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# WORK SAMPLING METHOD FOR ANALYSIS OF PERFORMANCE AND DETERMINING THE NUMBER OF WORKERS IN THE WAREHOUSE DEPARTMENT

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***Abstract:*** *Industrial competition demands that each company be effective and efficient, hence companies need to make optimal use of resources. The purpose of this research is to determine the productivity of the workers in completing their work and to discover how much workload is caused by the activities carried out. In addition, recommendations for improvements were also given as an effort to reduce the high rate of overtime hours and determine the appropriate number of the workforce at spare parts and raw materials division. The results showed that some workforces have an uneven workload. Meanwhile, based on the results of workload analysis, it can be seen that the workload of the warehouse feeder is classified as a high workload, which is 102%.*

***Keywords****: work sampling, workload analysis, productivity, standard time*

## 1. Pendahuluan

The intense competition in the industry requires companies to compete in producing the best products by utilizing resources optimally. The company must have the ability to increase its various production activities, in producing a product that requires time in each of its production activities. However, it is not only workers who can be measured. The measurement of working time is used to get the standard time that must be achieved by workers in completing a job. Every job has a standard time and different workload sizes depending on what job they are doing. Time is one of the main criteria in increasing production. It is very important to know the measurement of the work time required by workers to complete the work.

The workload is a worker's physical ability to accept work, from an ergonomic point of view, each workload of a job that is done must be balanced and in accordance with the workers' physical and psychological abilities [1]. The physical workload referred to, among others, is in the form of work that uses the power of workers who lift, encourage, care for psychological workloads, including workload related to the level of expertise and achievement of workers with other workers (Tarwaka et al., 2004). Unbalanced or too high workloads can result in excessive working hours so that workers need overtime to complete their work. Each company must have determined the amount of overtime provided for each job, overtime working hours that exceed 8 hours in one day. However, because the workload is too high, the work can exceed the limit of the set working hours resulting in overtime. Research on workload is carried out to see how much workload for each worker to complete his work efficiently and effectively and also how much workforce is optimal for completing work in order to reduce excess overtime hours.

The research was conducted at a company that operates in the field of animal husbandry and cow's milk processing factory in Malang City. This company produces its own livestock by developing more than 6,000 head of Friesian Holstein cattle which were founded directly from Australia and for bull cattle sperm are imported from quality cows in the United

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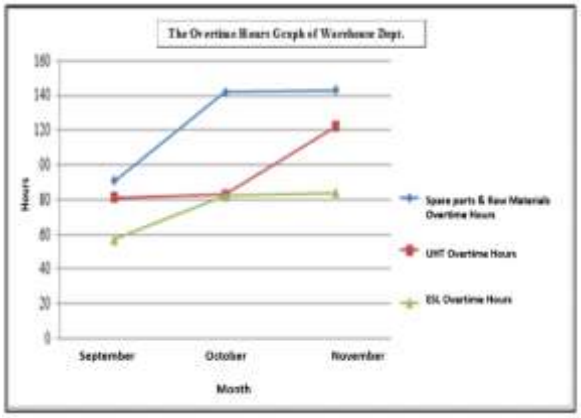
States. The result of this artificial insemination has enabled the industry to produce high-quality milk and has been exported to several countries. This proves that this industry is already competitive in the international arena. This industry produces pasteurized milk and UHT milk in several types of flavours with different packaging sizes. Apart from that the company also produces whipped cream, skim milk, yoghurt and cheese.

In carrying out the milk processing process, the company has used an integrated machine operated by a human workforce. In realizing the company's goals, such as efficiency in production, this company also needs to pay more attention to its workforce as an effort to support the company's long-term plan to make it happen. Therefore, this company must set standard time and workload for each job.

One of the divisions that have an important role to support the company's production process is the logistics or warehouse division. The warehouse is part of the company's logistics system that stores products (raw materials, parts, goods-in-process, finished goods) at and between the point of source and point of consumption, and provides information to management regarding the status, condition, and disposition of items [2].

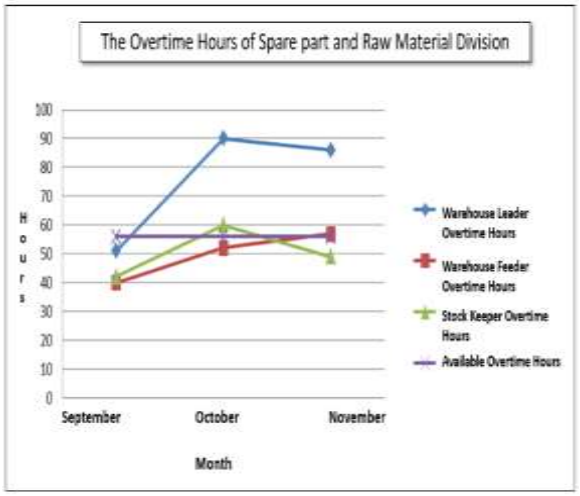
The warehouse division at this company does not yet have a standard time in its work activities, so work measurements are needed to find out the standard time for workers to complete their work and to find out whether workers have used work time optimally or the number of workers is not in accordance with what is needed. Figure 1 shows the total data of several sections in the warehouse/logistics department from September to November 2018.

The UHT section has 2 work shifts, the ESL section has 3 work shifts, while the spare part and raw material section only has 1 work shift. Among the three parts, spare parts and raw material have the highest overtime rate. This section has 1 operator and 1 warehouse leader.




**Picture 1.** Overtime Hours Warehouse Dept. Graphic

Based on the decree of Indonesia Minister of manpower and transmigration no. 120 of 2004 in article 3 states that the maximum limit of overtime hours in 1 week is 14 hours and in 1 month does not exceed 56 hours per month for one employee. Overtime hours data from the warehouse leader, stock keeper, and warehouse feeder in the spare part and raw material section is shown in Figure 2.




**Picture 2**. The Overtime Hours of Spare part and Raw Material Division

From Figure 2, it can be seen that the overtime hours for spare parts and raw materials in the logistics department are more than 56 hours per month. Therefore, this section has a high overtime rate.

Work on spare parts and raw materials is done by 1 warehouse leader, 1 stock keeper, and 1 warehouse feeder. Where based on the results of interviews with warehouse leaders and

operators, they did quite a lot of work to be handled simultaneously so that they had to work beyond predetermined working hours. Based on this, it is necessary to measure the working time. Work measurement is a measurement of work time (time study) of an activity carried out for productivity and to find out how much workload [3].

**Table 1**. Pre-Observation Results (*Pre-Work Sampling*)

| No. | Position | % Productive Time | % Non-Productive Time |
|---|---|---|---|
| 1. | *Warehouse Leader* | 74% | 26% |
| 2. | *Stock Keeper* | 75% | 25% |
| 3. | *Warehouse Feeder* | 79% | 21% |

Table 1 is pre-work sampling data conducted on warehouse leaders, stock keepers, and warehouse feeders to determine the percentage of productive and non-productive time in spare parts and raw materials. Observations of pre-work sampling were carried out 300 times at random times, where observations were made at 08.00-16.00 or normal working time. Workers are considered productive when working in accordance with the job description, while workers are said to be unproductive when carrying out activities outside of the job description. It can be seen in Table 1 that the results of the pre-work sampling show the percentage of non-productive workers is above 20%. This happens because there is idle, which should be more optimized.

The work sampling method is used to take measurements directly on the object of research. Furthermore, from the measurement with the work sampling method, the productivity of workers in completing their work will be known, and the standard time to complete a work cycle will be obtained, which is used as the standard time for completing work for all workers with the same type of work. The results of the work sampling method are then used to calculate the workload using the workload analysis (WLA) method. Workload analysis is a method used to calculate how much workload is caused by the activities carried out [4].

## 2. Method

This study uses a work sampling method to obtain workload calculations. Data processing begins with the collection of data on the percentage of productive and non-productive activities of workers while doing their job.

A total of 700 data were observed from 100 visits conducted for 7 hours a day starting from 08.00 WIB to 16.00 WIB, with breaks starting at 12.00 WIB to 13.00 WIB.

The method of data collection from this work sampling is collected according to random times, then research is carried out to observe the activities of workers in the warehouse section according to a predetermined random time.

Table 2 explains that from 700 observational data carried out at the warehouse leader, there were 543.21 productive activities outside the job description and 136 unproductive activities. Meanwhile, in the warehouse feeder, there were 572.3 productive activities outside the job description and 125 unproductive activities. For stock keepers, there were 545.10 productive activities outside the job description and 145 non-productive activities.

## 3. Results

From all observations to all operators, the amount of observation data carried out on one worker is 700 data. The total data that has been taken is 2100 data. Then, determine the number of productive percentages and productive observations.

The number of overall productive observations:

$= \frac{1660}{2100}$ x 100% = 78,7%

Percentage of productive warehouse leaders:

$= \frac{518}{700}$ x 100% = 74%

Percentage of productive stock keeper:

$= \frac{545}{700}$ x 100% = 77,9%

Percentage of productive warehouse feeder:

$= \frac{591}{700}$ x 100% = 84,4%

Next, determine the number of minutes of observation that have been made during the observation.

The number of minutes of observation:

= 7 hours' x 7 visits x 60 minutes
= 2940 minutes.

It is known that the number of outputs from the warehouse leader and stock keeper is 25 shipments and 12 loading and unloading. Meanwhile, 55 Warehouse feeders are used for loading and unloading (both from spare parts and raw materials as well as the addition of packaging).

The next step is to calculate the cycle time, normal time, and standard time:

Warehouse leader cycle times

$= \frac{2940 \times 0.74}{37} = 58{,}860$ menit

Stock keeper cycle times

$= \frac{2.940 \times 0.779}{37} = 61{,}898$ menit

Warehouse Feeder cycle times

$= \frac{2.940 \times 0.84}{55} = 44{,}902$ menit

Warehouse leader normal time

$= \frac{2940 \times 0.776 \times 1{,}00}{37} = 58{,}860$ menit

Stock keeper normal time

$= \frac{2940 \times 0.779 \times 1{,}00}{37} = 61{,}898$ menit

Warehouse feeder normal time

$= \frac{2940 \times 0.817 \times 1{,}00}{55} = 44{,}902$ menit

Calculating the standard time by entering a predetermined allowance factor.

Warehouse leader standard time

$= 58{,}860$ menit x $\frac{100\%}{100\%-21\%} = 74{,}50$ menit

Stock keeper standard time

$= 61{,}898$ menit x $\frac{100\%}{100\%-20\%} = 77{,}37$ menit

Warehouse feeder standard time

$= 44{,}902$ menit x $\frac{100\%}{100\%-21\%} = 56{,}837$ menit

After all the time calculations are known, the next step is to calculate the workload of all workers in the spare parts and raw material warehouse.

Workload = (%productive activities x *performance rating*) x (1 + *allowance*)
Warehouse leader workload = (0.776 x 1.00) x (1 + 21%) = 0.895
Stock keeper workload = (0.779 x 1.00) x (1 + 20%) = 0.935
Warehouse feeder workload = (0.844 x 1.00) x (1 + 21%) = 1.02

**Table 2**. Observation Data Results in 7 Visits

| Worker Activities | Visits Order | | | | | | | ∑ |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
| Productive *Warehouse leader* | 74 | 75 | 67 | 73 | 72 | 81 | 76 | 518 |
| Productive not-suitable with *job description* | 8 | 6 | 7 | 6 | 5 | 6 | 5 | 43 |
| Non- Productive *Warehouse leader* | 18 | 19 | 26 | 21 | 23 | 13 | 19 | 139 |
| Total | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 700 |
| Productive *Warehouse feeder* | 84 | 86 | 79 | 81 | 83 | 90 | 88 | 591 |
| Productive- not suitable with *job description* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Non-Productive *Warehouse feeder* | 16 | 14 | 2 1 | 19 | 16 | 10 | 13 | 109 |
| Total | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 700 |
| Productive *Stock keeper* | 75 | 79 | 75 | 78 | 74 | 82 | 82 | 545 |
| Productive not suitable with *job description* | 2 | 0 | 0 | 3 | 5 | 0 | 0 | 10 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Non produktif *Stock keeper* | 23 | 21 | 25 | 19 | 21 | 18 | 18 | 145 |
| Total | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 700 |

Before testing the adequacy of data and data uniformity, the percentage of productive for each worker is first calculated. Productive is the working time used by the operator when working according to the job description or not, if it is not suitable then it is considered non-productive.

**Table 3**. Warehouse Leader Average Productivity Data

| Visits Order | Warehouse Leader | | | Sum | %p |
|---|---|---|---|---|---|
| | Productive Activities | Productive not suitable with *job description* | Non-Productive Activities | | |
| 1 | 74 | 8 | 18 | 100 | 0,74 |
| 2 | 75 | 6 | 19 | 100 | 0,75 |
| 3 | 67 | 7 | 26 | 100 | 0,67 |
| 4 | 73 | 6 | 21 | 100 | 0,73 |
| 5 | 72 | 5 | 23 | 100 | 0,72 |
| 6 | 81 | 6 | 13 | 100 | 0,81 |
| 7 | 76 | 5 | 19 | 100 | 0,76 |
| Average | | | | | 0,74 |

From the observations of warehouse leader productivity in Table 3, the productivity obtained is 0.74 out of 700 observations made. This is because there are still quite a lot of non-productive activities carried out by warehouse leaders.

**Tabel 4**. Stock Keeper Average Productivity Data

| Visits Order | Stock Keeper | | | Sum | %p |
|---|---|---|---|---|---|
| | Productive Activities | Productive not suitable with *job description* | Non-Productive Activities | | |
| 1 | 75 | 2 | 23 | 100 | 0,75 |
| 2 | 79 | 0 | 21 | 100 | 0,79 |
| 3 | 75 | 0 | 25 | 100 | 0,75 |
| 4 | 78 | 3 | 19 | 100 | 0,78 |
| 5 | 74 | 5 | 21 | 100 | 0,74 |
| 6 | 82 | 0 | 18 | 100 | 0,82 |
| 7 | 82 | 0 | 18 | 100 | 0,82 |
| Average | | | | | 0,779 |

Table 4 shows that the average percentage of stock keepers is 0.779 out of 700 observations made. This is because there are still quite a lot of non-productive activities carried out by stock keepers while working.

**Table 5**. Warehouse Feeder Average Productivity Data

| Visits Order | Warehouse Feeder | | | Sum | %p |
|---|---|---|---|---|---|
| | Productive Activities | Productive not suitable with *job description* | Non-Productive Activities | | |
| 1 | 84 | 0 | 16 | 100 | 0,83 |
| 2 | 86 | 0 | 14 | 100 | 0,81 |
| 3 | 79 | 0 | 21 | 100 | 0,79 |
| 4 | 81 | 0 | 19 | 100 | 0,81 |
| 5 | 83 | 0 | 16 | 100 | 0,8 |
| 6 | 90 | 0 | 10 | 100 | 0,86 |
| 7 | 88 | 0 | 13 | 100 | 0,82 |
| Average | | | | | 0,844 |

Table 5 explains that the warehouse feeder average percentage is 0.84 out of 700 observations made. It can be seen that the productive percentage in the warehouse feeder is greater than the warehouse leader and stock keeper, but this still shows that there are still non-productive activities carried out by warehouse feeders when they are workers.

## 5. Discussion

The result of the largest percentage of productive activities was obtained by warehouse feeder 84.4% with productive activities of 591