiwan. It was expected this study could provide useful information for future related research as well as identifying future hotel management needs.

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