Workload Analysis to Optimize Productivity of The Inspection Division

Anisa Nur Maya Dwi Ratih Hilda Hidayat
Department of Industrial Engineering, Faculty of Engineering, Universitas Sebelas Maret
Surakarta, Indonesia
anisadrhh@student.uns.ac.id

Wahyudi Sutopo
University Centre of Excellence for Electrical Energy Storage Technology, Universitas Sebelas Maret, Surakarta, Indonesia
wahyudisutopo@staff.uns.ac.id

Abstract

The Inspection Division is an important part of a business in the textile and textile product (TPT) industry, including PT. XYZ Purworejo which produces gray fabric with custom woven and construction because of the make to order (MTO) system. Currently, the textile industry is one of the sectors that is prepared to become a mainstay in the application of industry 4.0 in Indonesia. The growth of an industry is certainly accompanied by increasing demand, which creates demands for workers to achieve production targets. To fulfill this, it is important for companies to pay attention to the operator's workload in order to have a maximum level of performance. The purpose of this study was to determine the workload of the Inspection Division operator at PT. XYZ and proposed improvements that can be implemented by the company to increase productivity. The results showed that the inspection division operators had an average workload of 1,216 (overload). To overcome this, additional operators, purchase of new machines, and preventive maintenance can be carried out.

Keywords
Workload Analysis, Productivity, Standard Time, Method Time Measurement, Inspection Division

1. Introduction

The growth of the textile and textile products (TPT) industry has also led to an increase in the number of employed workers, where according to the Ministry of Industry (2019), the textile and textile products industry absorbs 7.46 percent. To achieve maximum performance, it is important for companies to pay attention to the condition of their human resources. The efforts to improve employee performance include paying attention to workloads (Tjiabrata, F.R., et al 2017). Workload can be interpreted as the difference between the ability of workers and the demands of the job (Widyanti, 2010). Webster in Lysaght (1989) suggests workload as the amount of work or working time expected of workers and the total number of jobs that must be completed by a group of workers in a certain period of time.

In the era of the industrial revolution 4.0, the workers needed by business actors are skilled workers to increase productivity and competitiveness of the industrial sector. The development of the company's business and organization is very dependent on the productivity of workers in the company (Mangkunegara, 2000). According to The Organization for European Economic Cooperation (OEEC) in 1950, productivity is the quotient obtained by dividing by one of the factors of production. In this way it is possible to speak of the productivity of capital, investment, or raw materials according to whether output is being considered in relation to capital, investment or raw material, etc". In general, productivity is defined as the relationship between output with the actual input. The amount of incoming demand and high productivity demands from the company will also increase the workload received by workers.

PT. XYZ has an inspection division whose job is to inspect the fabrics produced. The company, which is located in Purworejo, only produces up to the semi-finished good stage, so that the fabric produced will be reprocessed to become a ready-to-use product. This is inseparable from the role of the workers involved in it, when workers can complete all their tasks according to the stipulated time period, it is ensured that activities in the inspection division will run clearly.

In the Inspection Division there are four subdivisions with different job descriptions. With the job description, it is expected to know the limits of duties, authorities, and responsibilities. However, in reality there are workers who do work that is not part of the job description. This will lead to the possibility of irregularities such as workload imbalances and dual work between one position and another. Planning and management of existing resources need to be done to prevent this from happening.

The purpose of this study was to determine the workload of the Inspection Division operator at PT. XYZ and proposed improvements that can be implemented by the company to increase productivity. Due to inappropriate job descriptions, lack of awareness of operators in implementing SOPs properly, inadequate machines, long cycle times, and poor layouts can cause workload imbalances. By measuring the workload, it can evaluate worker productivity and optimize performance.

2. Literature Review

According to Minister of Home Affairs Regulation No. 12/2008, workload is the amount of work that must be carried out by a position or organizational unit and is the product of the work volume and the time norm. Webster in Lysaght (1989) suggests workload as the amount of work or working time expected of workers and the total amount of work that must be completed by a department or group of workers in a certain time period. Besides, Widyanti (2010) workload can be interpreted as the difference between the ability of workers and the demands of the job. If the ability of the workforce is higher than the demands of the job, it will cause boredom. Meanwhile, if the ability of the workforce is lower than the demands of the job, it will cause fatigue. In the journal (Hoonaker, 2011) it is explained that workload is a concept needed to explain the extent to which workers have used their mental and physical work for certain tasks. Then the workload itself is influenced by the external demands of a job, the environment, organizational and psychological factors, and so on.

Workload analysis is a process to determine the number of working hours people use or need to complete a job within a certain time, or in other words workload analysis aims to determine how many personnel and how many responsibilities or proper workload is delegated to an officer (Komaruddin, 1996). Workload measurement is carried out to obtain information about the level of effectiveness and efficiency of the organization's work based on the number of jobs that must be completed within a year (Minister of Home Affairs Regulation in Muskamal, 2010). Thus, workload analysis is a process of analyzing the time used by a person or group of people in completing the tasks of a job (position) or group of positions (work units) carried out under normal circumstances. Factors that affect workload can be divided into two, external factors (outside the body) including tasks that are physical, organizational, and work environment as well as internal factors (inside the body) which are factors from within the body as a result of reactions to external workloads, such as age, body size, health and so on. Then the operational indicators used to measure the workload include targets to be achieved, working conditions, and work standards.

Productivity comes from the word productive which means all activities that give rise to utility. According to Sinungan (2003), in general, productivity is defined as the relationship between real and physical results (goods or services) and actual inputs. Productivity is also defined as the level of efficiency in producing goods or services. According to Reksohadiprojo and Sukanto (2003) in Afriani (2018), in general, productivity can be measured by calculating the ratio of output to input. Workers or operators are humans who are dynamic production factors who have the ability to think and work motivation, if the company management is able to increase their motivation, then work productivity will increase. According to Pamuji (2008), the factors that affect productivity include salary levels, experience and skills of workers, education and expertise, age of workers, procurement of goods, weather, material distance, relations between workers, managerial factors, and effectiveness.

Measurement of working time (work measurement or time study) is an attempt to determine the standard time needed to complete a job (Wignjosoebroto, 2008). Measurement of working time aims to get standard time. Generally, the measurement of working time can be divided into two parts, direct time measurement, which is carried out at the job site where the work is carried out and indirect time measurement, which is carried out without having to be at the work place. The measurement of working time begins by measuring the cycle time, which is the time obtained from observations and measurements of the time required by workers to complete a job, then determines the normal time, Normal time indicates that a well-qualified operator will work to complete the job at work speed normal (Wignjosoebroto, 2008). Meanwhile, according to Heizer and Render (2015) normal time is the average observation

time adjusted for speed, then standard time, According to Sutalaksana et al (2006) standard time is the time required by a normal worker to complete a job that is run in the best working system.

3. Methods

This research was conducted at the textile factory of PT XYZ Purworejo, where the research subject was the Inspection Division operator and the variables studied were the workload and productivity of each operator with standard time parameters as a benchmark for determining it. At the initial identification stage, field studies were carried out by conducting direct observations and interviews with the Inspection Division operators to find out the job descriptions of each subdivision and the obstacles often faced by operators, resulting in non-productive time. Furthermore, a literature study was carried out as a reference by reading previous research. Then formulated the problem to be solved and the goals to be achieved.

The next stage is data collection and processing. Sources of data used are primary data, namely data obtained directly from the object to be studied. In collecting data, observations were made, namely making visits or direct observations of objects. The next step is to determine the measurement sample using the Slovin's formula. Then calculate the standard time by first determining the performance rating and allowance of each subdivision. After that, calculate the workload and productivity of the operator. At the end of the problem identification is done with a fishbone diagram. Fishbone Diagram is an illustration used to explore potential or real causes of existing problems. The next stage is an analysis of the results of data processing obtained.

The problem discussed in this study is to analyze the workload of the Inspection Division operator at PT. XYZ and proposed improvements that can be implemented by the company to increase productivity. To overcome this problem, this research was conducted using a comparative method, namely by comparing the current operator output with the standard output set by the company. Previously, the analysis was carried out using the workload analysis method to assess the workload of the Inspection Division operator with standard time parameters using the downtime method. After that, suggestions for improvements related to existing problems will be given and conclusions will then be drawn.

4. Data Collection

Data collection in this study was carried out by recording the number of workers in the inspection division, measuring operator cycle times in each subdivision, job descriptions for each subdivision, performance rating and operator allowance, and non-productive activities of operators. In addition to these data, data were also collected in the form of operator conditions (occupational injuries/diseases), work environment, working hours and rest periods of operators, condition and number of machines, and layout of the inspection division. At this stage also produces an overview of the problems that occur in the inspection division. The following is Figure 1 of some of the problems encountered that trigger an imbalance in the workload of operators in the inspection division. Some of the data collected include data on the number of operators shown in Table 1, details of job descriptions and cycle time in Table 2, non-productive activities in Table 3.

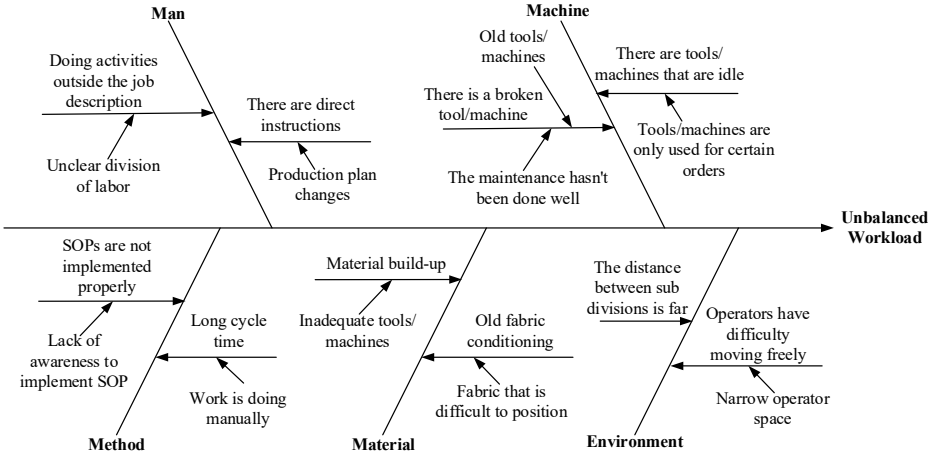

Figure 1. Fishbone Diagram on Inspection Division Problems

Table 1. Number of Operators

Operator	Number of Operators
Helper	4
Inspector (Shuttle)	32
Folding	8
Weigher	2
Total	**46**

Table 2. Details of Job Descriptions and The Cycle Time

Operator	Job description	Ws
Helper	Receive fabric from Weaving Division	25.667
	Check the identity of the fabric	17.333
	Sign the handover book	7.667
	Positioning in the rapier Inspecting machine	51.333
	Positioning on the Shuttle Inspecting table	37.667
	Moving the inspected fabric to folding	23.667
Inspector (Shuttle)	Prepare tools and work facilities	47.667
	Checking the identity of the fabric for each roll	28.500
	Record the identity of the fabric on the inspection form	44.833
	Inspecting the fabric and doing mending	1741.750
	Record all defects that occur on the inspection form	18.417
	Count the number of defective points after each roll	11.000
	Doing fabric grading (Four/Ten Point System)	6.333
	Tie the rope of the fabrics container to be moved	36.667
Folding	Loading and arranging fabrics into the folding machine	47.500
	Folding the fabric using a folding machine	203.500
	Record the length on the fabric identity form	17.500
	Record the identity and the results at the end of fabric	17.750
	Folding and tying rolls of fabric with raffia rope	37.250
	Transferring the tied fabric to the scales	6.250
Weigher	Weigh the fabric that has been folded or rolled	9.667
	Write the results of the scale on the end of fabric	5.667
	Entering fabric weighing results into the computer	45.667
	Print barcodes	83.333
	Paste the barcode on the fabric and fabric identity form	17.667

Table 3. Non-Productive Activities

Non-Productive Activities	Information	Operator Non-Productive Time (in seconds)			
		Helper	Inspector	Folding	Weigher
Personal Times	a. Go to toilet	180	300	240	180
	b. Talk to other operators	600	480	300	600
	c. Drink	300	120	180	120
Fatigue	a. A short break	720	480	300	720
	b. Stretching	480	315	300	90
Waiting	b. Waiting for tool repair	0	360	0	420
	c. Waiting queue (stack)	300	120	1200	900
	d. Waiting for leader's instructions	420	720	0	0
Non-Job Description	a. Help other operators work	840	600	300	300

5. Results and Discussion

Based on data processing, the results showed that the operator experienced excessive workload. then given alternative improvements to overcome these problems, where several alternatives include increasing the number of operators for equal distribution of workloads, investing by buying new machines/tools, and scheduling preventive maintenance. The proposed alternative solutions to the problem in detail are described in the follows.

5.1 Numerical Results

The numerical results that are processed in solving problems in the inspection division are in the form of calculating research samples, calculating standard time, calculating workload and productivity. From the data above, it can be seen that the total population is 46, so that the number of samples obtained according to the Slovin's formula (Sugiyono, 2011) is as follows:

$$n = \frac{N}{1 + N.e^2}$$

$$= \frac{46}{1 + 46.(0{,}15)^2}$$

$$= 19{,}574 \approx 20$$

From the calculation results obtained the number of samples that must be studied is 20 operators. The entire operator sample was taken on the morning shift.

Calculation of standard time is done by using downtime to find out the average cycle time of each job description for each subdivision. The following is an example of calculating normal time and standard time on the Helper with the job description "Receiving fabric from the Weaving Division":

$$Wn = Ws \times performance\ rating$$

$$= 25{,}667 \times 1{,}05$$

$$= 52{,}617 \text{ second}$$

$$Wb = Ws\ (\frac{100\%}{100\% - \%Allowance})$$

$$= 52{,}617\ (\frac{100\%}{100\% - 58\%})$$

$$= 125{,}278 \text{ second}$$

Workload is a comparison of total standard time and total effective working time, where effective working time is obtained from available time minus non-productive time. The following table 4 shows the results of calculating the workload of the inspection division operator.

Table 4. Workload of The Inspection Division Operator

No	Operator	Total Standard Time (in seconds)	Total Effective Working Time (in seconds)	Workload	Category
1	Helper	25972.063	21360	1.216	Overload
2	Inspector Shuttle	22348.961	21705	1.030	Overload
3	Folding	29158.293	22380	1.303	Overload
4	Weigher	28786.347	21870	1.316	Overload

5.2 Proposed Improvements

The proposed improvements to the Inspection Division can be increasing the number of operators for equal distribution of workloads, investing by buying new machines/tools, and scheduling preventive maintenance. Table 5 shows a comparison of the operator's workload in the current and proposed conditions.

Table 5. Comparison of The Operator's Workload

No	Operator	The Current Condition		The Proposed Conditions	
		Number of Operators	Workload	Number of Operators	Workload
1	Helper	2	1.216	3	0.811
2	Inspector Shuttle	16	1.030	18	0.915
3	Folding	4	1.303	6	0.869
4	Weigher	1	1.316	2	0.658

Based on the Decree of the Governor of Central Java Number 561/62 of 2020 and Article 77 paragraph (2) of Law No. 13 Th. 2003 can be calculated operator salary costs with the amount and workload current conditions and proposed conditions. Table 6 shows a comparison of the current and proposed conditions.

Table 6. Comparison of The Current and Proposed Conditions

Factor	The Current Condition	The Proposed Conditions
Order Processing Duration	4.9	2.2
Labor costs	Rp 10,640,363.12	Rp 6,029,986.11
Cost Difference Due to Processing Duration	Rp 4,610,377.01	
Cost Difference Due to Number of Operators	-Rp 2,858,100.00	
Savings	Rp 1,752,277.01	

Then the company can invest by buying new tools/machines. Table 7 shows a detailed calculation of the total investment required for the purchase of tools/machines for the weighing subdivision and folding subdivision. Table 8 show comparison of production quantities in current and proposed conditions. Table 9 shows the payback period of the investment to determine the rate of return on investment in a project or business.

Table 7. The Total Investment Required for The Purchase of Tools/Machines

SUBDIVISION OF WEIGHTERS						
No	**Details**	**Amount**	**Unit price**		**Cost**	
1	Computer	1	Rp	5,500,000.00	Rp	5,500,000.00
2	Printer	1	Rp	2,800,000.00	Rp	2,800,000.00
3	Installation fee	1	Rp	450,000.00	Rp	450,000.00
4	Training Fee	2	Rp	500,000.00	Rp	1,000,000.00
5	Etc	1	Rp	300,000.00	Rp	300,000.00
SUBDIVISION OF FOLDING						
No	**Details**	**Amount**	**Unit price**		**Cost**	
1	Folding Machine	1	Rp	213,834,750.00	Rp	213,834,750.00
2	Installation fee	1	Rp	17,500,000.00	Rp	17,500,000.00
3	Training Fee	4	Rp	750,000.00	Rp	3,000,000.00
4	Etc	1	Rp	2,500,000.00	Rp	2,500,000.00
TOTAL INVESTMENT					**Rp**	**246,884,750.00**

Table 8. Comparison of Production Quantities in Current and Proposed Conditions

Factor	**The Current Condition**	**The Proposed Conditions**
Total Production	846	1269
Income	Rp 5,500,000.00	Rp 8,250,000.00
Difference	Rp	2,750,000.00

Table 9. The Payback Period of The Investment

Periode (Tahun)	**Investment**	**Cost Saving**	**Cashflow kumulatif**
1	-Rp246,884,750.00	Rp 33,000,000.00	-Rp 213,884,750.00
2		Rp 33,000,000.00	-Rp 180,884,750.00
3		Rp 33,000,000.00	-Rp 147,884,750.00
4		Rp 33,000,000.00	-Rp 114,884,750.00
5		Rp 33,000,000.00	-Rp 81,884,750.00
6		Rp 33,000,000.00	-Rp 48,884,750.00
7		Rp 33,000,000.00	-Rp 15,884,750.00
8		Rp 33,000,000.00	Rp 17,115,250.00
9		Rp 33,000,000.00	Rp 50,115,250.00

Preventive maintenance can also be carried out which aims to prevent unexpected damage that can cause production facilities to experience damage during the production process. Maintenance activities include providing lubricating fluid, as well as checking or replacing components. Based on observations, it can be seen that in one day the average time wasted due to waiting for repair of tools and machines with poor or damaged conditions in the inspection subdivision is 360 seconds / week. From these results, it can be calculated monthly losses that arise with the assumption that the selling price of cloth is Rp. 6,500 / meter as follows:

$$\text{Loss} = \frac{(360 \times 4)}{3600} \times 250 \times Rp\ 6.500$$
$$= \text{Rp } 650.000 \text{ /month}$$

These losses can be reduced to eliminated by performing preventive maintenance. The suggestion given is that preventive maintenance can be carried out at least 3 times a week in the morning by 1 maintenance operator. Details of the equipment costs proposed for routine preventive maintenance of tools or machines shown in Table 10.

Table 10. The Equipment Costs

No	Equipment	Cost
1	Solder	Rp 42,500.00
2	Lubricant (oil)	Rp 39,500.00
3	Light components (ballast, starter, etc.)	Rp 126,000.00
Total Cost		**Rp 208,000.00**

6. Conclusion

Based on the results of data processing and analysis in this practical work report, it can be concluded that the level of workload on the Inspection Division showed that the operator experienced overload or excessive workload. To optimize the performance of the Inspection Division by increasing productivity, there are three proposals given, among others, by increasing the number of operators, making investments in the form of purchasing new tools or machines, and carrying out preventive maintenance. By implementing the proposed improvement, the company will experience an increase in total production and be able to complete orders faster. Meanwhile, the rate of return on the investment made will be positive in the eighth year so that the proposal is worthy of consideration.

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Biography

Anisa Nur Maya Dwi Ratih Hilda Hidayat is an undergraduate student of the Industrial Engineering Department of Universitas Sebelas Maret, Surakarta, Indonesia. She is also a part of Work System Design and Ergonomic Laboratory at Universitas Sebelas Maret. Her research interests are in work measurement and ergonomic design.

Wahyudi Sutopo is a professor in industrial engineering and coordinator for the research group of industrial engineering and techno-economy (RG-RITE) of Faculty Engineering, Universitas Sebelas Maret (UNS), Indonesia. He earned his Ph.D. in Industrial Engineering & Management from Institut Teknologi Bandung in 2011. He has done projects with the Indonesia endowment fund for education (LPDP), sustainable higher education research alliances (SHERA), MIT-Indonesia research alliance (MIRA), PT Pertamina (Persero), PT Toyota Motor Manufacturing Indonesia, and various other companies. He has published more than 130 articles indexed in Scopus, and his research interests include logistics & supply chain management, engineering economy, cost analysis & estimation, and technology commercialization. He is a member of the board of industrial engineering chapter - the institute of Indonesian engineers (BKTI-PII), Indonesian Supply Chain & Logistics Institute (ISLI), Society of Industrial Engineering, and Operations Management (IEOM), and Institute of Industrial & Systems Engineers