Evaluation on the efficiency of the construction sector companies in Malaysia with data envelopment analysis model

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Abstract. In Malaysia, construction sector is essential parts in driving the development of the Malaysian economy. Construction industry is an economic investment and its relationship with economic development is well posited. However, the evaluation on the efficiency of the construction sectors companies listed in Kuala Lumpur Stock Exchange (KLSE) with Data Analysis Envelopment (DEA) model have not been actively studied by the past researchers. Hence the purpose of this study is to examine the financial performance the listed construction sectors companies in Malaysia in the year of 2015. The results of this study show that the efficiency of construction sectors companies can be obtained by using DEA model through ratio analysis which defined as the ratio of total outputs to total inputs. This study is significant because the inefficient companies are identified for potential improvement.

1. Introduction

Bursa Malaysia, also known as Kuala Lumpur Stock Exchange (KLSE) is a platform that provides a fully integrated exchange offering a comprehensive range of exchange-related facilities including listing, trading, clearing, settlement and depository services [1]. Currently, there are 811 listed companies and 39 companies are under categories of Construction sector. In Malaysia, construction sectors are essential parts in driving the development of the Malaysian economy. According to [2], the construction industry is an economic investment and its relationship with economic development is well posited. At the same time, construction industry also demonstrates strong correlation with economic development, with the construction share of GDP positively correlated with GDP per capita [3]. Construction sector is an important industry in contribution economy growth of Malaysia although the contribution of Gross Domestic Product, GDP lesser than services, manufacturing and agriculture sector. The Gross Domestic Product, GDP 8.2% (RM 46.63 billion) in 2015 and it will be estimated to contribute 10.3% GDP per annum within the period 2016-2020
according to the Eleventh Malaysia Plan. The purpose of this research is to study the financial performance on the efficiency of the listed construction sectors companies in Malaysia by analyzing financial ratio in the year of 2015. This paper will be organized into few sections: Section 2 presents some literature review of the research with some basic concepts and definition of DEA. Section 3 includes the research methodology. Meanwhile section 4 discusses and interprets the obtained results. The final sections will be the conclusion of the research together with suggestion for further study.

2. Literature Review

The application of DEA measuring efficiency in the production of agricultural crops has been used regularly in the past studies [4, 5, 6]. The other researchers have applied DEA in a real life study case, for examples: energy consumption in cotton industry [7], direct seeding and wetland paddy cultivation at Sungai Besar District of Selangor, Malaysia which employed the DEA model and Cobb-Douglas production function on the measured paddy cultivation data [8]. Recent studies on the area of aquaculture sector in Peninsular Malaysia using two stage DEA model in evaluating contextual factors affecting the technical efficiency of freshwater pond culture systems [9] and bootstrapping DEA to estimate the bias-corrected technical efficiency (BCTE) of different culture systems and species of freshwater aquaculture in Malaysia [10] were sound concerned for the fish farmer in term of efficiency in the fish production.

Bank sector is the most studies in the application sector on DEA to measure performance and efficiency. Kamarudin, Ismail, and Mohd [11] claimed that DEA could analyze the efficiency and effectiveness of Malaysian Islamic Banks. The results showed Malaysian Islamic Banks were more efficient. Yang [12] suggested a DEA assessment framework applied to measure the performance of the two sub-processes, which is profit-making efficiency and risk-controlling efficiency. Widely literatures in banking area on DEA applications have been studied by the past researchers [12, 13, 14, 15, 16, 17, 18].

Rezaie et al.[19] applied Data Envelopment Analysis to compare the efficiency of 50 top companies listed by Tehran Stock Exchange (TSE) in the 1st quarter of the year 2010 as TSE was the first established stock market in 1967 and currently it is a largest stock market in Iran. The results obtained beneficiary managers and investors in stock exchange for investment and developing and determining corporate strategy as DEA is a suitable and efficient approach to model the fluctuations and uncertainties existing in financial data and factors affecting the efficiency of a corporation [19].

Other past studies have been done in different stock markets [20, 21, 22, 23, 24]. This research will focus on the efficiency of the listed construction sectors companies in Malaysia based on the financial ratios with a new propose Enhanced Data Envelopment Analysis (DEA) model to determine the potential improvement for the listed construction sector companies which have not been actively studied by the past researchers.

3. Data and Methodology

This study extracted data from financial reports through Bursa Malaysia in year 2015 in construction sector. Total of 39 companies from construction sector listed in Malaysia stock market are displayed in the following Table 1.
Table 1. Construction Companies in Malaysia Stock Market.

| CODE  | Abbreviations | Company Name                                    |
|-------|---------------|------------------------------------------------|
| 7007  | ARK           | ARK RESOURCES BERHAD                            |
| 7078  | AZRB          | AHMAD ZAKI RESOURCES BERHAD                    |
| 5190  | BENALEC       | BENALEC HOLDINGS BERHAD                        |
| 5932  | BPURI         | BINA PURI HOLDINGS BHD                         |
| 8761  | BREM          | BREM HOLDING BERHAD                            |
| 8591  | CRESBLD       | CREST BUILDER HOLDINGS BERHAD                  |
| 7528  | DKLS          | DKLS INDUSTRIES BHD                            |
| 5253  | ECONBHD       | ECONPILE HOLDINGS BERHAD                       |
| 8877  | EKOVEST       | EKOVEST BERHAD                                 |
| 9261  | GADANG        | GADANG HOLDINGS BHD                            |
| 5398  | GAMUDA        | GAMUDA BERHAD                                  |
| 5169  | HOHUP         | HO HUP CONSTRUCTION COMPANY BHD                |
| 6238  | HSL           | HOCK SENG LEE BERHAD                           |
| 3336  | IJM           | IJM CORPORATION BERHAD                         |
| 5268  | IKHMAS        | IKHMAS JAYA GROUP BERHAD                       |
| 4723  | JAKS          | JAKS RESOURCES BERHAD                          |
| 9083  | JETSON        | KUMPULAN JETSON BERHAD                         |
| 7161  | KERJAYA       | KERJAYA PROSPEK GROUP BERHAD                   |
| 5171  | KIMLUN        | KIMLUN CORPORATION BERHAD                      |
| 5129  | MELATI        | MELATI EHSAN HOLDINGS BERHAD                   |
| 5006  | MERGE         | MERGE ENERGY BHD                               |
| 9571  | MITRA         | MITRAJAYA HOLDINGS BERHAD                      |
| 7595  | MLGLOBAL      | ML GLOBAL BERHAD                               |
| 5085  | MUDAJYA       | MUDAJAYA GROUP BERHAD                          |
| 5703  | MUHIBAH       | MUHIBAH ENGINEERING (M) BHD                    |
| 8311  | PESONA        | PESONA METRO HOLDINGS BERHAD                   |
| 5070  | PROTASCO      | PROTASCO BERHAD                                |
| 7145  | PSIPTEK       | PRINSIPTEK CORPORATION BERHAD                  |
| 9598  | PTARAS        | PINTARAS JAYA BHD                              |
| 6807  | PUNCAK        | PUNCAK NIAGA HOLDINGS BERHAD                   |
| 5205  | SENDAI        | EVERSENDAI CORPORATION BERHAD                  |
| 5263  | SUNCON        | SUNWAY CONSTRUCTION GROUP BERHAD               |
| 9717  | SYCAL         | SYCAL VENTURES BERHAD                          |
| 5054  | TRC           | TRC SYNERGY BERHAD                             |
| 5622  | TRIPLC        | TRIPLC BERHAD                                  |
| 5042  | TSRCAP        | TSR CAPITAL BERHAD                             |
| 3565  | WCEHB         | WCE HOLDINGS BERHAD                            |
Ratio analysis is an applicable management tool which usually uses in a company with offering further understanding on financial results and trends over time, based on the analysis on the business situation and to identify the strengths and weaknesses for monitoring company’s performance. In this study, the six financial ratios have been considered to study. Three inputs factors to study which are current ratio, debt to assets ratio, debt to equity ratio and three outputs factors as: earning per share (EPS), return on assets (ROA), and return on equity (ROE).

3.1 Data Envelopment Analysis (DEA)

Data Envelopment Analysis (DEA) is a non-parametric mathematical linear programming technique and benchmarking technique, which is widely used in Decision Making Units (DMUs) among organization units such as insurances, hospitals, banks, property management, factory, retails, service operation and so on as performance measurement for efficiency evaluation and frontier analysis. Commonly, DEA is a set of measurements which is the ratio of total outputs to total inputs [25]; various inputs and outputs are combined into a single measurement of efficiency. DEA is used for improve performance of inefficient unit, either decrease the input or increase the input. Efficiency is defined as the comparison of what is actually produced or performed with what can be achieved with the same consumption of resources (money, time, labor)[26]. Farrell [27] has recommended a satisfactory measure of productive efficiency which considers all inputs and yet avoids number index problem as it is important for economic theorist and economic policy makers. Measuring of efficiency with a common set of inputs and outputs in Decision Making Units (DMUs) was first introduced by Charnes, Cooper, and Rhodes [28] for nonprofit and public sector organization. The efficiency of construction sectors companies can be obtained by using DEA model thru ratio analysis which defined as the ratio of total outputs to total inputs. In this paper, the CCR [28] DEA model formulation is represented as follows:

\[
\begin{align*}
\text{Max} & \quad h_k = \frac{\sum_{r=1}^{s} u_r y_{rk}}{\sum_{i=1}^{m} v_i x_{ik}} \\
\text{Subject to} & \quad \sum_{r=1}^{s} u_r y_{rq} \leq 1; \quad j = 1, 2, 3, K, n \\
& \quad \sum_{i=1}^{m} v_i x_{ij} \\
& \quad u_r, v_i \geq 0; \quad r = 1, A, s; i = 1, A, m. \quad (1)
\end{align*}
\]

where

- \(h_k\) is relative efficiency of DMU_k
- \(s\) is the number of outputs
- \(u_r\) is the weights to be determined for output \(r\)
$m$ is the number of inputs

$v_i$ is the weights to be determined for input $i$

$n$ is the number of entities

For the relative efficiency $h_k$ of DMU$_k$, equation (1) as an objective function which maximizes the efficiency of DMU$_k$, following by the constraint (2) is true, i.e: $0 \leq h_k \leq 1$. However, the model above is a nonlinear combine with a linear and fractional objective function together with the constraint. Hence transformation into general output maximization CCR DEA model in linear programming form can be simplified as [28, 29]:

$$h_k = \sum_{r=1}^{s} u_r y_{rk}$$  \hspace{1cm} (4)

Subject to

$$\sum_{i=1}^{m} v_i x_{ij} - \sum_{i=1}^{s} u_r y_{ij} \geq 0; j = 1,2,3,K,n$$  \hspace{1cm} (5)

$$\sum_{i=1}^{m} v_i x_{ik} = 1$$  \hspace{1cm} (6)

$$u_r, v_i \geq 0; r = 1,L,s; i = 1,L,m.$$  \hspace{1cm} (7)

4. Result and Discussion

Table 2. Ranking of Construction sector Companies

| DMUs    | Efficiency | Rank |
|---------|------------|------|
| ARK     | 29.88      | 23   |
| AZRB    | 14.62      | 31   |
| BENALEC | 4.15       | 36   |
| BPURI   | 19.94      | 26   |
| BREM    | 57.73      | 11   |
| CRESBLD | 8.10       | 33   |
| DKLS    | 34.85      | 20   |
| ECONBHD | 100.00     | 1    |
| EKOVEST | 3.90       | 38   |
| GADANG  | 53.63      | 13   |
| GAMUDA  | 38.80      | 18   |
| HOHUP   | 91.59      | 6    |
| HSL     | 93.38      | 5    |
| IJM     | 19.22      | 28   |
| IKHMAS  | 53.50      | 14   |
| JAKS    | 26.22      | 24   |
| JETSON  | 5.11       | 35   |
| KERJAYA | 81.71      | 7    |
Table 2 shown the relative efficiency and rank of the construction sector companies which listed in Bursa Malaysia. A total amount of four companies which are ECONBHD, MLGLOBAL, PTARAS, and SUNCON manage to score 100% efficiency. This indicates that these four companies have been fully utilized the inputs and maximizing the outputs. The rest of 35 companies are categorized as inefficient companies as the efficiency scores are less than 100%. HSL and HOHUP obtained maximum efficiency scores at 93.38% and 91.59% respectively in rank 5 and 6 which nearly close to 100%. Meanwhile, KERJAYA, MITRA, WCT and PRTASCO attained the efficient score within 60% to 82% in rank of 7, 8, 9 and 10 where positioned in the range of inefficiency. In addition, CRESBILD, TSRCAP, JETSON BENALEC, PSIPTEK, EKOVEST and MUDAJYA resulted the scores which less than 10% ranked in 33, 34, 35, 36, 37, 38 and 39 respectively.

5. Conclusions
DEA is a non-parametric mathematical linear programming technique and benchmarking technique, which is widely used in Decision Making Units (DMUs) among organization units such as insurances, hospitals, banks, property management, factory, retails, service operation, etc. as performance measurement for efficiency evaluation and frontier analysis. This study is to attempt the efficiency of construction sectors companies by using DEA model through ratio analysis which is defined as the ratio of total outputs to total inputs. The result obtained from this study showed that four companies which are ECONBHD, MLGLOBAL, PTARAS, and SUNCON manage to score 100% efficiency. This study is significant because the inefficient companies are identified for potential improvement.
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