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The cost analysis of material handling in Chinese traditional praying paper production plant

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Abstract. Chinese traditional praying paper industry is an industry which produced Chinese traditional religion praying paper. This kind of industry is rarely examined since it was only in Small and Medium Enterprise (SME's- form). This industry produced various kinds of Chinese traditional paper products. The purpose of this research is to increase the amount of production, reduce waiting time and moving time, and reduce material handling cost. The research was conducted at prime production activities, consists of: calculate the capacity of the material handler, the frequency of movement, cost of material handling, and total cost of material handling. This displacement condition leads to an ineffective and inefficient production process. The alternative was developed using production judgment and aisle standard. Based on the observation results, it is possible to reduce displacement in the production. Using alternative which by-passed displacement from a rolled paper in the temporary warehouse to cutting and printing workstation, it can reduce material handling cost from 2.26 million rupiahs to 2.00 million rupiahs only for each batch of production. This result leads to increasing of production quantity, reducing waiting and moving time about 10% from the current condition.

1. Introduction

From a worldwide perspective, it has been recognized that small and medium enterprises (SMEs) play a vital role in economic development, as they have been the primary source of job/employment creation and output growth, not only in developing but also in developed countries [1]. SME also play a vital role in the rural income because they scattered widely and very labor-intensive in the rural area [2]. Tambunan identifies several key issues for improving SME competitiveness in Indonesia, they are human resource, working capital, management and technological skills. These key factors are important to improve SME's business performance [3].

Chinese traditional praying paper industry is an industry which produced Chinese traditional religion praying paper. This kind of industry is rarely examined since it was only in Small and Medium Enterprise form. This industry produced various kinds of Chinese traditional paper products. In producing products, manufacturer has to follow several steps, which is, establishing paper from pulp, tin printing, cutting, screen printing and packing process. Paper is cut and printed as per product specification.

Material Handling cost is an expense arising from the activities of material from one machine to another or from one department to another which are determined to arrive at a particular [4, 5]. Units used was rupiah per meter of movement. Expected result in planning material handling is increasing

capacity, improving a working condition, customer service, room space, and reduce expenses [5, 6, 7, 8, 9].

In this industry examined, it has 4.5 tons of daily capacity. To produce daily, it needs 30 to 75 times of repeated material handling and 130.03 meters for a day of material handling in the main production line. Therefore, before doing re-layout for the existing main production line, the researcher needs to analyze the existing material handling condition.

2. Method and equipment

The method used in this paper is motion and time study (descriptive research) [10]. Steps in collecting primary data are field survey (preliminary survey), problem identification, collecting primary data and secondary data such as production process, material handling movement, the frequency of material handling, allowance, the capacity of handling, and time needed for material handling.

In this research, there were several movement in the department such as: material handling from temporary warehouse to printing and cutting, material handling from printing and cutting to re-cutting machine, material handling from re-cutting to screen printing, material handling from screen printing to packing workstation, and material handling from packing to final product warehouse.

According to Alreck & Settle, generally, the number of samples is 10% of the population is recommended within 30 to 500 parent population. In this research, the number of samples is 30 for each movement of material handling [11].

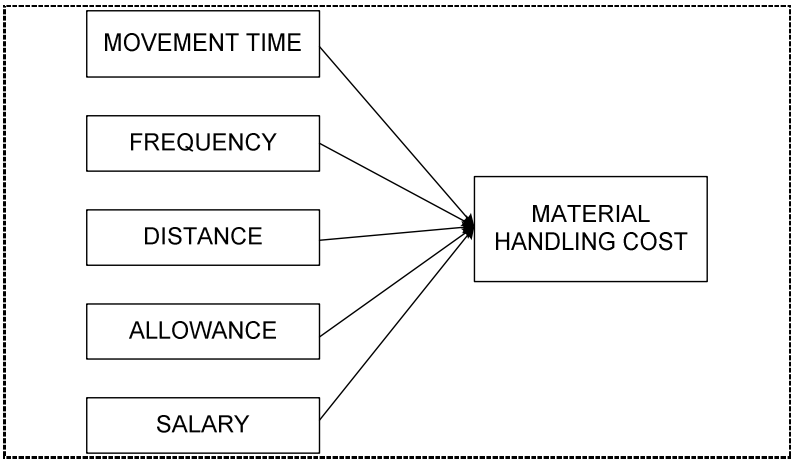

Figure 1. Conceptual Framework in Material Handling Cost

Whether movement time is time required to do movement of material from one workstation to another workstation, frequency is how many times it is needed to move material between workstations in a day at normal condition, distance is the length between workstations, allowance is given to the operator to release fatigue, and salary is used as the cost needed for the activities.

Material handling cost needed to calculate as follow: [12]

1. Firstly, it is needed to calculate the capacity of the material handler/tool (C) by dividing the volume of tool (v_{tool}) and material can be moved ($v_{material}$) as follow:

$$C = \frac{v_{tool}}{v_{material}} \quad (1)$$

2. Then, the frequency of movement (F) can be calculated by dividing material need to be moved with the capacity of material handler as follow:

$$F = \frac{n_{mat}}{C} \quad (2)$$

3. Cost of material handling (*OMH/m*) can be calculated by dividing cost with distance (*d*) as follow:

$$OMH\ (m) = \frac{Cost}{d} \tag{3}$$

4. The total cost of material handling (*OMH*) can be calculated by multiplying distance (r), frequency (*F*) and cost of material handling (*OMH/m*) as follow:

$$OMH\ = r \times F \times OMH(m) \tag{4}$$

Since the flow pattern in the production is odd angle, then the researcher developed an alternative route by cutting off the material handling from temporary warehouse to printing and cutting workstation by creating a door directly to the workstation as can be seen in Figure 2.

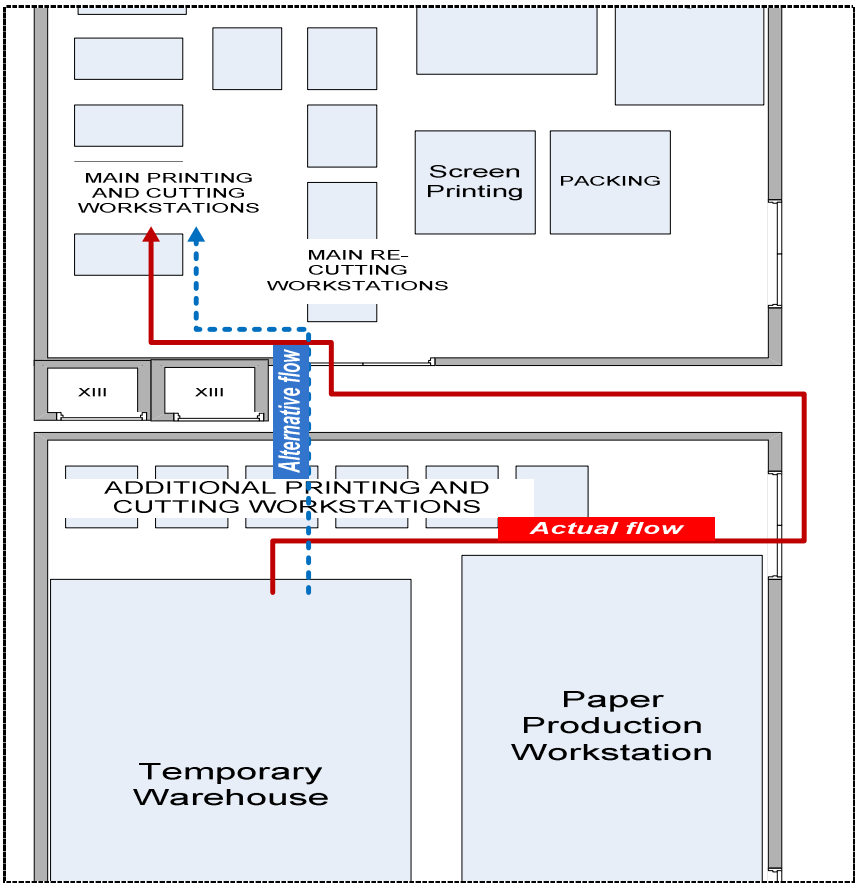

Figure 2. Creating an Alternative Route

Figure 2 shows an alternative used to calculate the cost of material handling so it can clearly educate the industry that even with a single improvement, they can reduce material handling cost.

3. Results and Discussions

Cost of material handling was calculated through the steps as stated in the equation (1) to (4) for each displacement from one to another workstation through several steps of process and result as follow:

Table 1. Recapitulation for Total Cost of Material Handling

Step of Process	EXISTING		ALTERNATIVE	
	Route	OMH (Rp/ month)	Route	OMH (Rp/ month)
1	A	655,824	F	478,582
2	B	238,368	B	238,368
3	C	884,416	C	884,416
4	D	277,542	D	277,542
5	E	204,630	E	204,630
TOTAL		2,260,780		2,083,538

Where A refers to displacement from temporary warehouse to printing and cutting workstation, B refers to displacement from printing and cutting to re-cutting workstation, C refers to displacement from re-cutting to screen printing workstation, D refers to displacement from screen printing to packing workstation, E refers to displacement from packing workstation to final product warehouse, and F is alternative route for displacement from temporary warehouse to printing and cutting warehouse. Based on Table 1, we can see that Route A and Route C is the most priority route to be reduced with value of OMH as high as 68% of the total cost. However, route C is not possible to be re-route because there's no other way to place the re-cutting to the nearer place with screen printing workstation.

Table 2. Recapitulation of Displacement in Process

Step of Process	EXISTING		ALTERNATIVE	
	Route	Distance (m)	Route	Distance (m)
1	A	87.63	F	66.00
2	B	8.19	B	8.19
3	C	11.91	C	11.91
4	D	4.30	D	4.30
5	E	18.00	E	18.00
TOTAL		130.03		108.40

As can be seen in Table 1, Alternative gives a better material handling cost to the production. Changing the route for one step give about 10% of cost reducing in this case. The reducing of material handling cost occurs because there are also reducing in the displacement in route A. This will also giving impact to increase in the production time so that with this improvement, production will increase to about 5 to 8% from the experience from the production manager.

For a better result in the material handling, re-layout is highly recommended for further research so that the industry can operate in an effective and efficient way, not only in the production as in this research.

4. Conclusions

The conclusion from this paper is reducing displacement in material handling will reduce total cost of material handling about 10%, from IDR 2,260,780 to IDR 2,083,538. this result will give direct impact to lower production time and giving increase for a number of product about 5 to 8%. Route A and C is Further research is needed for a better result in the total cost of material handling.

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