# Performance Modeling of Projects with Multi-Variate Input and an Output Using Data Envelopment Analysis

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*Abstract:* - Current efficiency models have not been used to measure the efficiency of projects conducted within an organization. Hence, the study aims to develop an efficiency model based on projects undertaken within an organization using non-parametric approach, specifically, data envelopment analysis. In-Fusion Solutions Sdn. Bhd. (ISSB) was chosen as the case study and data were collected from primary and secondary sources. Primary data were obtained through interviews conducted with personnel from the main office and the company branch in Chennai, India. Secondary data were obtained from published and unpublished documents, consisting of thirty-nine completed projects. The data used were of three inputs and an output namely, labor cost, material cost, project duration, and project contract value, respectively. The experimental result was able to identify efficient and inefficient projects. The results obtained showed that three (3) of the projects were efficient, while the remaining projects were not. Improvements for the inefficient projects were suggested based on input and output orientation.

*Key-Words:* **-** Data envelopment analysis, efficiency measurement model; project efficiency; non-parametric model

## 1 Introduction

Performance measurement is important for organizations in order to make good decisions. Performance measurement systems enable decision-makers to diagnose weak performance, identify and address root causes, and track improvement. Efficiency measurement is one of the main components in measuring organizational performance. The theory of efficiency is related to the association between resources used and results achieved. The optimization of resources can amplify the efficiency and competitiveness of the organization. Parametric and non-parametric approaches are among those that can be used to measure performance. Parametric approaches specify functional form and take residual term into account in the analysis. Non-parametric approaches are less structured in terms of the specification of the best practice frontier and assume no random error [13]. The main difference between these approaches is the distribution of data. Parametric approaches involve normality of the data distribution while non-parametric approaches do not. Non-parametric methods have many advantages over parametric ones. For instance non-parametric approaches are simple and less affected by outliers. These approaches do not require information about the distribution and the variance of the data.

Moreover, non-parametric methods are not concerned with the relationship between the sets of the data. Generally, these methods do not require assumptions about the data, and can be used with a broader range of data.

Parametric approaches have been used in many researches. For example, they have been used to determine the efficiency of Malaysian commercial banks, U.S. banks, German banks, EU banks, Washington State hospitals, Taiwanese international tourist hotels, as well as to compare efficiencies between French and Spanish banks, and to identify efficiency in productivity changes of Bangladeshi crop agriculture. [23], [4], [15], [20], [12], [16], [9], [10]. Non-parametric approaches have been used to measure the efficiency of Malaysian commercial banks, state road transport undertakings, U.S. business schools, top listed Egyptian companies [22], [5], [21], [17] and to improve the design of commercial websites [3].

There are many efficiency models available, which can be referred to or adopted in the performance measuring process. Finding the most suitable model that is easy to use and effective is crucial. Further, several questions need to be answered once the model has been found, such as whether the model can offer suggestions to the management on how to improve their inefficiencies, if such exist. It is also necessary to ask what the variables are that have to be considered and whether it is possible to include the identified variables simultaneously since the production system is actually an integration of all of these variables.

Organizations also emphasize the utilization of input such as labor, raw materials and capital efficiency to produce output such as revenue and profit [11]. The efficient utilization of input will eliminate waste, increase output and increase organization's profit [14]. Therefore, the need for efficiency measurement is vital for an organization to improve and succeed in the face of competition. Output is produced through the utilization of input by DMU.

Models for measuring the efficiency of DMU within an organization have been proposed by [11], [14], [2], and [1]. However, to the best of our knowledge those models could not be used to measure business efficiency for product within an organization or company. This study focuses on developing a business efficiency measurement model based on product within an organization using the non-parametric approach. Specifically, the study aims to identify suitable input and output variables, identify projects that are efficient and inefficient, and propose efficient operating costs for inefficient projects. For this study, the term 'DMU' is used interchangeably with the term 'product'.

## 2 Description of data used in constructing the project performance model

A case study by [25] was conducted on a consultancy firm, In-Fusion Solutions Sdn. Bhd. (ISSB), whose main business is providing solutions for learning and developing new media. ISSB was established in 2002 and its vision is to be the premier information and communication technology company, providing virtual education solutions in a full converging environment. ISSB offers advanced and innovative e-learning solutions to the global community. Currently, the company has a total of 180 employees.

As an education solution and services provider, ISSB's core products include courseware, and enterprise resource planning system for the educational environment, educational games, a learning content management system, a student information management system, an integrated campus management system, an Islamic banking and finance program, a knowledge information exchange system and portal experience. With a dedicated team of professionals comprising educationalists, instructional designers, writers, editors, translators, creative designers and multimedia specialists, ISSB plans to place itself at the forefront of today's society as a leading educational content company.

Primary and secondary data were used in the study. Primary data were obtained through interviews conducted with several members of staff from the main office and the company branch in Chennai, India [25]. Secondary data were obtained from published and unpublished documents. Secondary data consisted of thirty-nine completed projects. Secondary data were used to study the efficiency of ISSB projects. The data used consisted of three inputs and an output. These include labor cost, material cost, project duration, and project contract value. The three inputs are independent variables while the output is the dependent variable.

In this study, DMUs are projects undertaken by the company. The number of DMUs should be more than or equal to three times the sum of inputs and outputs [19]. From 45 projects, 39 projects were chosen as DMUs and were divided into two types: hardware (H) and courseware (C). The remaining 6 projects were not chosen due to the unavailability of data. It is important to select appropriate inputs and output in order to obtain a good project performance model. Three inputs and one output were identified as appropriate for the construction of the project performance model. The inputs were labor costs, material costs and project duration. The output chosen was project contract value.

Labor cost represents the total cost (measured in Malaysian ringgit) of employees involved in the projects. It consists of the sum of salaries of these employees. This cost is considered to be a significant component in measuring the efficiency of projects as employees and projects are dependent on each other. Employees are one of the major components in a project as it can only be completed with the cooperation of the employees.

Material cost is another input that is considered significant in developing a project. Material cost in this context represents the total cost of equipments such as the software and hardware used in the projects. The equipment cost includes the cost of equipment rental and the purchase of new equipment. This is also measured in Malaysian ringgit (RM). The materials used in one project are assumed to be different from those used in other projects.

Project duration is the amount of time taken to complete a project and is measured in months. Projects must be completed within a specified time-frame and failure to complete projects on time will cause an organization to suffer a loss in profit. Since project completion has a direct influence on an organization profits, it is seen as an important factor and is chosen as an input in the performance model.

The contract value is chosen as the output because it reflects the revenue obtained by the company. There are no other variables/data that can better describe the value of the project. Table 1 below shows a sample of projects with their respective inputs and output while Table 2 shows the descriptive analysis of the projects.

Table 1: Input and Output of Projects

| **PROJECT** | **INPUT** | | | **OUTPUT** |
|---|---|---|---|---|
| | **LABOR (RM ‘000)** | **MATERIAL (RM ‘000)** | **PROJECT DURATION (MONTHS)** | **CONTRACT VALUE (RM ‘000)** |
| C1 | 600.00 | 0.00 | 12 | 1000.00 |
| C2 | 473.45 | 0.00 | 24 | 557.00 |
| C3 | 1190.00 | 0.00 | 12 | 1400.00 |
| C4 | 290.70 | 0.00 | 12 | 342.00 |
| C5 | 670.55 | 0.00 | 12 | 788.88 |
| … | … | … | … | … |
| C23 | 9.00 | 0.00 | 0.5 | 10.00 |
| C24 | 6.00 | 0.00 | 3 | 7.50 |
| C25 | 9.00 | 0.00 | 2 | 9.80 |
| H1 | 90.00 | 2385.55 | 6 | 2650.61 |
| H2 | 480.00 | 673.06 | 24 | 1346.12 |
| H3 | 6.00 | 895.23 | 1 | 1053.22 |
| H4 | 6.00 | 950.00 | 1 | 1000.00 |
| H5 | 48.00 | 5.00 | 3 | 190.31 |

Table 2: Descriptive analysis of projects’ inputs and output

| | **LABOR (RM ‘000)** | **MATERIAL (RM ’000)** | **PROJECT DURATION (MONTHS)** | **CONTRACT VALUE (RM ’000)** |
|---|---|---|---|---|
| Maximum | 1190.00 | 2385.55 | 24 | 2650.61 |
| Minimum | 3.00 | 0.00 | 0.25 | 7.50 |
| Mean | 111.74 | 145.04 | 4.66 | 328.31 |
| Std. Deviation | 243.07 | 427.09 | 5.989 | 538.04 |

## 3 Project Performance Model

DEA has been adopted to construct the product performance model. DEA is a multi-variable model for measuring the relative efficiency of a homogeneous set of DMUs. The efficiency score for each DMU is equal to the ratio of the weighted sum of multiple outputs to the weighted sum of inputs, and is optimized as many times as the total number of DMUs. The efficiency scores are computed in the presence of multiple outputs and inputs simultaneously and the weights for inputs and outputs are not unique. A simple way to measure efficiency of a unit or DMU with one input and one output is to determine the ratio of output to input. The general efficiency measure is given by

$$\text{Efficiency} = \frac{\text{output}}{\text{input}}$$

The efficiency increases as the output value becomes larger and the input becomes smaller. However, in reality, an organization operates with multiple inputs to produce multiple outputs. This becomes the drawback of an efficiency measure which cannot utilize the situation where there is more than one input or more than one output. To overcome this problem, [26] conducted a study to show that DEA, which is a linear programming efficiency model, can be used in this to measure efficiency that involves multiple inputs and a single output.

Using DEA, the choice of optimal system of weights for a *j*th project involves solving a mathematical optimization model whose decision variables are the weights associated with each output and input. Various formulations have been proposed such as the ratio, additive, multiplicative, Charnes, Cooper and Rhodes (CCR) and Banker, Charnes and Cooper (BCC) models. However, this study focuses on the CCR model developed by [6]. In this study, the efficiency of each project has to be optimized individually.

The CCR model formulated for *j*th project takes the form

$$\text{maximize } \frac{w_1 y_{1j}}{\sum_{i=1}^{3} v_i x_{ij}} \tag{1}$$

subject to

$$\frac{w_1 y_{1j}}{\sum_{i=1}^{3} v_i x_{ij}} \le 1, \ \forall j, j{=}1,\ldots,39 \tag{2}$$

$$w_1, v_i \ge 0, \tag{3}$$

where

$w_1$ = weight for output of type 1 of *j*th project,
$y_j$ = amount of output of type 1 of *j*th project,
$v_i$= weight of input of type *i* of *j*th project,
$x_{ij}$ = amount of input of type *i* of *j*th project,
$w_1$ and $v_i \ge 0$, for $j = 1\ldots,39$ and $i = 1,\ldots,3$.

Objective function (1) and constraints (2) and (3) are composed of fractions and need to be transformed into linear form so that the model can be solved using simple linear programming such as simplex. There are two types of model in a linear programming technique that can be used; namely, the output orientation and input orientation models.

In the output orientation model, objective function is given by:

$$\text{Maximize } w_1 y_{1j} \tag{4}$$

subject to

$$w_1 y_{1j} - \sum_{i=1}^{3} v_i x_{ij} \le 0, \quad \forall j, j{=}1,\ldots,39 \tag{5}$$

$$\sum_{i=1}^{3} v_i x_{ij} = 1, \tag{6}$$

$$w_1, v_i \ge 0 \tag{7}$$

Model 4 is a linear equation. It constrains the weighted sum of inputs to unity and maximizes the weighted sum of outputs at the *j*th unit choosing appropriate values of $w_1$ and $v_i$.

In the input orientation model, the objective function is

$$\text{Minimize} \sum_{i=1}^{3} v_i x_{ij} \tag{8}$$

subject to

$$\sum_{i=1}^{3} v_i x_{ij} - w_1 y_{1j} \ge 0, \tag{9}$$

$$w_1 y_{1j} = 1, \tag{10}$$

$$w_1, v_i \ge 0 \tag{11}$$

Model 8 is a linear equation. It constrains the weighted sum of outputs to unity and minimizes the weighted sum of inputs at the *j*th unit, choosing appropriate values of $v_i$ and *w*.

The input-orientated model emphasizes how to use minimum input resources to achieve a given level of output. At the same time, an output-oriented model focuses on using a given set of inputs to achieve the maximum possible output. The relative efficiency of the projects selected can be measured through either of these two models.

# 4 Model Validation

The performance model was validated for effectiveness using a correlation test. [8] states that all inputs used must be related to the output produced to ensure the validity of theDEA model. Correlation analysis is suitable for identifying patterns in data, testing pattern and checking the relationship between the variables. The correlation test can also be used to study the changes in the value of dependent variable when the value of an independent variable changes.

Table 3 shows correlation relationships between input and output. The analysis shows that both labor and material have a high correlation value, *r*, and a large *p* value at significant level of 0.01 levels (2-tailed). Although the *r* value between project duration and project contract value is 0.457 (medium correlation) which is below 0.5, it can still be accepted because the significance level is 0.01 (2-tailed). It can be concluded that there are strong relationships between the independent variables and the dependent variable and there are strong correlation relationships between all inputs and the output.

Table 3: Correlation Relationship of Input and Output

| Correlation | | | | | |
|---|---|---|---|---|---|
| | | (I) Labor | (I) Material | (I) Project Duration | (O) Contract Value |
| (I) Labor | Pearson Correlation | 1 | -.019 | .680** | .526** |
| | Sig. (2-tailed) | | .908 | .000 | .001 |
| (I) Material | Pearson Correlation | -.019 | 1 | .063 | .822** |
| | Sig. (2-tailed) | .908 | | .703 | .000 |
| (I)Project Duration | Pearson Correlation | .680** | .063 | 1 | .457** |
| | Sig. (2-tailed) | .000 | .703 | | .003 |
| (O)Contract Value | Pearson Correlation | .526** | .822** | .457** | 1 |
| | Sig. (2-tailed) | .001 | .000 | .003 | |
| **. Correlation is significant at the 0.01 level (2-tailed). | | | I:Input, O:Output | | |

The relationship between inputs such as labor with project duration shows a fairly high correlation value ($r$ = 0.680), while material with project duration shows a low correlation value ($r$ = 0.063), and labor and material show negative correlation value ($r$ = -0.019). In a real situation, there should be no relationship between input variables. This is because the correlation value obtained is only a numerical value and is meaningless for relationships between all the inputs. If there is a high relationship between the inputs, one of the inputs needs to be eliminated in order to ensure there is no overlapping data [8].

# 5 Experimental results

The performance model was used to evaluate project efficiency, peer group analysis and projection of inefficient projects. The results are described in the following sections.

## 5.1 Evaluation of the Projects' Efficiency

Figure 1 shows the results of DEA from DEA-Solver output. The results show the comparative efficiency scores for efficient projects (score = 1) and inefficient projects (score < 1) relatively. From the results, three projects (arrows), H3, H9 and C7 are considered efficient. The other 36 projects are inefficient, with scores ranging from 0.037 to 0.984.

Project C24 is the most inefficient project with the lowest efficiency score, 0.0367. Figure 2 shows projects ranked by relative efficiency scores.

Project inefficiency occurs because there is no balance between the three inputs used with the output produced. Project C24 is the project with the lowest contract value but the cost of labor used is high and the project cost is relatively high (Table 3). The contract value for project C24 (RM 7,500.00) is the lowest contract value of all the projects but the cost of labor is high, at RM 6,000.00. The same situation was found for other inefficient projects but with relatively varying degrees of seriousness. The inefficient projects with high scores would be less imbalanced than projects that have very low efficiency scores.

Conversely, the inputs used by the efficient projects are relatively well balanced with the output, the projects' contract value. For example, for project H3, the contract value for the project is RM 1,053,216.00. This means that project H3 has the minimum costs of labor and material and was completed in a period of only 1 month. This shows that input resources used in the projects are balanced and controllable. The same situation can be observed for project C7 (efficiency score = 1), for which the contract value is RM 237,125.00, much higher than that of project C24, but for which the cost of labor is quite low, at RM 7,000.00.

Fig.1: Projects and scores

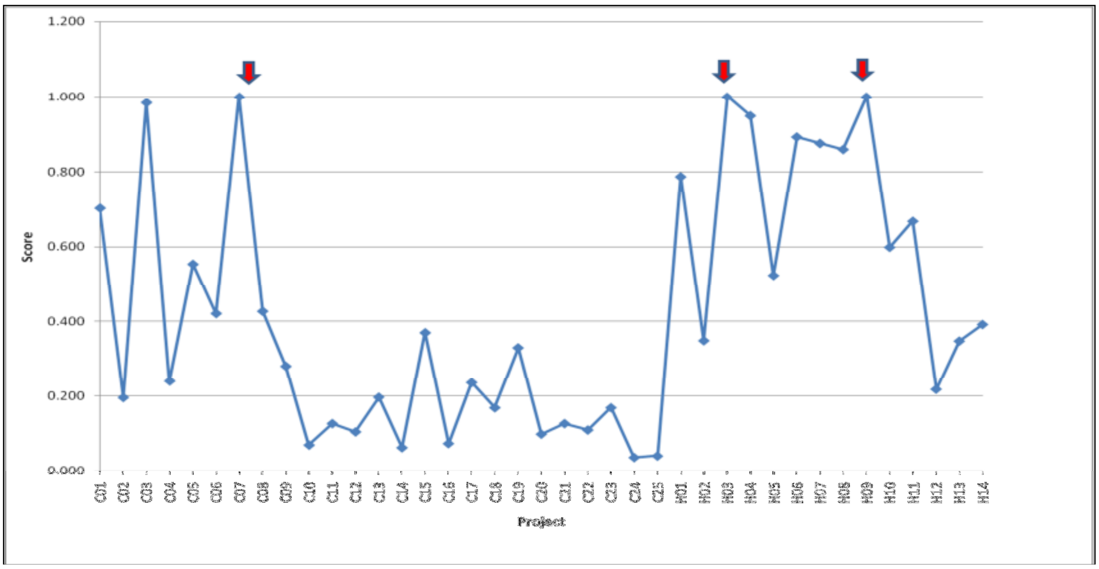
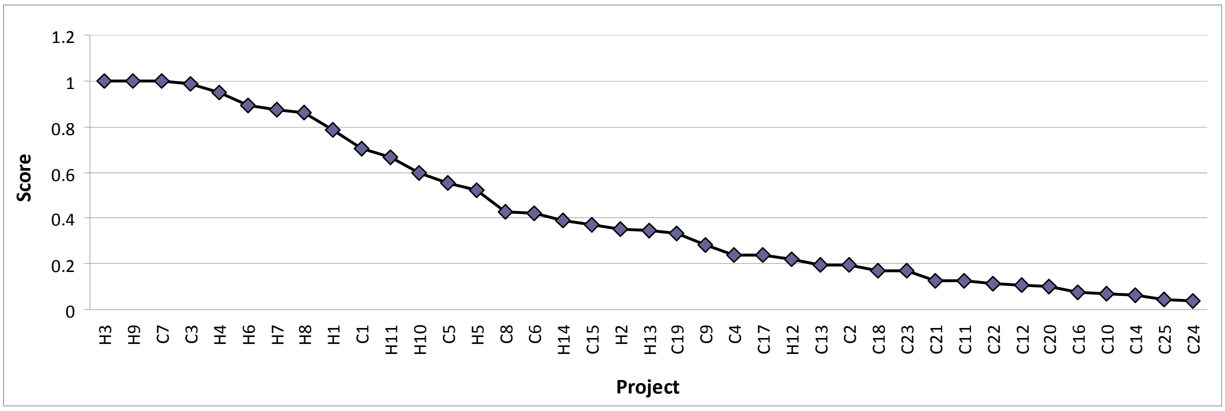



Fig.2: Projects ranked by relative efficiency scores




However, from the input labor perspective, the cost of labor for project H12 (RM 20,000.00) is higher than the cost of labor for project H9 (RM 15,000.00) but the contract value for project H12 is smaller than the contract value for project H9 (RM 149,250.00), which is RM 69,784.00. This condition allows project H9 (efficiency score=1) to be more efficient compared to project H12 (efficiency score= 0.21767), which ranked 25th in the efficiency score ranking.

In terms of the input of material, the cost of material for project H4 (RM 950,000.00) is higher than the cost of material used for project H3 (RM 895,234.00) but the contract value for project H4 is smaller compared than the contract value for project H3 (RM 1,053,216.00) , at 1,000,000.00. This makes H3 to be efficient and ranked first. as compared to H4, which is inefficient and ranked lower than H3, even although the two projects had the same labor costs and duration.

Furhermore, from the perspective of input project duration, fproject C12 took 6 months to complete, which is longer time than the time needed to complete project C7, which needed only 2 months. The cost of labor of RM 60,000.00 with a project duration of 6 months yielded project C12 a contract value of RM 75,000.00, as compared to the project C7, which yielded a much higher contract value of RM 237,125.00 but with a lower labor cost (RM 7,000.00) and a shorter project duration (2 months). This situation allows project C7 to be in a better position than project C12.

In summary, we can say that projects H3, H9, and C7 with relative efficiency scores of 1, are classified as efficient. These projects balance the input used with output produced and are able to produce maximum output from a given set of inputs or to use a combination of minimum inputs to achieve desired output. They are also able to use material and project duration (inputs) efficiently in the production of output.

Other 36 projects with relative efficiency scores of less than 1 are classified as inefficient. These are projects C01, C02, C03, C04, C05, C06, C08, C09, C10, C11, C12, C13, C14, C15, C16, C17, C18, C19, C20, C21, C22, C23, C24, C25, H01, H02, H04, H05, H06, H07, H08, H10, H11, H12, H13, and H14. The reasons for this are that these projects had imbalanced inputs and output and used excess resources in order to produce the output. They did not use labor, material and project duration (inputs) efficiently in the production of output. The duration of a project's completion was always longer, but the contract values were not high.

## 5.2 Peer Group Analysis

Peer group analysis was conducted to compare inefficient projects with efficient ones in order to improve the inefficient units by using reference sets which comprise efficient projects [7], [24].

Table 4 shows the reference sets for each inefficient project. The efficient projects are referred to as "reference sets" for projects that are inefficient. The reference sets for inefficient projects were chosen because they have the same pattern factor value and not because they have the same characteristics [18]. From Table 4, project C7 is the project most frequently referred to (35 times) and is therefore identified as the best. The second and third most efficient projects are H9 and H3, which are referred to 11 times and 8 times respectively.

Table 4: Reference set for inefficient projects

| Reference Set (Efficient Projects) | Inefficient Projects | Total |
|---|---|---|
| C7 | C1,C2, C3, C4, C5, C6, C8, C9, C10, C11, C12, C13, C14, C15, C16, C17, C18, C19, C20,C21, C22, C23, C24, C25, H1, H2, H4, H5, H6, H7, H8, H10, H11, H13, H14 | 35 |
| H3 | C3, C20, H1, H4, H6, H7, H8, H11 | 8 |
| H9 | C5, H1, H2, H6, H7, H8, H10, H11, H12, H13, H14 | 11 |

## 5.3 Projection for Inefficient Projects

The projection setting for inefficient projects is vital and can be done by setting the projection as well as controlling the balance of input utilization with output produced. Projections for inefficient projects were made using the reference sets with the respective dual weights given by DEA. The dual weights for each inefficient project for input orientation DEA and output orientation DEA are shown in Tables 5 and 6.

Table 5: Reference sets of inefficient projects and their dual weight value for input orientation

| **Inefficient Projects** | **Efficient Projects** | | | **Inefficient Projects** | **Efficient Projects** | | | **Inefficient Projects** | **Efficient Projects** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **C7** | **H3** | **H9** | | **C7** | **H3** | **H9** | | **C7** | **H3** | **H9** |
| **C01** | 4.21 | | | **C14** | 0.19 | | | **H01** | 1.03 | 1.784 | 3.534 |
| **C02** | 2.34 | | | **C15** | 0.18 | | | **H02** | 3.82 | | 2.94 |
| **C03** | 5.90 | | | **C16** | 0.12 | | | **H04** | | 0.949 | |
| **C04** | 1.44 | | | **C17** | 0.11 | | | **H05** | 0.78 | | |
| **C05** | 3.32 | | | **C18** | 0.08 | | | **H06** | 0.01 | 0.16 | 0.106 |
| **C06** | 2.16 | | | **C19** | 0.08 | | | **H07** | 0.02 | 0.139 | 0.107 |
| **C08** | 0.42 | | | **C20** | 0.06 | 0.00 | | **H08** | 0.03 | 0.114 | 0.108 |
| **C09** | 0.42 | | | **C21** | 0.06 | | | **H10** | 0.01 | | |
| **C10** | 0.42 | | | **C22** | 0.05 | | | **H11** | 0.04 | 0.023 | 0.238 |
| **C11** | 0.38 | | | **C23** | 0.04 | | | **H12** | 0.19 | | 0.152 |
| **C12** | 0.31 | | | **C24** | 0.03 | | | **H13** | 0.17 | | 0.013 |
| **C13** | 0.29 | | | **C25** | 0.04 | | | **H14** | 0.04 | 0.003 | 0.059 |

Table 6: Reference sets of inefficient projects and their dual weight value for output orientation

| **Inefficient Projects** | **Efficient Projects** | | | **Inefficient Projects** | **Efficient Projects** | | | **Inefficient Projects** | **Efficient Projects** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **C7** | **H3** | **H9** | | **C7** | **H3** | **H9** | | **C7** | **H3** | **H9** |
| **C01** | 6.000 | | | **C14** | 3.000 | | | **H01** | 1.307 | 2.264 | 4.484 |
| **C02** | 12.000 | | | **C15** | 0.500 | | | **H02** | 10.948 | | 8.413 |
| **C03** | 6.000 | | | **C16** | 1.714 | | | **H04** | | 1.000 | |
| **C04** | 6.000 | | | **C17** | 0.500 | | | **H05** | 1.492 | | 0.063 |
| **C05** | 6.000 | | | **C18** | 0.500 | | | **H06** | 0.021 | 0.179 | 0.119 |
| **C06** | 5.143 | | | **C19** | 0.250 | | | **H07** | 0.030 | 0.159 | 0.122 |
| **C08** | 1.000 | | | **C20** | 0.698 | 0.018 | | **H08** | 0.042 | 0.134 | 0.127 |
| **C09** | 1.500 | | | **C21** | 0.500 | | | **H10** | 0.026 | | 0.789 |
| **C10** | 6.000 | | | **C22** | 0.500 | | | **H11** | 0.063 | 0.034 | 0.357 |
| **C11** | 3.000 | | | **C23** | 0.250 | | | **H12** | 0.913 | | 0.698 |
| **C12** | 3.000 | | | **C24** | 0.857 | | | **H13** | 0.495 | | 0.038 |
| **C13** | 1.500 | | | **C25** | 1.000 | | | **H14** | 0.103 | 0.007 | 0.149 |

By using the reference sets given by DEA, the projections for inefficient projects can be computed for both input orientation and output orientation. From the input orientation, the projection focuses on how to reduce the inputs by maintaining the existing output, while from the perspective of the output orientation, the projection suggests an increment in output while maintaining the given inputs. For example, the projection of project H1 for input labor in the input orientation could be obtained by utilizing the efficient projects H3, H9, and C7, which act as the reference sets for project H1 to improve its efficiency score. The same applies to the projections for inefficient projects in the output orientation. The related mathematical formula for the projection of any inefficient project from the input orientation for the problem studied in this research is given as follows. Projection of the *i*th inefficient project $= \sum_{j=1}^{3} W_{ij} X_{ij}$, where $W_{ij}$ is the dual weight for *j*th reference set, and $X_{ij}$ is its input, for $j = 1,\dots,3$ and $i = 1,\dots,36$. In the output orientation, $X_{ij}$ will be replaced by $Y_{ij}$, the ouput of the *i*th reference projects. For example, by using the dual weights with respective reference sets, as shown on Table 7, projection for project H1 for labor (input) in the input orientation

= (dual weight)$_{H3}$ (labor)$_{H3}$ + (dual weight)$_{H9}$ (labor)$_{H9}$ + (dual weight)$_{C7}$ (labor)$_{C7}$

= RM 70,918.50.

The projection for project H1 for the contract value (output) in the output orientation

= (dual weight)$_{H3}$ (contract value)$_{H3}$ + (dual weight)$_{H9}$ (contract value)$_{H9}$ + (dual weight)$_{C7}$ (contact value)$_{C7}$

= RM 3,363,787.00.

The original values of the inputs, the output, their respective projected values and the difference in percentage between the original and the projected costs for project H1 is portrayed in Table 7.

Table 7: Project H1 projection summary

| **Input Orientation** | | |
|---|---|---|
| Original Labor Cost (RM) | Projected Labor Cost (RM) | (%) Difference = Projected - Original |
| 90,000.00 | 70,918.49 | -21.2 |
| Original Material Cost (RM) | Projected Material Cost (RM) | (%) Difference = Projected - Original |
| 2,385,547.20 | 1,879,771.34 | -21.2 |
| Original Project Duration | Projected Project Duration | (%) Difference = Projected - Original |
| 4 months and 3 weeks | 1 month and 1 week | -21.2 |
| Output Orientation | | |
| Original contact value | Projected Contract Value (RM) | (%) Difference = Projected - Original |
| 2,650,608.00 | 3,363,787.00 | +26.91 |

In input orientation, the utilization of inputs should be minimized in order for the projects to obtain the efficiency score of 1 or to make the projects efficient. Therefore, the inputs should be reduced to a certain value so that inefficient projects can improve their efficiency scores (see Appendix I). The acronyms L, M, PD, and CV denote labor, material, project duration (months), and contract value respectively.

Appendix I shows that project H4 has the smallest input reduction (Labor=5.05%, material= 10.53% and project duration=5.05%) when compared to project C3 (Labor=96.3%, material= 0% and project duration=1.6%) in order become efficient. According to the relative efficiency score ranking, project C3 has the smallest input reduction. However, with the high reduction of labor input, project C3 has the second smallest input reduction as compared to project H4. Project C24 has the largest input reduction. Its reduction of labor, material and project duration inputs are 96.31%, 0%, and 97.89% respectively.

In output orientation, the inputs are used in order to achieve the maximum amount of output production. The projects are efficient if the maximum amount of outputs are produced with the set of inputs given. Suggestions for the improvement of inefficient projects based on output orientation are shown in Appendix II. Similarly, with Appendix I, the acronyms L, M, PD, and CV denote labor, material, project duration (months), and contract value respectively.

Appendix II shows that project C3 has the smallest output increment (contract value=1.63%); that is, from RM 1,400,000.00 to RM 1,422,750.00. The labor input, however, has to be reduced from RM 1,190,000.00 to RM 42,000.00 in order to obtain a contract value of RM 1,422,750.00.

Projects C16, C10, C14, C25 and C24 have the largest output increments. It can be observed that these 5 projects have output increments of up to 999.9%. The projects, however, have to reduce some of the input to obtain 999.9% increment. The reduction of labor input for projects C10, C14 and C25 are 12.5%, 47.5% and 22.22% respectively. The reduction of project duration input for project C16 and C24 are 14.29% (from 4 months to 3 months, 1 week and 5 days) and 42.86% (from 3 months to 1 month, 2 weeks and 6 days) respectively.

# 6 Conclusion

The results showed that for input orientation, management should find ways to reduce the cost of labor, material and project duration without jeopardizing output production. It was found that all inefficient projects would need to reduce their inputs in order to produce their desired output. Only then could these projects improve their efficiency scores. This can be done by balancing the input utilization with the output produced. For the output orientation, all the inefficient projects need to improve their outputs with the available inputs.

DEA is a non-parametric method and the main advantage of this technique is that it considers multi-variables, known as inputs and output, simultaneously, and it does not require any parametric assumption of traditional multivariate methods.

In order to obtain a different view of the efficiency of business units, another non-parametric method such as an artificial neural network could be utilized. The use of two different methods would allow researchers to make comparison and make different suggestions to the management to improve the business units' performance.

The business efficiency model can be generalized by testing it with other IT companies in the same line of business regardless of the number of inputs and output. The model is simple and practical in implementation. The projects which act as the decision-making unit can later be used to determine the efficiency of the company department/unit that housed the projects.

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## Appendix I
## Suggestions for the improvement of inefficient projects based on input orientation

| No | Project and DMU I/O | Score Data | Projection | Difference | % | No | Project And DMU I/O | Score Data | Projection | Difference | % |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | H1 | 0.788 | | | | 21 | C7 | 1 | | | |
| | L | 90000 | 701918.5 | -19081.5 | -21.20% | | L | 7000 | 7000 | 0 | 0.00% |
| | M | 2385547 | 1879771 | -505775.9 | -21.20% | | M | 0 | 0 | 0 | 0.00% |
| | PD | 6 | 4.728 | -1.272 | -21.20% | | PD | 2 | 2 | 0 | 0.00% |
| | CV | 2650608 | 2650608 | 0 | 0.00% | | CV | 237125 | 237125 | 0 | 0.00% |
| **2** | H2 | 0.349 | | | | 22 | C8 | 0.427 | | | |
| | L | 480000 | 70886.81 | -409113.2 | -85.23% | | L | 15000 | 2987.867 | -12012.13 | -80.08% |
| | M | 673058 | 235218.3 | -437839.7 | -65.05% | | M | 0 | 0 | 0 | 0.00% |
| | PD | 24 | 8.387 | -15.613 | -65.05% | | PD | 2 | 0.854 | -1.146 | -57.32% |
| | CV | 1346116 | 1346116 | 0 | 0.00% | | CV | 101214 | 101214 | 0 | 0.00% |
| **3** | H3 | 1 | | | | 23 | C9 | 0.281 | | | |
| | L | 6000 | 6000 | 0 | 0.00% | | L | 12000 | 2952.03 | -9047.97 | -75.40% |
| | M | 895233.6 | 895233.6 | 0 | 0.00% | | M | 0 | 0 | 0 | 0.00% |
| | PD | 1 | 1 | 0 | 0.00% | | PD | 3 | 0.843 | -2.157 | -71.89% |
| | CV | 1053216 | 1053216 | 0 | 0.00% | | CV | 100000 | 100000 | 0 | 0.00% |
| **4** | H4 | 0.949 | | | | 24 | C10 | 0.07 | | | |
| | L | 6000 | 5696.837 | -303.163 | 0.0505 | | L | 48000 | 2949.077 | -45050.92 | -93.86% |
| | M | 950000 | 850000 | -100000 | -10.53% | | M | 0 | 0 | 0 | 0.00% |
| | PD | 1 | 0.949 | -0.051 | -5.05% | | PD | 12 | 0.843 | -11.157 | -92.98% |
| | CV | 1000000 | 1000000 | 0 | 0.00% | | CV | 99900 | 99900 | 0 | 0.00% |
| **5** | H5 | 0.524 | | | | 25 | C11 | 0.127 | | | |
| | L | 48000 | 5964.83 | -42035.17 | -87.57% | | L | 60000 | 2656.827 | -57343.17 | -95.57% |
| | M | 5000 | 2620.104 | -2379.896 | -47.60% | | M | 0 | 0 | 0 | 0.00% |
| | PD | 3 | 1.572 | -1.428 | -47.60% | | PD | 6 | 0.759 | -5.241 | -87.35% |
| | CV | 190305 | 190305 | 0 | 0.00% | | CV | 90000 | 90000 | 0 | 0.00% |
| **6** | H6 | 0.893 | | | | 26 | C12 | 0.105 | | | |
| | L | 3000 | 2680.311 | -319.689 | -10.66% | | L | 60000 | 2214.022 | -57785.98 | -96.31% |
| | M | 169960.5 | 151849 | -18111.53 | -10.66% | | M | 0 | 0 | 0 | 0.00% |
| | PD | 0.25 | 0.223 | -0.027 | -10.66% | | PD | 6 | 0.633 | -5.367 | -89.46% |
| | CV | 188845 | 188845 | 0 | 0.00% | | CV | 75000 | 75000 | 0 | 0.00% |
| **7** | H7 | 0.876 | | | | 27 | C13 | 0.197 | | | |
| | L | 3000 | 2628.313 | -371.687 | -12.39% | | L | 15000 | 2066.421 | -12933.58 | -86.22% |
| | M | 151893.9 | 133074.9 | -18818.99 | -12.39% | | M | 0 | 0 | 0 | 0.00% |
| | PD | 0.25 | 0.219 | -0.031 | -12.39% | | PD | 3 | 0.59 | -2.41 | -80.32% |
| | CV | 168771 | 168771 | 0 | 0.00% | | CV | 70000 | 70000 | 0 | 0.00% |
| **8** | H8 | 0.85 | | | | 28 | C14 | 0.063 | | | |
| | L | 3000 | 2549.67 | -450.33 | -15.01% | | L | 40000 | 1328.413 | -38671.59 | -96.68% |
| | M | 129933.9 | 110429.5 | -19504.39 | -15.01% | | M | 0 | 0 | 0 | 0.00% |
| | PD | 0.25 | 0.212 | -0.038 | -15.01% | | PD | 6 | 0.38 | -5.62 | -93.67% |
| | CV | 144371 | 144371 | 0 | 0.00% | | CV | 45000 | 45000 | 0 | 0.00% |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **9** | H9 | 1 | | | | 29 | C15 | 0.37 | | | |
| | L | 15000 | 15000 | 0 | 0.00% | | L | 15000 | 1295.646 | -13704.35 | -91.36% |
| | M | 80000 | 80000 | 0 | 0.00% | | M | 0 | 0 | 0 | 0.00% |
| | PD | 0.25 | 0.25 | 0 | 0.00% | | PD | 1 | 0.37 | -0.63 | -62.98% |
| | CV | 149250 | 149250 | 0 | 0.00% | | CV | 43890 | 43890 | 0 | 0.00% |
| **10** | H10 | 0.599 | | | | 30 | C16 | 0.074 | | | |
| | L | 15000 | 7198.633 | -7801.367 | -52.01% | | L | 12000 | 891.513 | -11108.49 | -92.57% |
| | M | 63129.5 | 37803.4 | -25326.1 | -40.12% | | M | 0 | 0 | 0 | 0.00% |
| | PD | 0.25 | 0.15 | -0.1 | -40.12% | | PD | 4 | 0.255 | -3.745 | -93.63% |
| | CV | 74270 | 74270 | 0 | 0.00% | | CV | 30200 | 30200 | 0 | 0.00% |
| **11** | H11 | 0.668 | | | | 31 | C17 | 0.236 | | | |
| | L | 6000 | 4010.609 | -1989.391 | -33.16% | | L | 20000 | 826.568 | -19173.43 | -95.87% |
| | M | 59376.75 | 39689.49 | -19687.26 | -33.16% | | M | 0 | 0 | 0 | 0.00% |
| | PD | 0.25 | 0.167 | -0.083 | -33.16% | | PD | 1 | 0.236 | -0.764 | -76.38% |
| | CV | 69855 | 69855 | 0 | 0.00% | | CV | 28000 | 28000 | 0 | 0.00% |
| **12** | H12 | 0.218 | | | | 32 | C18 | 0.169 | | | |
| | L | 20000 | 3669.286 | -16330.71 | -81.65% | | L | 12000 | 590.406 | -11409.59 | -95.08% |
| | M | 55827.2 | 12151.99 | -43675.21 | -78.23% | | M | 0 | 0 | 0 | 0.00% |
| | PD | 2 | 0.435 | -1.565 | -78.23% | | PD | 1 | 0.169 | -0.831 | -83.13% |
| | CV | 69784 | 69784 | 0 | 0.00% | | CV | 20000 | 20000 | 0 | 0.00% |
| **13** | H13 | 0.348 | | | | 33 | C19 | 0.33 | | | |
| | L | 12000 | 1401.655 | -10598.35 | -88.32% | | L | 17000 | 577.122 | -16422.88 | -96.61% |
| | M | 3000 | 1043.496 | -1956.504 | -65.22% | | M | 0 | 0 | 0 | 0.00% |
| | PD | 1 | 0.348 | -0.652 | -65.22% | | PD | 0.5 | 0.165 | -0.335 | -67.02% |
| | CV | 42800 | 42800 | 0 | 0.00% | | CV | 19550 | 19550 | 0 | 0.00% |
| **14** | H14 | 0.392 | | | | 34 | C20 | 0.099 | | | |
| | L | 3000 | 1176.946 | -1823.054 | -60.77% | | L | 5000 | 495.799 | -4504.201 | -90.08% |
| | M | 17918.85 | 7029.841 | -10889.01 | -60.77% | | M | 16515 | 1637.623 | -14877.38 | -90.08% |
| | PD | 0.25 | 0.098 | -0.152 | -60.77% | | PD | 3 | 0.14 | -2.86 | -95.32% |
| | CV | 21081 | 21081 | 0 | 0.00% | | CV | 18350 | 18350 | 0 | 0.00% |
| **15** | C1 | 0.703 | | | | 35 | C21 | 0.127 | | | |
| | L | 600000 | 29520.3 | -570479.7 | -95.08% | | L | 15000 | 442.804 | -14557.2 | -97.05% |
| | M | 0 | 0 | 0 | 0.00% | | M | 0 | 0 | 0 | 0.00% |
| | PD | 12 | 8.434 | -3.566 | -29.71% | | PD | 1 | 0.127 | -0.873 | -87.35% |
| | CV | 1000000 | 1000000 | 0 | 0.00% | | CV | 15000 | 15000 | 0 | 0.00% |
| **16** | C2 | 0.196 | | | | 36 | C22 | 0.11 | | | |
| | L | 473450 | 16442.8 | -457007.2 | -96.53% | | L | 10000 | 384.797 | -9615.203 | -96.15% |
| | M | 0 | 0 | 0 | 0.00% | | M | 0 | 0 | 0 | 0.00% |
| | PD | 24 | 4.698 | -19.302 | -80.43% | | PD | 1 | 0.11 | -0.89 | -89.01% |
| | CV | 557000 | 557000 | 0 | 0.00% | | CV | 13035 | 13035 | 0 | 0.00% |
| **17** | C3 | 0.984 | | | | 37 | C23 | 0.169 | | | |
| | L | 1190000 | 41328.41 | -1148672 | -96.53% | | L | 9000 | 295.203 | -8704.797 | -96.72% |
| | M | 0 | 0 | 0 | 0.00% | | M | 0 | 0 | 0 | 0.00% |
| | PD | 12 | 11.808 | -0.192 | -1.60% | | PD | 0.5 | 0.084 | -0.416 | -83.13% |
| | CV | 1400000 | 1400000 | 0 | 0.00% | | CV | 10000 | 10000 | 0 | 0.00% |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **18** | C4 | 0.24 | | | | 38 | C24 | 0.037 | | | |
| | L | 290700 | 10095.94 | -280604.1 | -96.53% | | L | 6000 | 221.402 | -5778.598 | -96.31% |
| | M | 0 | 0 | 0 | 0.00% | | M | 0 | 0 | 0 | 0.00% |
| | PD | 12 | 2.885 | -9.115 | -75.96% | | PD | 3 | 0.063 | -2.937 | -97.89% |
| | CV | 342000 | 342000 | 0 | 0.00% | | CV | 7500 | 7500 | 0 | 0.00% |
| **19** | C5 | 0.344 | | | | 39 | C25 | 0.041 | | | |
| | L | 670548 | 14431.88 | -656116.1 | -97.85% | | L | 9000 | 286.347 | -8713.653 | -96.82% |
| | M | 0 | 0 | 0 | 0.00% | | M | 0 | 0 | 0 | 0.00% |
| | PD | 12 | 4.123 | -7.877 | -65.64% | | PD | 2 | 0.082 | -1.918 | -95.91% |
| | CV | 488880 | 488880 | 0 | 0.00% | | CV | 9700 | 9700 | 0 | 0.00% |
| **20** | C6 | 0.421 | | | | | | | | | |
| | L | 36000 | 15150.35 | -20849.65 | -57.92% | | | | | | |
| | M | 0 | 0 | 0 | 0.00% | | | | | | |
| | PD | 12 | 4.329 | -7.671 | -63.93% | | | | | | |
| | CV | 513218 | 513218 | 0 | 0.00% | | | | | | |

# Appendix II
## Suggestions for the improvement of output orientation of inefficient projects based on

| No | Project and DMU I/O | Score Data | Projection | Difference | % | No | Project and DMU I/O | Score Data | Projection | Difference | % |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | H1 | 0.788 | | | | 21 | C7 | 1 | | | |
| | L | 90000 | 90000 | 0 | 0.00% | | L | 7000 | 7000 | 0 | 0.00% |
| | M | 2385547 | 2385547 | 0 | 0.00% | | M | 0 | 0 | 0 | 0.00% |
| | PD | 6 | 6 | 0 | 0.00% | | PD | 2 | 2 | 0 | 0.00% |
| | CV | 2650608 | 3363787 | 713179.05 | 26.91% | | CV | 237125 | 237125 | 0 | 0.00% |
| 2 | H2 | 0.349 | | | | 22 | C8 | 0.427 | | | |
| | L | 480000 | 202836.8 | -277163.2 | -57.74% | | L | 15000 | 7000 | -8000 | -53.33% |
| | M | 673058 | 673058 | 0 | 0.00% | | M | 0 | 0 | 0 | 0.00% |
| | PD | 24 | 24 | 0 | 0.00% | | PD | 2 | 2 | 0 | 0.00% |
| | CV | 1346116 | 3851801 | 2505684.6 | 186.14% | | CV | 101214 | 237125 | 135911 | 134.28% |
| 3 | H3 | 1 | | | | 23 | C9 | 0.281 | | | |
| | L | 6000 | 6000 | 0 | 0.00% | | L | 12000 | 10500 | -1500 | -12.50% |
| | M | 895233.6 | 895233.6 | 0 | 0.00% | | M | 0 | 0 | 0 | 0.00% |
| | PD | 1 | 1 | 0 | 0.00% | | PD | 3 | 3 | 0 | 0.00% |
| | CV | 1053216 | 1053216 | 0 | 0.00% | | CV | 100000 | 355687.5 | 255687.5 | 255.69% |
| 4 | H4 | 0.949 | | | | 24 | C10 | 0.07 | | | |
| | L | 6000 | 6000 | 0 | 0.00% | | L | 48000 | 42000 | -6000 | -12.50% |
| | M | 950000 | 895233.6 | -54766.4 | -5.76% | | M | 0 | 0 | 0 | 0.00% |
| | PD | 1 | 1 | 0 | 0.00% | | PD | 12 | 12 | 0 | 0.00% |
| | CV | 1000000 | 1053216 | 53216 | 5.32% | | CV | 99900 | 1422750 | 1322850 | 999.90% |
| 5 | H5 | 0.524 | | | | 25 | C11 | 0.127 | | | |
| | L | 48000 | 11382.81 | -36617.19 | -76.29% | | L | 60000 | 21000 | -39000 | -65.00% |
| | M | 5000 | 5000 | 0 | 0.00% | | M | 0 | 0 | 0 | 0.00% |
| | PD | 3 | 3 | 0 | 0.00% | | PD | 6 | 6 | 0 | 0.00% |
| | CV | 190305 | 363163.1 | 172858.09 | 90.83% | | CV | 90000 | 711375 | 621375 | 690.42% |
| 6 | H6 | 0.893 | | | | 26 | C12 | 0.105 | | | |
| | L | 3000 | 3000 | 0 | 0.00% | | L | 60000 | 21000 | -39000 | -65.00% |
| | M | 169960.5 | 169960.5 | 0 | 0.00% | | M | 0 | 0 | 0 | 0.00% |
| | PD | 0.25 | 0.25 | 0 | 0.00% | | PD | 6 | 6 | 0 | 0.00% |
| | CV | 188845 | 211369.2 | 22524.166 | 11.93% | | CV | 75000 | 711375 | 636375 | 848.50% |
| 7 | H7 | 0.876 | | | | 27 | C13 | 0.197 | | | |
| | L | 3000 | 3000 | 0 | 0.00% | | L | 15000 | 10500 | -4500 | -30.00% |
| | M | 151893.9 | 151893.9 | 0 | 0.00% | | M | 0 | 0 | 0 | 0.00% |
| | PD | 0.25 | 0.25 | 0 | 0.00% | | PD | 3 | 3 | 0 | 0.00% |
| | CV | 168771 | 192638 | 23867.005 | 14.14% | | CV | 70000 | 355687.5 | 285687.5 | 408.12% |
| 8 | H8 | 0.85 | | | | 28 | C14 | 0.063 | | | |
| | L | 3000 | 3000 | 0 | 0.00% | | L | 40000 | 21000 | -19000 | -47.50% |
| | M | 129933.9 | 129933.9 | 0 | 0.00% | | M | 0 | 0 | 0 | 0.00% |
| | PD | 0.25 | 0.25 | 0 | 0.00% | | PD | 6 | 6 | 0 | 0.00% |
| | CV | 144371 | 169870.2 | 25499.23 | 17.66% | | CV | 45000 | 711375 | 666375 | 999.90% |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | H9 | 1 | | | | 29 | C15 | 0.37 | | | |
| | L | 15000 | 15000 | 0 | 0.00% | | L | 15000 | 3500 | -11500 | -76.67% |
| | M | 80000 | 80000 | 0 | 0.00% | | M | 0 | 0 | 0 | 0.00% |
| | PD | 0.25 | 0.25 | 0 | 0.00% | | PD | 1 | 1 | 0 | 0.00% |
| | CV | 149250 | 149250 | 0 | 0.00% | | CV | 43890 | 118562.5 | 74672.5 | 170.14% |
| 10 | H10 | 0.599 | | | | 30 | C16 | 0.074 | | | |
| | L | 15000 | 12021.3 | -2978.698 | -19.86% | | L | 12000 | 12000 | 0 | 0.00% |
| | M | 63129.5 | 63129.5 | 0 | 0.00% | | M | 0 | 0 | 0 | 0.00% |
| | PD | 0.25 | 0.25 | 0 | 0.00% | | PD | 4 | 3.429 | -0.571 | -14.29% |
| | CV | 74270 | 124026.6 | 49756.625 | 66.99% | | CV | 30200 | 406500 | 376300 | 999.90% |
| 11 | H11 | 0.668 | | | | 31 | C17 | 0.236 | | | |
| | L | 6000 | 6000 | 0 | 0.00% | | L | 20000 | 3500 | -16500 | -82.50% |
| | M | 59376.75 | 59376.75 | 0 | 0.00% | | M | 0 | 0 | 0 | 0.00% |
| | PD | 0.25 | 0.25 | 0 | 0.00% | | PD | 1 | 1 | 0 | 0.00% |
| | CV | 69855 | 104505.3 | 34650.318 | 49.60% | | CV | 28000 | 118562.5 | 90562.5 | 323.44% |
| 12 | H12 | 0.218 | | | | 32 | C18 | 0.169 | | | |
| | L | 20000 | 16856.99 | -3143.01 | -15.72% | | L | 12000 | 3500 | -8500 | -70.83% |
| | M | 55827.2 | 55827.2 | 0 | 0.00% | | M | 0 | 0 | 0 | 0.00% |
| | PD | 2 | 2 | 0 | 0.00% | | PD | 1 | 1 | 0 | 0.00% |
| | CV | 69784 | 320593.2 | 250809.21 | 359.41% | | CV | 20000 | 118562.5 | 98562.5 | 492.81% |
| 13 | H13 | 0.348 | | | | 33 | C19 | 0.33 | | | |
| | L | 12000 | 4029.688 | -7970.313 | -66.42% | | L | 17000 | 1750 | -15250 | -89.71% |
| | M | 3000 | 3000 | 0 | 0.00% | | M | 0 | 0 | 0 | 0.00% |
| | PD | 1 | 1 | 0 | 0.00% | | PD | 0.5 | 0.5 | 0 | 0.00% |
| | CV | 42800 | 123047.9 | 80247.852 | 187.49% | | CV | 19550 | 59281.25 | 39731.25 | 203.23% |
| 14 | H14 | 0.392 | | | | 34 | C20 | 0.099 | | | |
| | L | 3000 | 3000 | 0 | 0.00% | | L | 5000 | 5000 | 0 | 0.00% |
| | M | 17918.85 | 17918.85 | 0 | 0.00% | | M | 16515 | 16515 | 0 | 0.00% |
| | PD | 0.25 | 0.25 | 0 | 0.00% | | PD | 3 | 1.415 | -1.585 | -52.82% |
| | CV | 21081 | 53734.82 | 32653.824 | 154.90% | | CV | 18350 | 185054.9 | 166704.92 | 908.47% |
| 15 | C1 | 0.703 | | | | 35 | C21 | 0.127 | | | |
| | L | 600000 | 42000 | -558000 | -93.00% | | L | 15000 | 3500 | -11500 | -76.67% |
| | M | 0 | 0 | 0 | 0.00% | | M | 0 | 0 | 0 | 0.00% |
| | PD | 12 | 12 | 0 | 0.00% | | PD | 1 | 1 | 0 | 0.00% |
| | CV | 1000000 | 1422750 | 422750 | 42.28% | | CV | 15000 | 118562.5 | 103562.5 | 690.42% |
| 16 | C2 | 0.196 | | | | 36 | C22 | 0.11 | | | |
| | L | 473450 | 84000 | -389450 | -82.26% | | L | 10000 | 3500 | -6500 | -65.00% |
| | M | 0 | 0 | 0 | 0.00% | | M | 0 | 0 | 0 | 0.00% |
| | PD | 24 | 24 | 0 | 0.00% | | PD | 1 | 1 | 0 | 0.00% |
| | CV | 557000 | 2845500 | 2288500 | 410.86% | | CV | 13035 | 118562.5 | 105527.5 | 809.57% |
| 17 | C3 | 0.984 | | | | 37 | C23 | 0.169 | | | |
| | L | 1190000 | 42000 | -1148000 | -96.47% | | L | 9000 | 1750 | -7250 | -80.56% |
| | M | 0 | 0 | 0 | 0.00% | | M | 0 | 0 | 0 | 0.00% |
| | PD | 12 | 12 | 0 | 0.00% | | PD | 0.5 | 0.5 | 0 | 0.00% |
| | CV | 1400000 | 1422750 | 22750 | 1.63% | | CV | 10000 | 59281.25 | 49281.25 | 492.81% |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 18 | C4 | 0.24 | | | | 38 | C24 | 0.037 | | | |
| | L | 290700 | 42000 | -248700 | -85.55% | | L | 6000 | 6000 | 0 | 0.00% |
| | M | 0 | 0 | 0 | 0.00% | | M | 0 | 0 | 0 | 0.00% |
| | PD | 12 | 12 | 0 | 0.00% | | PD | 3 | 1.714 | -1.286 | -42.86% |
| | CV | 342000 | 1422750 | 1080750 | 316.01% | | CV | 7500 | 203250 | 195750 | 999.90% |
| 19 | C5 | 0.554 | | | | 39 | C25 | 0.041 | | | |
| | L | 670548 | 42000 | -628548 | -93.74% | | L | 9000 | 7000 | -2000 | -22.22% |
| | M | 0 | 0 | 0 | 0.00% | | M | 0 | 0 | 0 | 0.00% |
| | PD | 12 | 12 | 0 | 0.00% | | PD | 2 | 2 | 0 | 0.00% |
| | CV | 788880 | 1422750 | 633870 | 80.35% | | CV | | | | |
| 20 | C6 | 0.421 | | | | | | | | | |
| | L | 36000 | 36000 | 0 | 0.00% | | | | | | |
| | M | 0 | 0 | 0 | 0.00% | | | | | | |
| | PD | 12 | 10.286 | -1.714 | -14.29% | | | | | | |
| | CV | 513218 | 1219500 | 706282 | 137.62% | | | | | | |