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The Operational Efficiency and Sustainability of Selected De Luxe Class Hotels in Metro Manila

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Abstract

For a hotel to survive, it must consistently perform at its most fluid efficiency. Inefficient performance means wastes in the use of hotel inputs that is detrimental in maintaining low operating expenses to sustain survival in the hotel industry. This paper aims to determine the sources of efficiency and sustainability performance of 10 De Luxe Class Hotels in Metro Manila, Philippines accredited by the Department of Tourism from 2005- 2014. The efficiency and productivity of the sample were assessed using slack-based and Malmquist productivity index models of the Data Envelopment Analysis (DEA). The results indicated that an average deluxe hotel was productive and cost efficient. However, technology was obsolete and could cause the downtrend in revenue or tourist visit. It also hinted decreasing returns to scale. Slacks revealed that an average deluxe hotel should reduce its inputs (operating expenses, capital, employees and rooms) wastages to catch up with Pan Pacific Hotel Manila. Regression analysis proved that the De Luxe class hotels are operating at decreasing return to scale. It also reveals that older hotels were not efficient than younger (newly established) hotels. Although not statistically significant, larger hotels were not efficient in their operation than their smaller counterparts. Overall, the De Luxe class hotels' operation is not sustainable.

Keywords: *Hotels, DEA, SFA, Total factor productivity, efficiency, resource use*

1. Introduction

The hospitality and travel industry is one of the fastest growing sectors in the Philippines. The industry alone is a multi- billion dollar enterprise. It is always exciting, never boring, and offers unlimited opportunities (Cariño, 2013). The World Travel and Tourism Council (2014) reported that travel and tourism generated 1,226,500 jobs directly in 2013 (3.2% of total employment). The sector is forecasted to grow by 1.7% in 2014 at 1,248,000 employments in hotels, travel agencies, airlines, and other passenger transportation services (excluding commuter services). It also includes the activities of the restaurant and leisure industries directly supported by tourists. By 2024, travel and tourism will account for 1,595,000 jobs directly. This is an increase of 2.5% over the next ten years.

There are five (5) levels of hotel accommodation standards in the Philippines ranging from one to five star. One Star is a 25 - 40% achievement or 251 to 400 points. These enterprises appeal to budget minded travelers and the facilities and services are limited in range. The two star or economy is a 40-55% achievement or 401 to 550 points. These enterprises appeal to tourists seeking more than the basic accommodation offering expanded facilities and higher level of comfort. The three star or standard is a 55–70% achievement or 551 to 700 points. These enterprises offer a very good level of accommodation with more spacious public areas, higher quality facilities and a greater range of services. The four star or first class is a 70–85% achievement or 701 to 850 points. These properties are upscale in all areas. The accommodation is refined and stylish. The service includes an extensive array of facilities. The five star or De Luxe Class Hotel is an 85-100% achievement or 851 to 1,000 points. These properties reflect the characteristics of luxury and sophistication with world class facilities and meticulous service.

Varied types of hotels offer similar but differentiated services and products. DOT (Department of Tourism) set minimum requirements for the maintenance of each hotel classification. The scope of the hospitality industry, such as: lodging segment, food and beverage segment, entertainment and recreation, and travel and tourism. This paper concentrates only on the lodging segment of the hospitality industry.

The hotel has been the most fabled type of lodging. It has been commemorated in movies and musicals, and some of the country's most important business has been conducted within hotel walls. Varying greatly in style and service, most hotels share a similar structure. Guest rooms usually have a bed, bathroom, telephone, and television. In addition to housekeeping, services may include luggage assistance, a business center with computers, internet access, and a photocopier or fax machine, a spa, recreation facilities, restaurants, or bars.

The concept of hospitality is old. People were hospitable because of their own superstitious fears that a stranger was either God or a representative of evil spirits, perhaps even the devil himself. Through a myth, the travels of Odysseus, as recorded by homer in the Odyssey and the Iliad give insights into lodgings of those ancient days. While roaming the Mediterranean his statement show his appreciation of hospitable welcomes where he stayed (Brown, 2011)

In ancient Greece, hospitality was provided by certain elements of religion; missionaries, priests, and pilgrims form a very large part of travelling public. In ancient Rome the inns were large mansions. Owners of these inns would not allow guests to stay unless they carried a "letter of eviction" which is a permission to travel for government officials. In the Old Testament, Jacob and his brother travelling in Judea, going to an inn, and foddering their mounts. Certainly, the most famous inn is the one in Bethlehem. Today, the hotel is made up of several businesses or revenue centers and cost counters. A few and thousand products and services are sold every day. Hotel businesses are open for all the days in a year and twenty-four hours in a day to provide opportunities to different professions.

Philippine Travel and Tourism has a direct impact on gross domestic product, investment, and employment opportunities. Hotels are most often in or near business districts, travel destinations, and airports. The hotel's location is a sign of economic development. Hence, the performance of the hotel industry is important (Ahlia, 2013).

Based on the data published by DOT, there are 64 accredited hotels in Metro Manila, 21 of which are De Luxe Class Hotels. This type of hotel has the highest set of standards among the categories. These establishments must meet the requirements of a 5-star hotel with points ranging between 851 and 1,000 or at percentile scores of 85% to 100%. These properties reflect the characteristics of luxury and sophistication. The facilities are world class in every manner and meticulous service exceeds guest expectations. Based on the percentage of hotel rooms by Tourism Research and Statistics division, 57.09% of the 15, 567 available rooms in 2014 were under the De Luxe class Hotels The hotels also gathered the highest occupancy rate of 70.82% in 2014 among the other hotel categories.

To endure a highly competitive environment, there is a demand for the hotels to constantly formulate marketing strategies, strengthen hotel operations, and upgrade the quality of service (Chen, 2006). For a hotel to survive, it must consistently perform at its most fluid efficiency. Inefficient performance means wastes in the use of hotel inputs that is detrimental in maintaining low operating expenses to sustain survival in the hotel industry. Hence, this study combines the strength of both the Data Envelopment Analysis (DEA) and Stochastic Frontier (SF) models in one methodology to detect inefficiency and sustainability of De Luxe hotels. The DEA efficiency is used prior to the stochastic frontier model in measuring the level of efficiency in performance (Assaf, 2012). Furthermore, this study analyzes the performance of De Luxe Hotels in Metro Manila that use multiple inputs to produce multiple outputs.

This study aims to determine the efficiency and sustainability of De Luxe Hotels in Metro Manila, Philippines over the period of 2005-2014. To achieve this, the following objectives are raised: (1) t0 determine the sources of productivity and efficiency of De Luxe Hotels; (2) to determine the shortage in outputs and excess in inputs; (3) to identify the factors affecting productivity of the samples; and (4) to determine the sustainability of De Luxe Hotels.

This study will provide the investors insight to decision-making considerations when investing on a hotel. This study attempts to prove that investors should not just seek companies that command a large portion of the market share, but more on the De Luxe Hotel's performance particularly its efficiency and sustainability.

For the participating sample of De Luxe Class Hotels in Metro Manila, the study will provide a comprehensive evaluating tool in assessing performance and identifying internal strengths and weaknesses. More specifically, this study will result to clearly set means of evaluating comparative advantages of leading competitors, identifying the best practices of the hotel industry's functional leader, and incorporating the findings into a strategic plan geared to elevate the hotel's status. By identifying efficient firms, hotel managers will be able to determine key performance measure affecting the hotel's business sector functions. Measuring one's own performance levels against the leading competitor will provide the sample with information and insights on the strategies for enhancing the full utilization of hotel resources. With this information, the management can monitor its effectiveness in achieving its goals and objectives, managing products and services, and obtaining customer satisfaction. These factors affecting effectiveness are important determinants of long-term survival.

Since the hotel industry helps in creating source of income that provides additional income and employment in the economy, this study will prove that government support is necessary in promoting the country and its attractions to tourists.

By promoting hotel survival through efficient performance, hotel clients will benefit from the study when the hotel

management responds to the results of the study. In effect, customer satisfaction can improve customer loyalty thereby increasing the positive image of De Luxe Class Hotels.

The results of this study will serve as guide and direction for future researches focusing on hotel performance and efficiency. More specifically, the results can give comprehensive information on factors resulting to declining hotel performance and loss of clientele.

To the researcher, this study provides solid exposure on the employment of DEA and SFA techniques as well as its applicability in efficiency and sustainability measurements. From a consumer's point of view, it may also provide helpful insights to the researcher on her choice of hotels.

2.0 Methodology

The main focus of the study is the research design which contains the type of analysis engaged and time period of the study. The parametric and non- parametric approaches in this research model and tests are defined.

Quantitative research is an approach for testing objective theories by examining the relationship among variables. These variables, in turn, can be measured, typically on instruments, so that numbered data can be analyzed using statistical procedures. It involves the utilization of inferential statistics in order to obtain the results of the study. In inferential statistics, there is the analyzation of a sample data about the real world.

This study is an evaluative research that measures the performance of 10 DOT- accredited De Luxe Class Hotels in Metro Manila, Philippines. The objectives of this research will be addressed through the application of Data Envelopment Analysis (the slack based-index) and Stochastic Frontier Analysis to measure the sustainability performance of the sample.

This study is intended to evaluate the efficiency and sustainability performance of the De Luxe Class Hotels sample. The hotel industry will be evaluated based on data from 2005- 2014. This study uses four inputs and an output to perform necessary productivity, efficiency and sustainability analysis. Furthermore, it employed other dummy variables such as age and size (assets) of the De Luxe Class Hotels that may affect their technical efficiencies. Finally, a non-parametric (DEA) and parametric (SFA) approaches will be used to measure the productivity, efficiency growth and sustainability in this study. The combined application of these two quantitative methodologies will better estimate the performance of the De Luxe Class Hotels from 2005- 2014 (Dong et al, 2014).

Performance measurement of this research covered a period of ten years, from 2005-2014. This study included a total of 10 DOT- accredited De Luxe Class Hotels in Metro Manila, Philippines. Eleven De Luxe Class Hotels will be excluded from this study due to the unavailability or incompleteness of their data. Table below provides a list of the full sample of the firms included in this study.

SELECTED DOT- ACCREDITED DE LUXE CLASS HOTELS	
1. Diamond Hotel Philippines	6. Manila Hotel Corporation
2. DusitThani Hotel	7. Sofitel Philippine Plaza Manila
3. EdsaShangri-la Manila	8. The Heritage Hotel Manila
4. Hotel Inter Continental Manila	9. The Pan Pacific Hotel Manila
5. Makati Shangri-la Manila	10. The Peninsula Manila

Source: Official Website of the Department of Tourism (www.tourism.gov.ph)

Each of the hotel firm will be treated as a DMU, considering four input and an output factors. The input factors of the DMUs measured were: 1) number of rooms, 2) number of employees, 3) operating expenses, and 4) capital. While the output factor for the model includes: 1) total revenue. The dummy variables (age and size) will be tested against sustainability if it significantly affects operation of the De Luxe hotels.

Lodging accommodation is the main purpose of a hotel. Thus, the number of rooms available projects the size of a hotel. This refers to the amount of rooms that are provided for rent to guests without any subsequent adjustment being made for size and quality. Parallel to the study of Assaf (2010) and Shyu and Hung (2012), this study will use number of rooms to represent the principal product offering of De Luxe Class Hotels. Another input variable is the number of employees which refers to the number of individual employees involved in the operation of hotels, including guest rooms, catering and management staff as has been applied in several literature including, Anderson (2000), Barros et al (2009), Huang et al (2012) and Assaf (2012)

Capital is the result of productive human action not immediately consumed but directly employed in the pursuit of additional goods. The term Capital has several meanings and it is used in many business contexts. In general, capital is accumulated assets or ownership. More specifically, Capital is the amount of cash and other assets owned by a business. These business assets include accounts receivable, equipment, and land/buildings of the business. Capital can also represent the accumulated wealth of a business, represented by its assets less liabilities. Depreciation or properties and equipment can be used as a proxy for capital as applied on the studies conducted by Barros (2006) and Cua (2005).

In the segment of the hotel operation, operating expenses includes wage expenses, water and electricity fuel expense, food and beverage costs, insurance premiums, and maintenance and repair costs (Barros, 2004; Huang, et al.,2012; and Hwang, 2003).

De Luxe Class hotels' resources will be utilized to produce the different output factors. Revenues generated by the De Luxe Class Hotels were mainly from rooms, but may also involve other key operations like food and beverage service and other sources such as laundry, nightclubs, and service fees. Thus, total revenue is considered as an output variable in the study correspond to the variables pertained in Chen (2007), Anderson (2000), Cua (2005) and Huang, et al. (2012). The two dummy variables will be used to investigate whether the size in terms of assets and age is significantly related to the technical inefficiency of SFA.

A resource with economic value that an individual, corporation or country owns or controls with the expectation that it will provide future benefit is called an asset. Assets are bought to increase the value of a firm or benefit the firm's operations. An asset is something that can generate cash flow, regardless of whether it is a company owned manufacturing equipment or a rental. In the context of accounting, assets are either current or fixed (non-current). Current means that the asset will be consumed within one year. Generally, this includes things like cash, accounts receivable and inventory. Fixed assets are those that are expected to keep providing benefit for more than one year, such as equipment, buildings and real estate. Age in years, is the age of the hotel (Aissa and Goaied, 2015).

The four inputs, one output and two dummy variables will be used in this research to measure the efficiency and sustainability performance of the 10 De Luxe Class Hotels under study.

2.1 DEA

This study uses Data Envelopment Analysis (DEA) as a method of measuring efficiency of the Deluxe Class Hotels in Metro Manila. DEA is a non-parametric method used to evaluate the efficiency of a decision making unit by comparing it with linear combinations of other DMUs engaged in making the same outputs from the same inputs or resources. This technique is formulated in two ways: one is to minimize inputs for a given level of outputs and one is to maximize outputs for a given level of inputs (Cowie, 2002).

Using DEA methodology, the relative efficiency of firms can be calculated which can be an advantage for the need to assign a priori measures of comparative importance to any inputs or outputs (Cabanda et al, 2008). Linear programming method is used for evaluating the efficiency of DMU's using data as inputs and outputs quantities of a group of firms to construct a piece-wise frontier over the data points. Efficiency measures are calculated relative to this frontier, which represents an efficient technology. Thus, this method is an ideal measure for broad measurement of efficiency. The inefficiency of a unit can be decomposed into its pure technical and scale efficiency. Pure technical efficiency measure is gained by estimating the efficient frontier under the notion of variable return to scale. It only reflects and used as an index of managerial performance without scale efficiency. The ratio of overall technical efficiency to pure technical efficiency is responsible for scale efficiency measure. On the other hand, the scale efficiency measure has the ability to provide the management to select the best size of resources or to select the size of production to achieve the predictable production level (Kumar & Gulati, 2009).

DEA can deal either with input- oriented or output oriented efficiency measure for an entity (Coelli et al, 2005). In an input-oriented case, DEA seeks the maximum possible proportional reduction in input used while maintaining the number of outputs produced from each firm. In the output-oriented case, it seeks the maximum proportional increase in output produced with a certain level of input used.

Charnes, Cooper, and Rhodes (1978) first introduced DEA into the Operations Research (OR) literature. The original CCR model was applicable only to technologies characterized by constant returns to scale globally. It turned out to be a major breakthrough. Banker, Charnes, and Cooper (1984) extended the CCR model to accommodate technologies that exhibit variable returns to scale. The primal model or CCR allows the DMU being measured to determine the set of optimal weights for each of its factors (outputs are denoted by y. and inputs by x in the following model) so as to maximize its efficiency. The solution consists of a set of weights (for outputs and y for inputs) chosen so that the efficiency of any other unit with these weights won't exceed 1, the value at which a unit is relatively efficient. Which model is denoted primal and which dual is arbitrary, some authors prefer to call this model the primal model, as it conveys better the basic idea behind DEA. On the other hand BCC model measures technical efficiency as the convexity constraint ensures that the composite unit is of similar scale size as the unit being measured. The resulting efficiency is always at least equal to the one given by the CCR model, and those

DMUs with the lowest input or highest output levels are rated efficient. Unlike the CCR model, the BCC model allows for variable returns to scale.

The returns to scale mean that the increasing or decreasing efficiency of a DMU based on size of its outputs. A constant returns to scale means that a DMU able to linearly scale inputs and outputs without increasing or decreasing efficiency. Variable returns to scale is a situation that a DMU experience increasing return to scale (IRS) or decreasing return to scale (DRS) efficiency due to scale variability of inputs and outputs.

A firm is technically efficient if it operates on the frontier of technology. A DMU is technically inefficient if it operates beneath the frontier. The productivity of the firm is the ratio of output to inputs (Productivity= output/input). Total factor productivity is the ratio of all outputs to all inputs employed. Technical change occurs when the production frontier shifts out over time.

2.2 Malmquist Productivity Index

Productivity measurement consists of measuring the change in ratio of outputs used in a production process over time. DEA method allows decomposition of productivity growth into two components: the technical efficiency change and technological change (Malmquist, 1953). The Malmquist productivity index is used as an indicator of productivity. It represents the total factor productivity growth. When one has panel data and an input or output based, Malmquist measure the productivity change and to decompose this productivity change into technical change and technical efficiency change. DEA envelops all points on or below the frontier line. On the other hand, the division of Malmquist Total productivity index as to the change in technical efficiency and technological change. This allows measurement of the change in efficiency and technological change when dividing the equations (Barros, 2004).

$$\textbf{Technical Efficiency change}=\frac{D^{t+1}\,(x^{t+1},y^{t+1})}{D^{t}(x^{t},y^{t})}$$

$$\textbf{Technological change}=\left[\left(\frac{D^{t}(x^{t+1},y^{t+1})}{D^{t+1}(x^{t+1},y^{t+1})}\right)x\left(\frac{D^{t}(x^{t},y^{t})}{D^{t+1}(x^{t},y^{t})}\right)\right]^{1/2} \qquad (1)$$

Efficiency change measures the change in efficiency between period's t and t+1, while technical change captures the shift in the frontier technology available to the firm over time. Technological change is the increase in the efficiency of a product that resulted in an increase in output without an increase in input. A value greater than one (>1) in both cases indicates growth in productivity. Value less than one (<1) indicate securing cost reduction.

Caves et al. (1982) introduced Malmquist index for the first time in productivity analysis. This method defined the index as a ratio of two distance functions representing multiple inputs and multiple outputs technology without the need to specify a firm's behavioral objective such as profit maximization or cost minimization.

An output based Malmquist productivity change index was specified by Fare et al, 2004 as:

TFPCH=EFFCH X TECHCH

$$M_0\,(x^{t},y^{t},x^{t+1},y^{t+1}) =$$

$$\frac{D^{t+1}\,(x^{t+1},y^{t+1})}{D^{t}(x^{t},y^{t})}\;x\;\left[\left(\frac{D^{t}(x^{t+1},y^{t+1})}{D^{t+1}(x^{t+1},y^{t+1})}\right)\left(\frac{D^{t}(x^{t},y^{t})}{D^{t+1}(x^{t},y^{t})}\right)\right]^{1/2} \qquad (2)$$

Y and X refers to outputs and inputs across t to t+1. Productivity growth directly involves improvements in the efficiency change components and is considered evidence of being able to reach the frontier through the improvements in the technical change components are considered evidence of innovation. Output oriented model focuses on the amount by which output quantity can be expanded using a given amount of inputs.

MPI (Mo) measures the change over time of input- output (Xt+1 , Yt+1) relative to input-output starting point (X,Y). The ratio of the distance of each point serves as a benchmark to compare a certain pack of input (x) and output (y). Mo greater than one (Mo>1) means an improvement in efficiency growth from period t to t+1, while Mo less than one (Mo<1) means a decline in total factor productivity (Cabanda et al, 2008; 21).

i - represents De Luxe Class Hotels 1, 2……..10

t –represents years 1,2……10
x1,2,….4 = number of rooms, number of employees, capital and operating expenses
y= represents the total revenue
$M_{0=}$ Malmquist Productivity Index

Malmquist productivity index factors are presented in Equation 2. The measure in the change in the output oriented measure of technical efficiency between given periods t and t+1 are presented by the ratio outside the square brackets. The shift in technology are captured between two period evaluated as Xt and Xt+1 by the geometric mean of the ratio inside the square brackets. Technical change is the remaining part of the index in the equation 2. It is the geometric mean of the shift in technology between two periods, evaluated at Xt+1 and also Xt (Coelli et al, 2005). Since DEA does not account for measurement noise, Geometric means or average is applied.

Results show that a value greater that (>1) indicates positive performance while value lesser than one (<1) indicates negative performance over the period. If the value is equal to one, it means that there is no progress or improvement on the performance.

2.3 Slack Based Measure of Efficiency (SBM)

While maintaining the current levels of outputs, the input oriented DEA models consider the possible input reductions and keeping the current levels of inputs, the output oriented DEA models consider the possible output augmentations. Slack in efficiency is a product of input and output inefficiency. It provides a scalar measure that covers all the inefficiency that can be identified. For slack calculation, the formula is:

$$\rho = \left(\frac{1}{m} \sum_{i=1}^{m} \frac{x_{io} - s_i^-}{x_{io}} \right) \left(\frac{1}{s} \sum_{r=1}^{s} \frac{y_{ro} + s_r^+}{y_{ro}} \right)^{-1} \qquad (3)$$

The first part of equation 3 measures the mean proportional reduction of inputs or input mix inefficiencies. The second part measures the mean proportional rate of output expansion or output mix inefficiencies. The result can be 0<p<; if p is equal to zero, then X input has no slacks. It means that there is an efficient use of input resources. On the other hand, if p is greater than zero, it means that in x input, slacks are present making the usage of input to be inefficient.

2.4 Stochastic Frontier Analysis

The researcher will use the stochastic frontier analysis approach in the second stage of the paper. Aigner, Lovell, and Schmidt (1977), and Meeusen and Van Den Broeck (1977) introduced the stochastic production frontier models. The two models allow for technical inefficiency (Ui), but they also recognize the fact that random error or shocks (Vi) outside the control of producers can affect output. The great virtue of stochastic production frontier models is that the impact on output shocks due to variation in labor and machinery performance. Vagaries of the weathers and just plain luck can at least in principle be separated from the contribution of variation in technical efficiency. The pioneer requirement involves a production function for cross- sectional data where error term had two components: to account for random effects and to account technical inefficiency (Coelli, 1996). Battese and Coelli (1995) proposed a model imposing allocative efficiency (Kumbhakar & Lovell, 2000).

This model can be expressed in the following form (Coelli, 1999):

$Y_{it} = x_{it}\beta + (V_{it} - U_{it})$, i=1, 2, ..., 10, t = 1, 2, ..., 10 (4)

Where:
Y_{it} is the total revenue (or the logarithm of the output) of the i-th de luxe hotel at time t;
x_{it} is columns of input quantities of the deluxe hotel at time t;
x1 = operating expenses (Pmillion)
x2 = capital (Pmillion)
x3 = number of employees
x4 = number of rooms
β is a vector of unknown parameters to be tested at 5% level;
the V_i are random variables which are assumed to be independently and identically distributed (iid.) $N(0,\sigma_V^2)$, and independent of the
U_i which are non-negative random variables which are assumed to account for technical inefficiency in production and are often assumed to be iid. $|N(0,\sigma_U^2)|$. Battese and Coelle in 1995 expressed Ui as:
$m_{it} = z_{it}\delta$,

where z_{it} is a p×1 vector of variables which may influence the efficiency of a firm;
z1 = size (assets in Pmillion)
z2 = age (in years)
and δ is columns of parameters to be estimated at 5% level.

For instance, if Yi is the log of output and xi contains the logs of the input quantities, then the Cobb-Douglas production function is obtained. (Coelli 1998)

The model Yi = xi□ + (Vi - Ui) is a stochastic frontier production function because the output values are bound above by the stochastic (random) variable, exp(xiβ + Vi).

The random error, Vi, can be positive (above the frontier) or negative (below the frontier), and so the stochastic frontier outputs vary on the derministic part of the frontier model, exp (xiβ).

Tests of Hypotheses

For the frontier model (equation 4), the null hypothesis, that there are no technical inefficiency effects in the model, can be conducted by testing the null and alternative hypotheses, Ho: σ2=0 versus Hi: σ2>0.

(Remember that σ2 is the variance of the normal distribution, which is truncated (reduced) at zero to obtain the distribution of ui. If this variance is zero, then all the ui's are zero, implying that all firms are fully efficient.)

2.4 Logistic Regression

It is used to measure the sustainability of the De Luxe class hotels. It is a probability test that measures the relationship between the independent and dependent variables by determining the ratio of their occurrence over time.

3.0 Empirical Results

This section focuses on the presentation and discussion of the empirical results obtained in this study using DEA and SFA. Two DEA models were applied (Malmquist and Slack-based) to determine the efficiency and productivity of selected De Luxe Class hotels in Metro Manila for the period 2005 to 2014. Stochastic frontier analysis is used to identify the relevance of the age and size as well as the sources of total factor productivity of the samples. Result from DEA was used as sustainability indicator in the Logit regression.

Table 1 shows the source of annual productivity and efficiency. Average annual productivity of the deluxe hotels reveals improvement (1.027 > 1.00) over the 10-year period. The source of productivity is cost efficiency (effch = 1.058 > 1.00) but not technological progress (techch = 0.971 < 1.00). Managerial efficiency (pech = 1.040) and advantageous conditions (Sech = 1.017) makes a deluxe hotel cost efficient from 2005 – 2014. Example of advantageous condition is the location of the deluxe hotel near airports with lesser traffic. The location where a firm operates influences managerial efficiency and is an important competitive key in the hotel industry (Aissa & Goaied, 2015).

Table 1. Malmquist Index Summary of Annual means.

MALMQUIST INDEX SUMMARY OF ANNUAL MEANS					
Year	effch	techch	Pech	sech	tfpch
2	1.421	0.743	1.651	0.861	1.056
3	1.226	0.987	0.996	1.231	1.210
4	0.930	1.017	0.966	0.963	0.946
5	1.095	0.922	1.005	1.090	1.010
6	0.894	1.139	0.868	1.031	1.019
7	0.963	1.056	0.952	1.012	1.017
8	1.099	0.946	1.091	1.007	1.040
9	0.931	1.044	0.937	0.994	0.972
10	1.063	0.937	1.062	1.002	0.997
mean	1.058	0.971	1.040	1.017	1.027

The above results indicated that an average deluxe hotel was productive and cost efficient. However, technology was obsolete and could cause the downtrend in revenue or tourist visit. It also hinted decreasing returns to scale.

Table 2 shows the cross section of productivity and efficiency of deluxe hotel from 2005 – 2014. Eight hotels are

productive (tfpch > 1.00) and two hotels show no improvement in productivity (tfpch < 1.00). The eight hotels are cost efficient (effch > 1.00) but regress in technological progress. Pan Pacific have shown below standard (< 1.00) performance but maintains managerial efficiency in the use of inputs. Peninsula Manila is not productive but maintains cost efficiency in converting inputs to the desired level of revenue.

Table 2. Summary of deluxe Hotels' productivity and efficiency.

MALMQUIST INDEX SUMMARY OF FIRM MEANS						
	Firm	effch	techch	pech	sech	tfpch
Diamond Hotel Philippines	1	1.088	0.963	0.997	1.091	1.047
Dusit Thani Hotel	2	1.086	0.960	1.070	1.015	1.043
Edsa Shangri-la Manila	3	1.059	0.952	1.029	1.029	1.008
Hotel Inter Continental Manila	4	1.040	0.983	1.036	1.004	1.022
Makati Shangri-la Manila	5	1.025	0.981	1.000	1.025	1.005
Manila Hotel Corporation	6	1.006	0.999	1.006	0.999	1.005
Sofitel Philippine Plaza Manila	7	1.037	0.993	1.028	1.009	1.030
The Heritage Hotel Manila	8	1.242	0.944	1.257	0.989	1.173
The Pan Pacific Hotel Manila	9	0.993	0.969	1.000	0.993	0.962
The Peninsula Manila	10	1.028	0.963	1.006	1.022	0.990
	Mean	1.058	0.971	1.040	1.017	1.027

On the average, a hotel was productive and cost efficient. Its cost efficiency was boost by managerial efficiency (pech > 1.000) and advantageous condition (sech > 1.00). Growth in hotel technology was lagging that may cause decline in revenue in the long run. Due to highly competitive environment there is growth in the hotel industry's productivity and could affect profitability (Rubio & Gonzales, 2009).

The above results implied that the majority of the selected deluxe hotels were productive and efficient but failed to keep abreast in technological progress. This is parallel to the study of Barros et al. (2009) that hotels are technically efficient but co- existed is the deterioration of technological progress.

The above analyses showed that the selected deluxe hotels were productive and cost efficient. However, with obsolete hotel technologies, there could be some wastes in resource inputs utilization. Table 3 shows the efficiency summary of the selected deluxe hotels. Nine hotels registers cost inefficiency (inefficient administration of inputs, vrste < 1.00) and disadvantageous condition (scale <1.00). The return to scale (rts) show that majority of the selected deluxe hotels operates at decreasing returns to scale (drs). This means that majority of the deluxe hotels are operating at higher scale sizes. They should decrease their scale of operation to be efficient. Only Pan Pacific enjoys the maximum (100% efficiency) level of operation (crste = vrste = sech = 100) called the most productive scale size (mpss).

Table 3. Efficiency summary of the selected deluxe hotels.

	EFFICIENCY SUMMARY:				
	firm	crste	vrste	scale	rts
Diamond Hotel Philippines	1	0.456	0.459	0.994	drs
Dusit Thani Hotel	2	0.475	0.542	0.877	drs
Edsa Shangri-la Manila	3	0.571	0.739	0.772	drs
Hotel Inter Continental Manila	4	0.703	0.730	0.962	drs
Makati Shangri-la Manila	5	0.803	1.000	0.803	drs
Manila Hotel Corporation	6	0.351	0.361	0.971	drs
Sofitel Philippine Plaza Manila	7	0.720	0.780	0.924	drs
The Heritage Hotel Manila	8	0.093	0.102	0.919	drs
The Pan Pacific Hotel Manila	9	1.000	1.000	1.000	-
The Peninsula Manila	10	0.574	0.701	0.820	drs
	mean	0.575	0.641	0.904	

The above findings implied that majority of the selected deluxe hotels were experiencing decreasing return to scale (drs) at higher scale of operation. At decreasing returns to scale, hotels were generating revenues at a decreasing rate.

The first objective showed that the selected hotels were productive and efficient from the hotel industry's perspective. However, the second objective showed that hotel technology were obsolete that caused inefficiency in the use of the resource when compared to the same size of deluxe hotel (as explained by the vrs).

Table 4 shows the summary of resource use (slacks for revenue and inputs). Although all of the deluxe hotels attained their desired level of revenue (no shortage in revenue generation, slack = 0), all inputs (operating expenses, capital, number of employees, and number of rooms) necessitates adjustment to make the hotels efficient. Gravely affected are Manila hotel and Dusit Thani (the highest excess in operating expenses; Diamond hotel and Hotel intercon (great excess in capital); Sofitel, Manila Hotel and Peninsula Manila (excess number of employees); and Sofitel, Manila Hotel, Diamond Hotel, Dusit Thani and Heritage hotel (excess rooms).

The above findings on slacks revealed that an average deluxe hotel should reduce its inputs (operating expenses, capital, employees and rooms) wastages to catch up with Pan Pacific Hotel Manila. Excess employees and rooms meant an average hotel has few visitors or occupants during the period covered in this study. These were the reasons why too many vacant rooms and idle employees were detected in the analysis. Also, increasing cost of operation and deterioration of capital due to overhead cost incurred by the hotels. Less efficient firms spend on hotel operations, other expenses, employ too many employees and are large in terms of number of rooms (Anderson & Scott, 2000). To reach the efficient frontier available slacks should be adjusted (Barros, 2005).

Table 4. Summary of slacks for revenue and inputs.

Summary of Slacks							
firm		Revenue	Operating Expenses	Capital	# of employees	# of rooms	rts
Diamond Hotel Philippines	1	0.000	0.000	1466.493	115.422	260.286	drs
Dusit Thani Hotel	2	0.000	207.191	0.000	15.482	195.301	drs
Edsa Shangri-la Manila	3	0.000	8.745	90.904	0.000	97.446	drs
Hotel Inter Continental	4	0.000	0.000	223.210	15.930	68.359	drs
Makati Shangri-la Manila	5	0.000	0.000	0.000	0.000	0.000	drs
Manila Hotel Corporation	6	0.000	220.320	0.000	235.542	280.780	drs
Sofitel Philippine Plaza	7	0.000	40.567	0.000	371.022	317.039	drs
The Heritage Hotel Manila	8	0.000	79.972	20.705	0.000	168.568	drs
The Pan Pacific Hotel Manila	9	0.000	0.000	0.000	0.000	0.000	-
The Peninsula Manila	10	0.000	40.348	0.000	205.263	51.146	drs
mean		0.000	59.714	180.131	95.866	143.893	

Table 5 shows the specific factors affecting revenue and technical inefficiency of selected deluxe hotels in Metro-Manila. The constant suggests that about Php38.01 billion was the revenue of an average deluxe hotel at the beginning of 2005. Revenue increases by 13.7%, 39.0% and 102.9% for every 100% increase in the conversion of the inputs to outputs. However, as number of vacant room increase, revenue declined by 97.1 % implying that the deluxe hotels were sensitive to non-occupancy of rooms. The stochastic frontier regression proved that maintaining the operation of deluxe hotels were high at decreasing rate of return (drs: 0.584 = 0.137 + 0.390 + 1.029 – 0.971). Sigma indicates standard deviation or inefficiency. Beta indicates the contribution of the independent variable to dependent variable. If beta represents standardized coefficient then it represents the explaining power of each independent variable to dependent variable.

On the average, a deluxe hotel was old and the findings reveal that older hotels were not efficient than younger (newly established) hotels. Although not statistically significant, larger hotels were not efficient in their operation than their smaller counterparts. A study by Aissa and Goaied (2015) supported that hotel size has a negative impact on its efficiency. It also reveals that age on the performance of hotels resulting mainly from the fact that as the age increases, there are more potential failures. Hotels with fewer years in the business implement new technologies and new amenities capable of attracting consumers. However, these finding were refuted by Assaf and Cvelbar (2010) where they found that there is a positive relationship between the age and size of hotel to technical efficiency. The mean efficiency of an average deluxe hotel was 73.9%. There is a need to upgrade the effort (operation) of deluxe hotel to 26% to stay alive in the industry.

The value of sigma (= 0.248) is greater than zero, signifying that the De Luxe class hotels are not efficient during their 10 year operation. The value of gamma (= 0.951) is also greater than zero indicating that the departure from the frontier (best practice De Luxe class hotel) is due to technical inefficiency and not entirely due to random variation. All of the parameters passed the 5% level of significance. The above model from Cardona and Garcia (2015) passed the test for the parameters. The model assumes a half normal distribution and time varying inefficiency of De Luxe hotels from 2005 – 2014. The hypothesis test on the assumption that the model did not assumes half normal distribution where mu is equal to zero was rejected at 5% level of significance.

Table 5. The effects of factors to revenue and technical inefficiency of hotels.

Stochastic Frontier Estimates			
	b	t-ratio	sig.
constant	3.638	5.86	0.001
Operating Expenses	0.137	2.35	0.025
Capital	0.390	5.90	0.001
# of employees	1.029	8.93	0.001
# of rooms	-0.971	-5.65	0.001
Technical Inefficiency			
constant	-1.849	-1.13	ns
Size (Assets)	0.127	0.65	ns
Age	0.018	3.04	0.005
sigma	0.248	2.21	0.01
gamma	0.951	30.56	0.001
dependent: Revenue			
mean efficiency = 73.9			

Logistic regression was used to predict sustainability of De Luxe class hotels' operation as affected by operating expense ratio (operex/rev), capital turnover ratio (rev/cap) and number of room to employee ratio (room/emp). In this study, sustainability was proxied by the maximum efficiency (*mpss* = 1, *not mpss* = 0). De Luxe hotels operating at their maximum efficiency (most productive scale size = 100%) were sustainable.

Table 6 shows the omnibus tests of model coefficients and summary. The results indicate that the predictors operating expense ratio (operex/rev), capital turnover ratio (rev/cap) and number of room to employee ratio (room/emp) influence the maximum efficiency (sustainability) of deluxe hotels at 5% level of significance. The chi-square of 17.523 on 3 degrees of freedom is significant at 5% level ($\rho = 0.001 < 0.05$) indicating the ability of the predictors to influence the sustainable (mpss = 1, 15%) and not sustainable (not mpss = 0, 85%) De Luxe hotels.

Table 6. Omnibus tests of model coefficients and model summary.

Omnibus Tests of Model Coefficients			
	Chi-square	df	Sig.
Step	17.523	3	.001
Block	17.523	3	.001
Model	17.523	3	.001
Model Summary			
-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square	
67.019	.161	.282	

The model summary reveals that -2 log likelihood statistic is 67.019 implying how appropriately the logit model predicts sales promotion. The Cox & Snell R2 (= 16.1%) is better than zero indicating interpreted relationship of the predictors [operating expense ratio (operex/rev), capital turnover ratio (rev/cap) and number of room to employee ratio (room/emp)] to the dependent variable (sustainability). The Cox & Snell R2 corrected the Nagelkerke R2 indicating that the logit estimate is a better fit at 28.2%. Pseudo R-square in both Cox & Snell R2 and Nagelkerke R2 has lower values than the traditional ordinary least squares (OLS) R-squared values.

Table 7 classifies sustainability as sustainable (mpss = 1) and not sustainable (not mpss = 0) on. The Classification Table shows the sensitivity of prediction indicating correctly 26.7% (4/15) of the predicted event (sustainable) was observed. Also, the classification table allows us to correctly classify 85/85 (100%) of the De Luxe hotels where the predicted event was not mpss (not sustainable). This is known as the specificity of prediction; that is, the percentage of not mpss (not sustainable) correctly predicted. Overall our predictions were correct 89 out of 100 times, for an overall success rate of 89%.

Table 7. Classification table of sustainable De Luxe hotels

Classification Table				
Observed		Predicted		
		Sustainability		
		1 = mpss	0 = not mpss	Percentage Correct
Sustainability		-1.73	1.73	
1 =mpss	-1.73	4	11	26.7
0 = not mpss	1.73	0	85	100.0
Overall Percentage				89.0

Table 8 shows the variables in the equation to predict the odds of sustainable (mpss = 1) and not sustainable (not mpss = 1) operation of De Luxe hotels. The logistic regression shows coefficient (B), standard error (S.E.), Wald test (Wald), significance (Sig.) and odds ratio for each of the predictors (Exp(B)). The coefficient (B) represents the basis for odds ratio. The Wald test represents the unique contribution of each predictor (coefficient) to sustainable operations of deluxe hotels. Except for number of rooms per employees (room/emp, $\rho = 0.055$), all parameters were accepted at 5% level of significance or lower.

Table 8. Variables in the equation for sustainable operation.

Variables in the Equation						
	B	S.E.	Wald	df	Sig.	Exp(B)
operex/rev	-3.802	1.262	9.071	1	.003	.022
rev/cap	-2.455	1.108	4.912	1	.027	.086
room/emp	2.060	1.075	3.672	1	.055	7.843
Constant	2.066	1.800	1.317	1	.251	7.894
Dependent variable: sustainable (mpss = 1, not mpss = 0)						

The *Exp(B)* presents the extent to which raising the corresponding measure (say operating expense ratio = operex/rev) by one unit influences the odds ratio of sustainability. The change in *EXP(B)* is the change in odds; that is, if value exceeds 1 then the odds of an outcome occurring (maximum efficiency = mpss = sustainable) increase; if the figure is less than 1, any increase in the predictor leads to a drop in the odds of the outcome occurring. The *EXP(B)* value associated with "operating expense ratio (operex/rev)" is .022 implying that De Luxe hotels are .022 times more likely not to sustain operation because of higher operating expenses than the generation of revenue. This means that deluxe hotels managerial flexibility and competency tend to decline reflecting below 100% maximum efficiency. Also, the odds ratio for "capital turnover ratio (rev/cap)" indicates that deluxe hotel is .086 times more likely not sustainable (mpss = 0) because of low turnover ratio. Lower capital turnover ratio is bad because it means that the deluxe hotel was using its capital inefficiently; that is, generating less revenue using more investmentAlthough significant at 10% level, the odds ratio for "number of rooms per employees ratio (room/employee)" indicates that a deluxe hotel is 7.843 times more likely sustainable (mpss = 1) when using more labor. Less rooms to clean and employees (staff) tend to be non-productive and clean too slowly. In this case, the deluxe hotels have more employees than the number of rooms to be clean or maintained. About 14 rooms a day should be assigned to one hotel staff. Most of the rooms in deluxe hotel don't have to be tidy up and change every day. Majority of the rooms need change in dirty towels and cleaning of trashes that could be done in less an hour. Thus, the finding on the negative value of the number of rooms in the SFA was supported in this logit regression.
The above results indicated that the null (hypothesis) "There are no explanatory variables [operating expense ratio (operex/rev), capital turnover ratio (rev/cap) and number of room to employee ratio (room/emp)] that affect or influence the maximum efficiency (sustainability)' was refuted or rejected in favor of the alternative hypothesis. The study found that two (2) of the declared independent variables affect sustainability of deluxe hotels. Hence, there is a greater chance that the deluxe hotel didn't reached maximum efficiency because of insufficient managerial flexibility and competency, thus, not sustainable.

4.0 Conclusions

The study evaluated the efficiency, productivity and sustainability performance of ten selected De Luxe class hotels in Metro Manila from 2005 to 2014 using DEA-MPI to identify the sources of technical efficiency and

DEA-SBM to determine input and output slacks or resource wastage. SFA regression analysis was used to determine the sources of technical inefficiency with respect to age and size of the hotels. To measure the sustainability of the De Luxe class hotels, logistic regression was applied. The study has answered its objectives and hypotheses.

Results show that on the average, the selected De Luxe class hotels are inefficient in terms of technological efficiency but are technically efficient in terms of managerial efficiency and scale efficiency change. Majority of the De Luxe class hotels were productive and efficient but regressed in technological progress. All of the hotels attained revenue generation without slacks but nine of the hotels were operating at decreasing return to scale. Slacks revealed that an average deluxe hotel should reduce its inputs (operating expenses, capital, employees and rooms) wastages to catch up with Pan Pacific Hotel Manila. Only Pan Pacific enjoys the maximum (100% efficiency) level of operation (crste = vrste = sech = 100) called the most productive scale size (mpss).Regression analysis proved that the De Luxe class hotels are operating at decreasing return to scale and older and larger hotels were inefficient than the newly established hotels and smaller counterparts. Logistic regression indicates that De Luxe class hotels operation is not sustainable.

Based on the findings, the study recommends that the selected De Luxe class hotels need to improve the hotel's technological progress. Management's adaptability to technological advances will enable them to attract customers and will prevent the non- occupancy of rooms. On- line registration and payments makes it convenient for customers. Implementation of customer relationship management by sending frequently through emails of programs, discounts and holiday packages will allow customers to be informed on upcoming hotel events. In order to reduce the excess in resource wastage, proper administration of resources enables the organization to monitor its effectiveness in achieving goals, objectives, managing products and services and obtaining efficient results. Since majority of the selected De Luxe class hotels were operating at their maturity stage, hotels should constantly provide new attraction and amenities by constantly formulating strategies, strengthen hotel operations and upgrade their quality of service capable in attracting customers.

To be competitive and reduce cost, it is important for the management to concentrate on the efficiency and sustainability measures that will provide the management the insight on how the organization can properly manage their resources and be able to sustain their operation and survive in the industry.

It is further recommended that future studies should cover other hotel classifications, hotel departments and include soft, market –oriented variables such as the hotel's image, customer satisfaction, and service quality to achieve a more complete analysis.

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