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ANALYSIS OF WORKLOAD ON CUTTING OPERATOR USING NASA - TLX METHOD ANDWORK SAMPLING IN CV MULYA JAYA ABADI

Mad Yusuf[1], Ni Made Sudri[1]
[1]Industrial Engineering, Institut Teknologi Indonesia, South Tangerang, Indonesia, 15314

Abstract.
CV Mulya Jaya Abadi is engaged in the bag industry. In this study, the workload analysis of the cutting section is carried out to analyze the level of physical workload and mentalworkload and whether the workload needs to be improved. The method used in this study using the NASA-TLX method and sampling test. The NASA - TLX method is used to measure mental workload objectively, while the dimensions of mental workload on NASA- TLX are mental needs, physical needs, time requirements, performance, effort, and stress levels. Sampling test is a technique for conducting a large number of observations on work activities. Complaints for operators where the work is done standing up, feeling sluggish, sleepy when working not concentrating so that the operator experiences fatigue and results ina workload for the operator. Based on the results of the study using a sampling test where observations were made five working days, from the calculation of the uniformity test and the data adequacy test, the data was uniform and sufficient. The results of the average calculation that cutting operators are indicated in the category of productive workers with Gunawan percentage 88.44%, Segat 89.33%, Ariyadi 88.00%, and Parid 87.55%, the results of the physical workload for Gunawan operators get the results 128%, Segat operators 153%, Ariyadi operators 138%, and for Parid operators 136%. and for the calculation of workload using the NASA-TLX method, the most dominant aspect is the physical requirement of 26%, because of the physical activity required in the work, so that the operator experiences fatigue. For mental needs due to the operator in his work requires concentration.

Keywords: Physical Workload, Mental Workload, NASA – TLX, Sampling Test

Introduction

At work, it is often associated with feeling tired and stress which can reduce the concentration of workers when doing work so that it can cause the risk of work accidents. Everyone has a different workload. Manual work causes physical and mental workloads, therefore mental and physical workloads are needed for workers to be able to find out whetherthe work performed by workers includes a safe workload over a long period of time. CV Mulya Jaya Abadi is engaged in the bag industry, in this production section the workers consist of: cutting, preparing, sewing, qc, and packing. In this study of process workers cutting, which consists of 4 people. Problems that occur in process employees cutting. This is the amount of work that must be completed by the operator to achieve the target, complaints for operators where the work is done standing up, feeling sluggish, sleepy when working, not concentrating so that the operator experiences fatigue and results in a workload for the operator. To find out this problem, it is necessary to research the mental workload and productivity of operator workers cutting. The method in this study uses the Nasa TLX method (Task Load Index) Nasa TLX is a subjective method of measuring mental workload. This method is divided into two parts, namely the stage of scale comparison and giving value tothe work. The Nasa TLX method has the advantage that it is suitable for various types of work and each assessment factor is able to provide information about workloads. Work sampling is a technique for conducting a large number of observations of work activities. Workload measurement using work sampling used to calculate the standard time, standard production, workload and the amount of labor required. Method work sampling can be used to determine productive and non-productive activities. This study analyzes the level of physical and mental workload experienced by section operators cutting for evaluation and improvement solutions.

Literature Review

a. NASA – TLX

The NASA-TLX method (NASA*Task Load Index*) is a method used to measuremental workload subjectively based on six dimensions, namely mental needs, physical needs, time requirements, performance, effort, and frustration levels. The measurement ofthis method is divided into two stages, namely the comparison of each scale and the valueof the work. The following is the measurement of the NASA-TLX method:

- Weighting

  At this stage, respondents are asked to choose one of the two indicators that are felt to be more dominant in causing mental workload to the work done. The NASA- TLX questionnaire was given to workers in the form of pair wise comparisons and thencalculated the number of tallies for each indicator that workers felt was the most influential.
- Rating

  At the rating stage, respondents were asked to rate the six indicators of mentalload. The rating given is subjective depending on the mental burden felt by the workerrespondents. To get the NASA-TLX mental load score, the weights and ratings for each indicator are multiplied and then added and divided by 15.

- Calculating Product Value

  Calculating the value of this product is obtained by multiplying the rating by the weight factor for each descriptor. Thus, 6 product values are produced for 6 indicators, namely mental needs, physical needs, time requirements, performance, frustration levels, and effort:

  $$\text{Product} = \text{Rating X Weight factor}$$

- Count Weighted Workload (WWL)

  Obtained by adding up the six product values

  $$\text{WWL} = \sum \text{Product}$$

- Calculating the average WWL

  Obtained by dividing WWL by the total weight

  $$Score = \frac{\sum Product}{15}$$

- Score Interpretation

  The interpretation of the mean score of WWL is referring to the categories definedby Hart and Staveland (1988).

Table 1. *Score interpretation*

Load Range Work	Load Category Work
0-9	Very low
10-29	Low
30-49	Currently
50-79	Tall
80-100	Very high

b. Work Sampling

Work samplingis a technique for conducting a large number of observations of the work activities of machines, processes or operators. Measurement with this method is the same as measuring work with downtime which is classified as direct work measurement because the implementation must be directly at the workplace. Broadly speaking methodwork samplingcan be used to measuredelay ratioof a number of machines, employees. Then can set performance levelof a person during his working time based on the times when this person works or does not work, especially for manual work, this work sampling method can be used to determine the standard time for a process or workoperation.

Research Methods

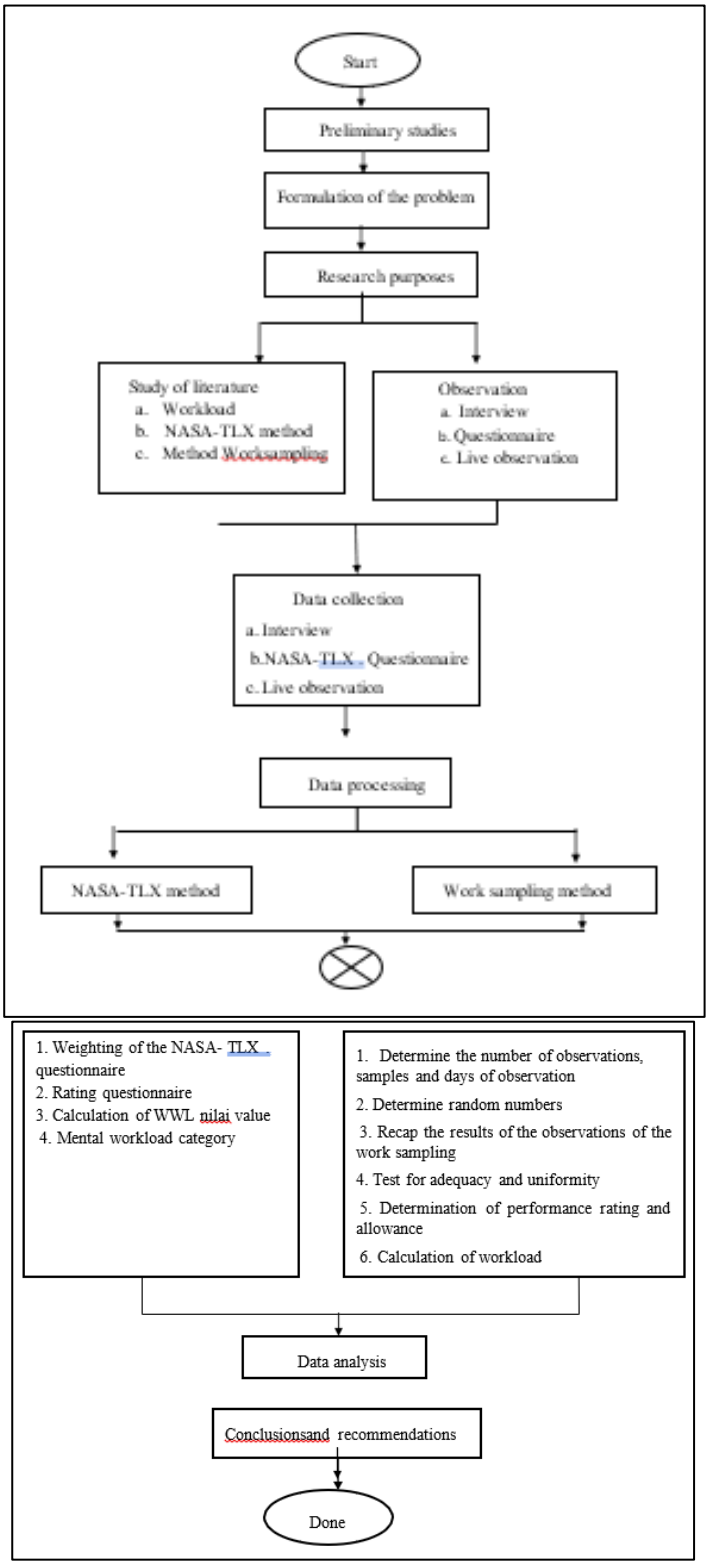

Figure 1. *Flowchart*

Result and Discussion

a. NASA-TLX method

Weighting of NASA TLX Questionnaire Results

Table 2. *Questionnaire weighting data*

Number	Name	Indicator						Total
		Mental Demand	Physical Demand	Temporal Demand	Performance	Effort	Frustration Level	
1	Gunawan	1	3	4	2	4	1	15
2	Segattulloh	3	3	4	1	2	2	15
3	Ariyadi	2	3	2	4	4	0	15
4	Parid	2	4	1	3	2	3	15

Rating

Table 3. *Rating value*

Number	Name	Indicator						Total
		Mental Demand	Physical Demand	Temporal Demand	Performance	Effort	Frustration Level	
1	Gunawan	70	70	80	90	80	70	460
2	Segattulloh	70	90	50	70	70	50	400
3	Ariyadi	60	90	70	50	70	80	420
4	Parid	70	80	70	70	60	50	400

Counting Products

Calculating the value of this product is obtained by multiplying the rating by the weightfactor for each descriptor.

Table 4. *Calculating product value*

Work Station	Name	Aspect	Weight	Rating	Rating x Weight	Total
Cutting	Gunawan	MD	1	70	70	1170
		PD	3	70	210	
		TD	4	80	320	
		OP	2	90	180	
		EF	4	80	320	
		FR	1	70	70	
Cutting	Segat	MD	3	70	210	990
		PD	3	90	270	
		TD	4	50	200	
		OP	1	70	70	
		EF	2	70	140	
		FR	2	50	100	
Cutting	Ariyadi	MD	2	60	120	1010
		PD	3	90	270	
		TD	2	70	140	
		OP	4	50	200	
		EF	4	70	280	
		FR	0	80	0	

Cutting	Parid	MD	2	70	140	1010
		PD	4	80	320	
		TD	1	70	70	
		OP	3	70	210	
		EF	2	60	120	
		FR	3	50	150	

WWL Average Score

Table 5. *Average WWL*

Number	Name	Average WWL
1	Gunawan	78
2	Segat	66
3	Ariyadi	67
4	Parid	67

Based on the table above, the mental workload category in sectioncuttingbelong to tall.

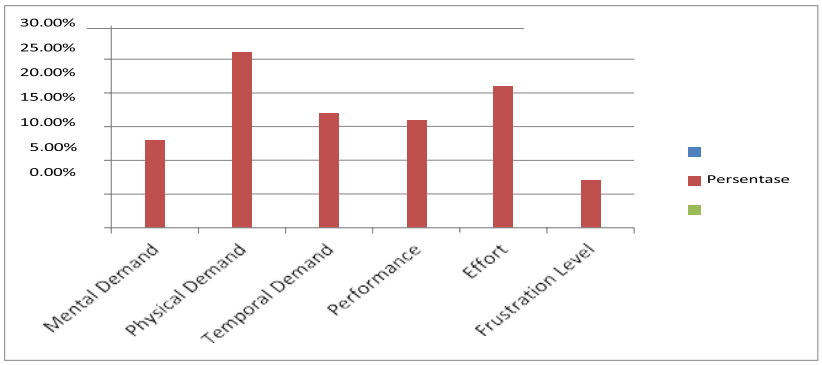

Figure 2. *Percentage graph of each indicator*

In the graphic above, the results of physical needs are 26% which states the highest physical need indicator, the high physical need is due to the many physical activities carried out by the operator from taking materials, drawing patterns, cutting patterns, and patterning bags. Then the level of effort of 21% is the effort expended mentally and physically required. Where the high physical needs and time affect in completing the work on the business so that the work is completed quickly and on time. Furthermore, this 17% time requirement is due to the time pressure that is felt when completing work activities. Indicator of the time needed to complete the target according to the working hours. Work performance of 16% where successin completing work to achieve the target. This mental need of 13% is due to the concentration of thinking at work, such as when carrying out activities of drawing patterns, cutting patterns, and patterning materials, so that mistakes do not occur when doing these activities and the lowest indicator of frustration level is 7%, that the level of frustration classified as still under control at the time of completing the work.

b. Work Sampling

Uniformity Test and Data Sufficiency Test

Perform data uniformity test to determine whether the data is uniform and does not exceed the upper control limit (BKA) and lower control limit (BKB). For the level of confidence in this study of 95% where the researcher has confidence in the measurement results of 95% and for the level of accuracy of 5%, it means that the maximum deviation allowed in this study is 5%. On test This work sampling uniformity uses the percentage value of operator productivity for 5 days. Worker Name: Gunawan.

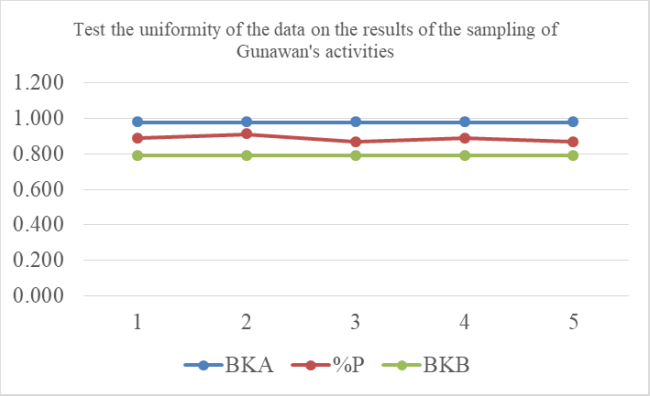

Figure 3. *Percentage value of operator productivity for 5 days worker Name: Gunawan*

Table 6. *Upper control limit (BKA) and lower control limit*

BKA	%P	BKB
0.978	0.889	0.791
0.978	0.911	0.791
0.978	0.867	0.791
0.978	0.889	0.791
0.978	0.867	0.791

After the data is uniform, then the data is tested for data adequacy, to determine the data to be used in this study. Perform data adequacy test If N' N, then the data is saidto be sufficient. Based on the calculations of the four operators that the data is declared sufficient and no additional data is needed. Calculation results N' N for operatorsGunawan 200.76 225, Segat 183.34 225, Ariyadi 209.53 225, Parid 218.40 225.

Determination of Productive Working Hours

Table 7. *Determination of productive working hours*

Nama Pekerja	Part	Productive Working Hours	Description
Gunawan	*Cutting*	141.44	Hours/Month
Segat	*Cutting*	142.88	Hours/Month
Ariyadi	*Cutting*	140.80	Hours/Month
Parid	*Cutting*	140.16	Hours/Month

Based on the calculation of the highest productive working hours in the cutting namely Segat with working hours of 142.88 hours/month, Gunawan with 141.44 hours/month, Ariyadi with 140.80 hours/ month, and Parid with 140.16 hours/month. From the results of these calculations due to the large amount of work from the process operator cutting.

Determination of the Amount of Adjustment and Allowance
Worker Name: Gunawan

Table 8. *Determination of the amount of adjustment and allowance*

Number	Work Element	Adjustment	Allowance %
1	Deploying Material	1.20	0.32

2	Drawing Pattern	1.26	0.26
3	Cutting Fabric Pattern	1.14	0.33
4	Doing Rope Cutting	1.24	0.35
5	Doing PVC Cutting	1.19	0.31
6	Doing Spunbond Cuts	1.16	0.30

Adjustment factor is a technique of adjusting the results of observations of the operator in completing the job. In this adjustment, the method used iswesting house. Westinghouseis a way of giving direction to scores or scores on 4 factors to determine fairness or unfairness in work, namely skills, effort, working conditions, and consistency factors. Allowance factors are given to activities in terms of personal needs, relieving fatigue, and unavoidable obstacles. The granting of slack intends to provide an opportunity for the operator to do the things that must be done so that the standard time obtained can be said to becomplete and representative working time data on the observed work system.

Conclusion

1. Based on the results of the calculation of subjective measurements using the NASA-TLX method The results of physical needs are 26% which states the highest physical needs indicators, the high physical needs are due to the many physical activities carried out by operators from taking materials, drawing patterns, cutting patterns, and patterning bags. Then the level of effort of 21% is the effort expended mentally and physically required. Where the high physical needs and time affect in completing the work on the business so that the work iscompleted quickly and on time. Furthermore, this 17% time requirement is due to the time pressure that is felt when completing work activities. Indicator of the time needed to completethe target according to the working hours. Work performance of 16% where success in completing work to achieve the target. This mental need of 13% is due to the concentration ofthinking at work, such as when carrying out activities of drawing patterns, cutting patterns, and patterning materials, so that mistakes do not occur when doing these activities and the lowest indicator of frustration level is 7%, that the level of frustration classified as still under control at the time of completing the work. As for the results of calculations with work sampling. The physical workload for the Gunawan operator was 128%, the Segat operator was 153%, the Ariyadi operator was 138%, and for the Parid operator 136%.
2. Suggestions for improvement that can be given are by adding a work chair in the cutting sothat operators are not tired in doing their activities and provide work instructions because work instructions are not written.

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