1. Introduction

Each SME wants an operator that is able to work optimally, so that the productivity of the SMEs is expected to increase of overall. This research has been done in the SMEs that worked in general printing.

There are seven elements of work for SMEs, that are, operator brings paper and ink to the printing site, measure the amount of ink needed and put it into the printing press, print paper with a printing machine, brings printouts to pod station, cuts the mold, perform printing results, the last element is bring the print out to the storage area. The seven elements of work are done at 4 work stations, which are: printing station, pod station, separation station, and office.

Based on the results of preliminary observations it was found that the station that needed the most physical work was the pod station. This SMEs has a specific problem that they do not have the design of work system especially in pod station. For this reason, a work system will be designed for the station. So that, the aim of this research is to design the work system for the pod station.

First, the operator productivity measurements using Data Envelopment Analysis. It calculated by cycle time, presentation of work, and the number of products produced as variables to get the optimum function.

DEA is a mathematical programming technique based on linear programming is used to evaluate the efficiency of a decision-making unit which is responsible for using a number of inputs to obtain an output target. DEA method was created as a performance evaluation tool in a unit activity entities (organizations), hereinafter referred to Decision Making Unit (DMU). Simply put, this measurement is expressed by the ratio: output / input, which is a measurement of the efficiency or productivity [1].
2. Methodology

In the measurement of efficiency using DEA, there are two models frequently used, namely Constant Return to Scale (CRS) and a Variable Return to Scale (VRS) \[2\]. However, in this study using a CRS. DEA model is oriented towards input based on assumptions constant return to scale that is known as CCR models. In the constant return to scale models of each DMU will be compared with the rest of the DMU in the sample with the assumption that the internal and external conditions are the same DMU. Criticisms of these assumptions is that the assumption of constant returns to scale is only suitable for the conditions in which the entire DMU operating at optimal scale \[3\]. However, in reality though the DMU operates with a power source (input) the same and produce the same output, but also internal and external conditions may be different so as to result in a DMU is not operating at optimal scale. According Charnes, Cooper, and Rhodes this model can show the overall technical efficiency or value of profit efficiency for each DMU \[4\].

DEA assumes that each DMU will choose weights that maximize the efficiency ratio. Because each DMU using a combination of different inputs to produce outputs different combinations, each DMU will choose a set of weights that reflect that diversity. Generally DMU will assign a high weight for the input and output use is little that can be produced by many. Weights is not the economic value of the input and output, but rather as a determinant to maximize the efficiency of a DMU. As gambararan, if a DMU is a company oriented to profit (profit-maximizing firm) and each input and output has a cost per unit and the selling price per unit,

DEA may be formulated as a linear program fractional solution can be obtained if the model is transformed into a linear program with weights of input and output such as a decision variable DMU (decision variables) \[5\] simplex method can be used to solve the model has been transformed into a linear program. DEA requires completion of a linear program for each DMU. The result is a set of weights for a DMU and figures relative efficiencies. DEA has several managerial values\[6\]. First, DEA efficiency for each DMU, DMU relative to others in the sample. This efficiency rate allows someone DMU analysis to identify the most in need of attention and remedial action plan for the DMU walkin / less efficient.

Second, if a less efficient DMU (efficiency <100%) showed a number of DMU DEA has perfect efficiency (efficient reference sets, efficiency = 100%) and a set multiplier that can be used by managers to develop strategies for improvement. Such information allows one analysis made DMU hypothetical use fewer inputs and produce outputs at least equal to or more than the DMU walkin efficient, so the DMU hypothetical would have perfect efficiency when using weights input and weighting the outputs of DMU inefficient. The approach members strategic direction for managers to improve the efficiency of a DMU walkin efficient through the introduction of too much used input and output production is too low.

Third, DEA provide cross efficiency matrix. A cross-DMU efficiency of the DMU B weighted ratio of output divided by the weighted input which is calculated using the input level and output DMU A and the weight of input and output DMU B. Analysis of cross can help one manager to identify an efficient DMU but using a combination of inputs and produce a very different output combinations with other DMU \[7\]

The approach used is input-oriented DEA assuming variable returns to scale (VRS). Selection of these assumptions are based approach that has not been operating at optimal scale due to the many government policies that affect and limited availability of natural resources. Efficiency scores for each firm to-i has a value between 0 - 1. The score of 1 indicates a point on the frontier where the company has technically efficient. Assuming VRS DEA will produce efficiency score greater than or equal to the value obtained when using the assumption of constant returns to scale (CRS) \[8\],

Productivity measurement is done with the approach Malmquist Productivity Index. Some of the advantages of this method, among others, can measure the change increase or decrease performance over several time periods. In addition, this method can decompose the changes in productivity into technical efficiency change and technological change. Malmquist Productivity Index between t and t + 1 is expressed as follows \[9\]:

\[\text{Malmquist Productivity Index}_{t+1} = \frac{\text{TE}_{t+1} \times \text{TC}_{t+1}}{\text{TE}_{t} \times \text{TC}_{t}}\]
\[ m_t(q_t, q_{t+1}, x_t, x_{t+1}) = \frac{d^t(q_t, x_t)}{d^{t+1}(q_{t+1} x_{t+1})} \left[ d^{t+1}(q_{t+1} x_{t+1}) - d^t(q_t, x_t) \right]^{1/2}. \]

Where \( d(x, y) \) indicates the distance input function

The index value change in efficiency can be greater than 1 (one) which indicates the level of efficiency increase, equal to 1 (one) means that no changes in efficiency, and less than 1 (one) showing a drop in efficiency between \( t \) and \( t + 1 \)[16]. This value indicates how far the position of a company on the production frontier. Just as changes in efficiency, value changes in technology could also be greater, equal to, or less than 1 (one) which indicates whether the frontier moved forward, fixed, or retreat[10]. Shifting forward the frontier indicated there are advances in technology and vice versa[11].

In resolving problems or Company level organizational efficiency of each branch or unit, using mathematical problem solving Data Envelopment Analysis (DEA). The data input in the form of input and output factors. Input factor consists of the percentage of Work (X1, %), Cycle (X2, CNN), Output factor used is the amount of product (Y1, Unit). Data processing steps are, first, calculated variable expenses for each DMU to be assessed levels of efficiency. Second, determine a mathematical model that will be used as a means of solving the problem, in this case using a mathematical model of Data Envelopment Analysis (DEA). Third, calculated targets for DMU relatively less efficient for the input obtained from the difference between the actual input value to the value of the input slack.

3. Results and Discussion

Operator start working from 8:00 to 11:59 AM, break from 12:00 to 12:59 PM, followed at 13:00 to 18:30 PM. Having obtained the data from observations on SMEs will be a recapitulation of data collection to facilitate data processing. Recapitulation data operator activity can be seen in table 1.

| operator activity | Work | idle | total |
|-------------------|------|------|-------|
| 1                 | 77   | 15   | 92    |
| 2                 | 73   | 19   | 92    |

In Table 2 shows the percentage of operator activity. This table consists of the percentage of operator’s work and idle. Recapitulation percentage of the activity of each operator can be seen in the following table.

| operator activity | Work   | idle  | total |
|-------------------|--------|-------|-------|
| 1                 | 83.69% | 16.31%| 100%  |
| 2                 | 79.34% | 20.66%| 100%  |

Target of printed sheet in 8-hours working day are 3000 sheets. When multiplied by the target of the print sheet with 8-hour working day, the first mold then takes 2852.27 seconds can be completed in 1 day 10 Molds.

DMU determination can be obtained by assuming the response to the characteristics of smaller the better as input and set a unit (one) as the output. Table 3 below is data DMU that is already in the set:

| input | output |
|-------|--------|
| X1    | Y1     |
| 0.83  | 1      |
| 0.79  | 1537.82|
The data in Table 3 were determined both responses ie, percentage of work (X1) has the same characteristics, namely bigger the better, and Cycle Time (X2) has the characteristics both smaller the better the response included in the DMU input. Unit (one) set as well as the DMU output.

\[
\max \theta = \sum_{r=1}^{u} u_r y_{r0}
\]

(2)

with constraints,

\[
\sum_{i=1}^{v} v_i x_{i0} = 1 \sum_{r=1}^{u} u_r y_{rj} \leq \sum_{i=1}^{m} v_i x_{ij} \quad j = 1, ..., n; u_1, u_2, ..., u_s \geq 0; \text{and } v_1, v_2, ..., v_m \geq 0
\]

(3)

where the value 1 to the data there are 2 DMU

The calculation using the software lingo and get the following results that shows in Table 4,

| Table 4. Calculation Model DEA CCR |
|-------------------------------------|
| DMUj | input | output | Result |
| X1  | X2    | Y1    |
| DMU1 | 0.83  | 1314.45 | 1 | 1,000 |
| DMU2 | 0.79  | 1537.82 | 1 | 1,000 |

Due to the result value equal to 1, we conclude that both the DMU has passed the threshold Bayas expected quality.

4. Conclusion

In observations carried out in this following SME, obtained percentage of carriers for productive work is 83.69% on the carrier I and 79.34% in the second operator. From the calculation of DEA found that both operators have result value equal to 1. It means that both of them have passed the threshold Bayas expected quality.

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