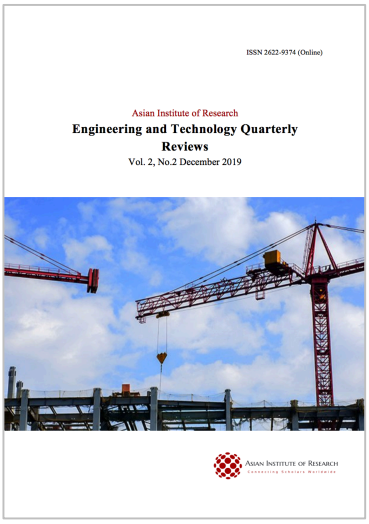

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Measurement of Standard Time Work with the Predetermined Motion Time System Method at the Production Department in PT.PIJ Sidoarjo

Wiwik Sumarmi[1]

[1] Department of Industry Technology. Universitas Muhamadiyah Sidoarjo, Indonesia

Correspondence: Wiwik Sumarmi, Department of Industry Technology. Universitas Muhamadiyah Sidoarjo, Jalan Raya Gelam Sidoarjo, Indonesia. E-mail: sumarmi.umsida@gmail.com

Abstract
The purpose of this study is to measure standard work time in the production section at "PT. Prestasi Ide Jaya" (PT.PIJ) where there are several workers and machine operators, if between one of the operators on each machine does not work properly it will cause the production process to stop. In this study there are two variables, namely 1) the dependent variable is the time and movement of the machine operator, 2) the independent variable of several Therblig movements: a. reach out, b. take off, c. holding, d. direct, and e. transport. Measuring the standard time of operator movements with Work Factor and Time Measurement Methods. The calculation results can be concluded that the Time Measurement (MTM) and Work factor (WF) methods can provide a standard time that is following the standard time that is smaller than real conditions. Company is proposing to reduce operator movements that are not needed in the production process.

Keywords: Methods Time Measurement, Work factor, Standard Time Work

1. Introduction

Standard time is the time needed by a worker who has an average ability level to complete a job. Standard time measurement is divided into two parts, namely direct measurement and indirect measurement. According to Wignjosoebroto (2003) in Febriana (2013), work time measurement is a method of balance between human activities contributed by the unit of output produced. The measurement of work time is related to efforts to determine the standard time needed to complete a job. PT. PIJ is one of the companies engaged in the manufacturing industry with the products produced are sandals and EVA sponges that are used for flip flops products. In the process of producing EVA sponges, they still use machines with the help of human power. Parts of eva sponge production are 17 workers and 7 machine operators, if between one of the operators in each machine does not work properly it will cause the production process to cease and it will also cause a buildup in each machine, thus inhibiting the production process.

2. Method

2.1 Research Method

Observations were done by direct observation to PT. PIJ and conducting interviews with relevant parties to support data originality. Data retrieval is done by observing directly the production process site and the ongoing production process. Data of observations carried out were processed in March 2017. The data needed is data on the number of operators, standard time data from operator movements from each production machine in seconds. Data that has been collected, data processing is carried out by using measures to determine the maturity of the machine operator. Calculations to find out my suitable time using the Work Factor method and Method Time Measurement. As for the smooth running of the production process so that the calculation of cycle time, normal time and standard time is carried out. After that, an analysis of the standard time calculation is carried out by comparing the results obtained from the calculation between using the WF and MTM methods with the methods used by the company. From the results of the analysis obtained, the proposed improvements to the methods applied by the company are made, namely Work Factor methods and Time Measurement Methods

2.2 Literature Study

Working Time Measurement
Time Study is basically an attempt to determine the length of work time required by an operator to complete a job (Niebel, 1988 in Rinawati et al, 2012). Whereas Wignjosoebroto (2006) suggests that work time measurement is a method of determining the balance between human activities contributed by the unit of output produced. Basically, the measurement of working time is divided into two parts, namely direct measurement of work and indirect measurement of work. The first way is called because the measurement is carried out directly, namely where the measured work is carried out. Two ways include the method of measuring work using stopwatch time study and work sampling. While the measurement of indirect work can be done without having to go to the workplace as long as knowing the work through the elements of work or elements of the movement. This method can be done in standard time data activities (data standards) and time movement data (predetermined systems) Wignjosoebroto (2006).

Methods Time Measurement (MTM)
Wignjosoebroto (2006) suggests that the measurement of time methods in foreign terms better known as Time Measurement Methods (MTM) is a predetermined time standard system that is developed based on the study of image work movements of an industrial work operation recorded in film. This system is defined as a procedure to analyze each operation or work method into the basic movements needed to carry out the work, and then set the standard time of each movement based on the type of movement and working conditions of each existing.
Work Factor

Wignjosoebroto (2006) suggests that work factors are one of the systems of the earliest Predetermined Time System and are widely applied. This system makes it possible to set the time for manual works using predetermined movement time data. The first step is to make a detailed analysis of each work step based on four basic variables (limbs, motion transfer work, manual control, and existing weight / obstacles) and use the work unit factor as a measurement. The next step is to set the standard time of movement for each of the identified work movements. Of course, in determining the standard time for work in total, you still have to add it to the allowance time needed.

This is the formula to calculate cycle time, normal time, and standard time (rinawatikk, 2012):

Cycle Time

$$X = \frac{\sum x}{n}$$

X is the Symbol for Cycle Time
$\sum \boldsymbol{x}$ is the symbol for Observation Time

n is the symbol for Numbers of Observation

Normal Time
Wn= Total Time x *performance rating* (%)

Wn is the symbol for normal time
Performance Rating is an assessment of the performance of the operator p = 1 if the operator works normally, p <1 if the time is broken, p> 1 if it is too fast.

Standard Time
Standard Time = Normal Time + (*Normal Time* + *Allowance* %)

$$StandardTime = NormalTime \times \frac{100\,\%}{100\,\% - allowance\,\%}$$

Chart
The Chart or simultaneous motion (simo) chart is a type of chart that is often used in movement studies as a tool for recording and analyzing an activity. This chart is used to analyze work that describes the simultaneous movements of both hands. From this chart, it will be known how the activities of each hand, and can be analyzed whether the effectiveness of the movement can be increased by eliminating, replacing, or combining motion (Herjanto, 2008).

Job Description : measurement of the side of the lid
Department : Measurement
Map Number :
Recent [V] Proposal [ ]
Mapped By : Michael Ronald
Date : March 17, 2011

Left Hand	Distance (m)	Time (Second)	Symbol		Time (Second)	Distance (m)	Right Hand
unemployed	2	4	D	Re	4	2	Reaching Fiber
unemployed		2	D	G	2		Holding fiber
unemployed		6	D	M	6		Bring Fiber
Reaching the Ruler	0.41	3	Re	Re	3	0.4	Reaching Markers
Holding the Ruler		2	G	G	2		Holding fiber
Bring the Ruler		4	M	M	4		Bring Markers
Directing the ruler to the board		3	P	P	3		Directing Markers
Hold the Ruler		28	U	U	28		Using Markers
Hold the Ruler		3	Ri	Ri	3		Release the Markers

Figure 1. The Example of Simo Chart (Source: Herjanto, 2008)

3. Results and Discussion

3.1 Result

All data collected has been calculated using the method applied by the company. Data on the standard time of operator movement on each machine in the eva sponge production process in one production process at PT.PIJ is as follows:

Table 1. Time Standard Data of Operator Motion of the Company

Machine Type	Operator Motion Type					Time Total for Operator Motion (Sec/unit)
	Reaching (sec/unit)	Holding (sec/unit)	Directing (sec/unit)	Release (sec/unit)	Carry (sec/unit)	
1. **The operator of Kneder 1**	4,78	1,5	-	1,5	11,46	19,24
2. **The operator of Roll 1**	1,4	1,5	2,82	1,5	2,23	9,45
3. **The operator of Cutting roll 1**	2,3	1,5	2,45	1,5	2,1	9,85
4. **The operator of Kneder 2**	4,87	1,5	-	1,5	7,56	15,43
5. **The operator of Roll 2**	1,4	1,5	2,82	1,5	2,23	9,45
6. **The operator of Cutting Roll 2**	2,3	1,5	2,45	1,5	2,1	9,85
7. **The operator of Press**	1	1,5	2,25	1,5	2,4	8,65
Time Total						81,92

(Data Source: PT.PIJ)

Standard Time Data Processing with Work Factor Method

Based on calculations with the Work Factor method, it can be seen that the Work Factor method obtained a total standard time of operator motion in each machine that is smaller than the method used in the company can be seen in the table below:

Table 2. Operator Motion Sandart Time Data with Work Factor Method

Machine Operator	Operator Motion Type					Time Total for Operator Motion (Sec/unit)
	Reaching (sec/unit)	Hold (sec/unit)	Directing (sec/unit)	Release (sec/unit)	Carry (sec/unit)	
1. **The operator of Kneder 1**	3,135	0,72	-	0,72	6,817	11,43
2. **The operator of Roll 1**	1,26	0,48	0,435	0,48	3,21	5,86
3. **The operator of Cutting roll 1**	0,63	0,24	0,435	0,24	1,605	3,15
4. **The operator of Kneder 2**	2,595	0,6	-	0,6	4,89	8,75
5. **The operator of Roll 2**	1,26	0,48	0,435	0,48	3,21	5,86
6. **The operator of Cutting Roll 2**	0,63	0,24	0,435	0,24	1,605	3,15
7. **The operator of Press**	0,63	0,24	0,525	0,24	1,605	3,24
Time Total (sec/unit)						41,44

(Source: Result of Data Processing)

Raw Time Data Processing with Time Measurement Methods

Based on calculations with the Methods of Time Measurement method, it can be seen that the Methods of Time Measurement method shows that the total standard time of operator movements on each machine is smaller than the method used in the company, which can be seen in the table below:

Table 3. Operator Motion Sandart Time Data with *Time Measurement Methods*

Machine Operator	Operator Motion Type					Time Total for Operator Motion (Sec/unit)
	Reaching (sec/unit)	Hold (sec/unit)	Directing (sec/unit)	Release (sec/unit)	Carry (sec/unit)	
1. **The operator of Kneder 1**	4,743	1,971	-	0,54	10,158	17,41
2. **The operator of Roll 1**	1,566	1,314	0,252	0,36	3,438	6,93
3. **The operator of Cutting roll 1**	1,566	1,314	0,252	0,36	3,438	6,93
4. **The operator of Kneder 2**	3,73	1,642	-	0,45	8,559	14,52
5. **The operator of Roll 2**	1,566	1,314	0,252	0,36	4,68	8,17
6. **The operator of Cutting Roll 2**	1,566	1,314	0,252	0,36	4,68	8,17
7. **The operator of Press**	1,566	1,314	0,252	0,45	4,374	7,87
Time Total (sec/unit)						70

(Source: Result of Data Processing)

The following is to clarify the total standard time of operator movements by using the Work Factor method and Methods Time Measurement compared to the factory standard time:

Table 4. Comparison of Factory Standard Time with WF and MTM Methods

Machine Operator	Factory Standard Time (Sec/unit)	*Work Factor Method* (sec/unit)	*Methods Time Measurement* (sec/unit)
1. The operator of Kneder 1	19,24	11,43	17,41
2. **The operator of Roll 1**	9,45	5,86	8,17
3. **The operator of Cutting roll 1**	9,85	3,15	8,17
4. **The operator of Kneder 2**	15,43	8,75	14,52
5. **The operator of Roll 2**	9,45	5,86	8,17
6. **The operator of Cutting Roll 2**	9,85	3,15	8,17
7. **The operator of Press**	8,65	3,24	7,87
Time Total (Second)	81,92	41,44	70

(Source: Result of Data Processing)

3.2 Discussion

Based on calculations with the two methods, namely the Work Factor method and Time Measurement methods, it can be seen that the Work Factor method obtained a total standard time of operator movements on each smaller machine, namely the kneder 1 for reaching (3.135 seconds), holding (0.72 seconds), release (0.72), and

transport (6.817 seconds), for roll machine 1 movement reaches (1.26 seconds), holds (0.48 seconds), directs (0.435 seconds), releases (0.48) , and transporting (3.21 seconds), 1 movement reaching a roll roll machine (0.63 seconds), holding (0.24 seconds), directing (0.435 seconds), releasing (0.24), and transporting (1.605 seconds) , kneder machine 2 for reaching (2.595 seconds), holding (0.6 seconds), releasing (0.6 seconds), and transporting (4.89 seconds), for roll 2 movement machines reaching (1.26 seconds), holding (0.48 seconds), directing (0.435 seconds), releasing (0.48 seconds), and transporting (3.21 seconds), the 2 movement cutting roll machine reaches (0.63 seconds), holds (0, 24 seconds), directing (0.435 seconds), releasing (0.24), and transporting (1.605 seconds), and for the press machine the movement reaches (0.63 seconds), holds (0.24 seconds), directs (0.525 seconds) , removing (0.24), and transporting (1.605 seconds) then the total operator movement time of the whole machine is 41.44 seconds.

As well as the Methods of Time Measurement method, the standard time of movement of the operator on each machine is obtained, namely kneder machine 1 for reaching (4.743 seconds), holding (1.971 seconds), releasing (0.54), and transporting (10.158 seconds), for roll 1 reaching (1,566 seconds), holding (1,314 seconds), directing (0,252 seconds), releasing (0,36 seconds), and transporting (3,438 seconds), 1 roll cutting machine reaching (1,566 seconds), holding (1,314 seconds), direct (0.252 seconds), release (0.36 seconds), and transport (3.438 seconds), kneder engine 2 for reaching (3.73 seconds), holding (1.642 seconds), releasing (0.45 seconds), and transporting (8.559 seconds), for roll 2 movement reaching (1.566 seconds), holding (1,314 seconds), directing (0.252 seconds), releasing (0.36 seconds), and transporting (3.438 seconds), cutting roll 2 movement reaching (1.566 seconds), holding (1.314 seconds), directing (0.252 seconds), releasing (0.36 seconds), and transporting (3.438 seconds), and for press machines s reaching range (1.566 seconds), holding (1.314 seconds), directing (0.252 seconds), releasing (0.45), and transporting (4.374 seconds) then the total operator movement time of the whole machine is 70 seconds.

With a standard time that is smaller than the factory default time, the Time Measurement Methods (MTM) and Work factor (WF) methods can provide a standard time that is following the standard time produced smaller than the real conditions in the company. So that the proposed standard time calculation method is accepted and the researcher can suggest using both methods namely Time Measurement Methods (MTM) and Work Factor methods because both of these methods are following the operator's movement of each machine and produce a smaller standard time than the factory default time. So, in this case the researchers suggest reducing operator movements that are not needed in the production process.

4. Conclusion and Recommendation

Conclusions

Based on the results of the study, it can be concluded that the two methods are by Work Factor and Time Measurement Methods have a standard time that is smaller than the factory default time, then the Work factor (WF) method can provide a standard time of movement following the standard time produced more small from real conditions in the company.

Recommendations

The suggestions that can be given by the author in this study are as follows:
1. Time Measurement Methods and Work Factor methods should be used as material for consideration in measuring the standard time of operator movements on each machine in the production process because this method can provide a smaller standard time and by the operator's movements, to minimize production completion time.
2. For the measurement of the standard time of the operator's movement on each production machine, the company should need to consider the operator's movement on the engine during the production process to determine the most effective method

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