Jurnal Tekstil: Jurnal Keilmuan dan Aplikasi Bidang Tekstil dan Manajemen lndustri | ISSN 3024-9295 (print), 2797-9229 (online) | Vol. 9, No. 1, 2026, Hal. 31-41

Analysis of Optimal Labor Requirements Using Workload Analysis in Woven Chair Production at PT. XYZ

Hilkam Arbi Dinova[1*], Wiwin Widiasih[2]
[1,2]Industrial Engineering, University of 17 August 1945 Surabaya, Jl Semolowaru No.45 Surabaya, 60118, East Java, Indonesia
1412200173@surel.untag-sby.ac.id[1*], wiwin_w@untag-sby.ac.id[2]

Received May 29, 2026/Revised June 12, 2026/Accepted June 17, 2026/Published June 23, 2026

ABSTRACT

PT. XYZ is engaged in furniture manufacturing that produces aluminum woven chairs with a make to order (MTO) system. Changes in the number of product requests cause the distribution of workloads between work stations to become unbalanced so that the company's production targets have not been achieved optimally. This study was conducted to obtain standard work time and evaluate the level of labor workload through the application of the Work Load Analysis (WLA) method, as well as to compare alternative labor costs in the production process of the Hampton DAC type aluminum woven chair. The Stopwatch Time Study method was applied to determine the standard time for each work activity, while the Work Load Analysis (WLA) method was used to analyze the optimal labor requirements based on the level of workload that occurs in the field. Based on the results of the study, the weaving process is the activity with the largest standard time, which reaches 52.63 minutes for each product unit. Based on the WLA analysis, the optimal labor requirement is 36 workers, while the company's actual workforce is 27 workers, so additional labor is needed. The results of the cost comparison show that the use of casual daily labor is the most efficient alternative compared to overtime and the addition of permanent workers.

Keywords: *cost comparison, standard time, stopwatch time study, work load analysis, workload*

1. Introduction

The development of the manufacturing industry is driving companies to increase production process efficiency to meet consumer needs while ensuring product quality. In production activities, labor is a crucial factor influencing smooth operations and achieving production targets. Suboptimal labor management can lead to an imbalance in the workload, thus reducing production process efficiency (Widiasih & Nuha, 2019). Furthermore, the company's daily production volume tends to fluctuate because production capacity is determined by the number of incoming orders. Previous research has demonstrated the need for workload analysis to determine labor requirements that align with the work capacity at each production station (Syarifuddin et al., 2025). Facing competition, the company strives to provide optimal service and product quality to ensure customer satisfaction. The following table presents order data for the period January 2025 to December 2025.

Table 1. Production demand and fulfillment data

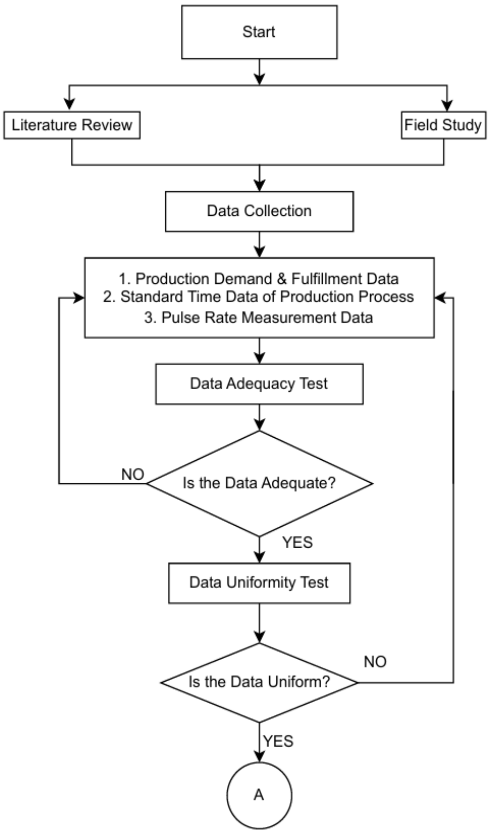
Month	Demand (pcs)	Fulfillment (pcs)	Unfulfilled (pcs)
January	390	382	8
February	370	370	0
March	405	395	10
April	395	395	0
May	385	378	7
June	365	355	10
July	400	400	0
August	420	408	12
September	360	360	0
October	415	405	10
November	410	410	0
December	480	465	15
Total	4795	4723	72

Based on data on demand and production fulfillment for woven aluminum chairs, it is known that monthly demand fluctuates and the company cannot fully meet it. This is reflected in the discrepancy between demand and production capacity in some periods.

PT. XYZ is a furniture manufacturing company specializing in woven aluminum chairs produced using a make-to-order (MTO) system. Changes in demand have resulted in uneven distribution of work across workstations, resulting in some workers experiencing high workloads while others have low utilization rates. High workload conditions can cause workers to experience fatigue and decreased work effectiveness, therefore workload analysis is needed to identify workload levels and determine appropriate improvement solutions (Widiasih & Nuha, 2018). The company currently employs 27 workers distributed across six production workstations consisting of cutting, bending, assembly, welding, sanding, and weaving processes. Previous research has shown that workload imbalances can lead to overload and underload conditions, which result in low work efficiency and increased demand for production system improvements (Al-Muqaffa et al., 2025). Furthermore, the company lacks measurable work time standards for each production activity, making it difficult to determine optimal production capacity and workforce size. This study applies the Work Load Analysis (WLA) method to evaluate workload levels and determine appropriate worker requirements for a woven aluminum chair production line. Furthermore, this study also conducts a comparative cost analysis of several labor supply alternatives, such as adding permanent employees, overtime, and using casual labor to obtain more economical and efficient alternatives for the company (Monoarfa et al., 2024).

2. Research Method

This research was conducted at PT. XYZ located on Jl. Soenandar Priyo Sudarmo, Balepanjang, Tropodo, Krian, Sidoarjo, East Java. This company is engaged in furniture manufacturing, specifically the production of Hampton DAC type aluminum wicker chairs with a make-to-order (MTO) system. This research focuses on the analysis of working time, labor workload, and labor cost comparison in the production process. Working time measurements were carried out using the Stopwatch Time Study method to obtain cycle time, normal time, and standard time. Furthermore, the Workload Analysis (WLA) method was used to analyze the workload level and determine optimal labor requirements. In addition, a cost comparison analysis was conducted between adding permanent employees and freelance workers to obtain the most efficient labor alternative for the company. Research flowchart is shown on Figure 1.



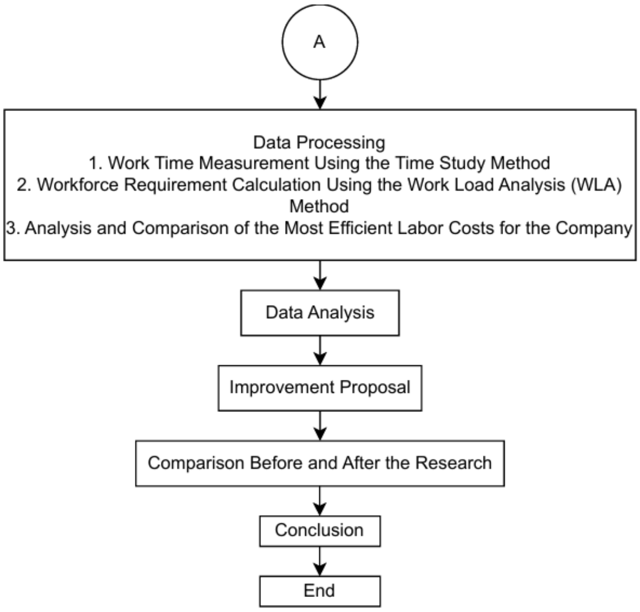


Figure 1. Research flowchart

2.1 Field Study

The field study was conducted through direct observation of production activities at PT. XYZ. This stage aims to obtain actual information regarding production flow, working conditions, processing times, and workforce activities at each workstation. Data collection was conducted through field observations and interviews with workers and the company to identify issues related to workload and workforce needs. Previous research explains that primary data collection can be conducted directly in the production area through observation and interviews to obtain actual work process data and production times (Ramadhaniyah & Satoto, 2025). Previous research states that the application of workload analysis can help companies determine the optimal number of workers so that the production process can run more effectively and efficiently (Aldiansyah & Kusnadi, 2023).

2.2 Problem Identification

The problem identification stage was carried out through direct observation of the production process at PT. XYZ. The results of the observation showed an imbalance in the workload, especially in the weaving process which has a longer processing time compared to other processes so that the production target has not been achieved optimally. In addition, the company does not yet have a measurable working time standard for each production activity. Therefore, a standard time analysis using the Stopwatch Time Study method and an analysis of labor requirements using the Work Load Analysis (WLA) method are needed to improve production effectiveness and balance the workload of workers (Rida et al., 2023). Work measurement is conducted to obtain standard times as a reference for determining workers' ability to complete a task (Reynaldi, 2024). Previous research explains that workload analysis can help companies determine optimal workforce requirements and increase production process efficiency (Suci et al., 2026).

2.3 Data Collection

Data collection was conducted through direct observation, interviews, and company documentation. The data used included production demand data, workforce numbers, and time measurements for each production activity. Based on previous research, the data collection process can be carried out through direct observation and recording of work activities using a stopwatch and observation sheets to obtain information on production process times (Reynaldi, 2024).

2.4 Stopwatch Time Study

The Stopwatch Time Study method is used to measure the completion time of production activities to obtain standard work times. Measurements are made using a stopwatch to record the completion time for each work station. This method is widely used because it is easy to implement and can provide fairly accurate measurement results in determining standard production times (Nurdiansyah & Satoto, 2023).

1. Data Uniformity Test
    a. Data is grouped into several subgroups
    b. Calculating the average (mean) value of the observation data

$$\bar{X} = \frac{\sum_{i=1}^{n} x_i}{k} \quad (1)$$

Note:
$\bar{X}$ = overall average (grand mean)
Xi = average of each subgroup
i = subgroup index (i=1,2,3,…k)
k = number of subgroups
Σ = summation symbol, indicating the total of all subgroup averages

    c. Calculate standard Deviation

$$\sigma = \frac{\sqrt{\sum_{j=1}^{i}\left(X_{ij} - \bar{X}\right)^2}}{N-1} \quad (2)$$

Note:
σ = standard deviation of the observation data
Xij = observation time of the j-th observation in the i-th subgroup
$\bar{X}$ = average observation time (mean)
j = observation index within a subgroup
i = subgroup index
N = Total preliminary observations
X = Observation time data

    d. Determine the Upper Control Limit (UCL) and Lower Control Limit (LCL) values

$$UCL = \underline{X} + k\sigma$$
$$LCL = \underline{X} - k\sigma \quad (3)$$

Note:
UCL = Upper Control Limit
LCL = Lower Control Limit
$\bar{X}$ = overall average (grand mean)
k = control limit coefficient (typically 2 or 3)
σ = standard deviation

    e. Create a control chart and plot the average value for each subgroup.

2. Data Adequacy Test

$$N' = \left[\frac{k}{s}\frac{\sqrt{N\left(\sum {X_i}^2\right) - \left(\sum X_i\right)^2}}{\sum X_i}\right]^2 \quad (4)$$

Note:
K = 98,7% confidence level, k = 3
s = 1,30% degree of accuracy
x = number of observations taken
N′ = number of observations taken late and uniform
N = number of observations to be taken

3. Performance Rating
Performance rating is the process of assessing an operator's performance level by comparing actual work performance to predetermined normal work standards. This assessment is conducted to determine whether the operator's work speed is below normal, meets standards, or exceeds normal working conditions (Dewina et al., 2026).

Table 2. Performance rating system westinghouse

Skill			Effort		
+0,15	A1	Superskill	+0,13	A1	Superskill
+0,13	A2		+0,12	A2	
+0,11	B1	Excellent	+0,10	B1	Excellent
+0,08	B2		+0,08	B2	
+0,06	C1	Good	+0,05	C1	Good
+0,03	C2		+0,02	C2	
0,00	D	Average	0,00	D	Average
-0,05	E1	Fair	-0,04	E1	Fair
-0,10	E2		-0,08	E2	
-0,16	F1	Poor	-0,12	F1	Poor
-0,22	F2		-0,17	F2	
Condition			**Consistency**		
+0,06	A	Superskill	+0,04	A	Superskill
+0,04	B	Excellent	+0,03	B	Excellent
+0,02	C	Good	+0,01	C	Good
0,00	D	Average	0,00	D	Average
-0,03	E	Fair	-0,02	E	Fair
-0,07	F	Poor	-0,04	F	Poor

The following is the equation for calculating performance ratings.

$$Performance\ Rating\ (PR)\ = 1 + rating\ factor \quad (5)$$

Note:
PR = performance rating
Rating Factor = performance adjustment factor determined based on the operator's skill, effort, working conditions, and consistency
1 = normal performance level representing 100% standard performance

4. Allowance

An allowance is additional time given to workers as a break during work activities. Allowances are necessary because workers need time off to meet personal needs or overcome certain obstacles during the work process, ensuring that their physical condition and performance are maintained (Habibah et al., 2024). The following is the equation for calculating allowances

$$Allowance\ = \frac{Personal\ allowance + Fatigue\ Allowance + Delay\ Allowance}{Effectif\ Working\ Hours\ x\ 60\ minutes}\ x\ 100\% \quad (6)$$

Note:
Allowance (%) = total allowance percentage
Personal Allowance = allowance for personal needs
Fatigue Allowance = allowance for fatigue recovery
Delay Allowance = allowance for unavoidable delays
Effective Working Hours = available effective working time
60 = conversion factor from hours to minutes

5. Normal Time

Normal time indicates the time it takes an operator to complete a job with a normal work capability. Normal time is calculated using observation time and a rating factor using the following equation:

$$Wn = Ws \times Pf$$

Note:
Wn = Normal time
Ws = Cycle time
Pf = Adjustment factor

6. Standart Time

Standard time can be determined by first finding the cycle time and normal time (Wingjosoebroto, 2008). Thus, standard time can be calculated using the following equation:

$$Wb = Wn\ x\ \frac{100\%}{100\% - \%\ allowance} \quad (8)$$

Note:
Wb = standard time
Wn = normal time
Allowance (%) = allowance factor expressed as a percentage
100% = conversion factor used in the standard time calculation

2.5 Work Load Analysis

Work Load Analysis (WLA) is a method used to evaluate workload levels to determine appropriate workforce requirements based on the workload experienced by workers. The workload analyzed includes both physical and mental workload (Arvianto & Firmansyah, 2024). The physical workload index values are shown in Table 3.

Table 3. Physical Workload Index

Index	Category
0,9 – 1	*High*
0,75 – 0,89	*Medium*
0,6 – 0,74	*Low*

In the Work Load Analysis (WLA) calculation, the data used includes working hours, production volume, effective work days, and standard time for each production activity. All of this data is used as the basis for determining optimal labor requirements based on the WLA calculation method.

$$WLA = \frac{Standard\ Time \times Demand}{Working\ days/month\ x\ working\ hours\ x\ 60\ minutes} \quad (9)$$

Note:
WLA = workload analysis
Standard Time = standard processing time per unit
Demand = required production quantity
Working Days/Month = effective working days per month
Working Hours = effective working hours per day
60 = hour-to-minute conversion factor

3. Result and Discussion

3.1 Data Collection

Process time data was obtained by measuring the working time for each production activity at six work stations with 30 observations and three observations for each process. Furthermore, the average working time was calculated for each work station, which includes the processes of cutting aluminum raw materials, bending the chair frame, assembling the frame, welding the frame, sanding the frame, and weaving the chair frame.

Table 4. Work Time Measurement Data for Raw Material Cutting Process 1

No	Cutting Process 1	No	Cutting Process 1	No	Cutting Process 1
1	22,31	11	22,62	21	22,94
2	22,44	12	22,84	22	23,13
3	22,28	13	22,71	23	22,99
4	22,53	14	22,91	24	23,17
5	22,37	15	22,79	25	23,04
6	22,61	16	22,97	26	23,22
7	22,46	17	22,86	27	23,09
8	22,69	18	23,02	28	23,27
9	22,55	19	22,89	29	23,14
10	22,77	20	23,09	30	23,33
$\sum x$			685,03		
$\bar{x}$			22,83		
$\sum x^2$			15644,76		
$(\sum x)^2$			469266,10		
σ			0,2968		

3.2 Data Uniformity Test

1. Calculating the average (mean) value of the observation data

$$\bar{X} = \frac{22{,}31 + 22{,}44 + 22{,}28 + \ldots + 23{,}33}{30} = 22{,}83 \quad (10)$$

2. Calculating Standard Deviation

$$\sigma = \sqrt{\frac{\Sigma(Xi - X)^2}{N-1}}$$
$$= \sqrt{\frac{(22{,}31-22{,}83)^2 + (22{,}44-22{,}83)^2 + (22{,}28-22{,}83)^2 + \ldots + (23{,}33-22{,}83)^2}{30-1}} = 0{,}2968 \quad (11)$$

3. Determining Upper (UCL)and Lower (LCL) Control Limits

$$UCL = \bar{x} + k\sigma = 22{,}83 + 3\,x\,0{,}296 = 23{,}72 \quad (12)$$
$$LCL = \bar{x} - k\sigma = 22{,}83 - 3\,x\,0{,}296 = 21{,}94 \quad (13)$$

4. Create a control chart and plot the average value for each subgroup.

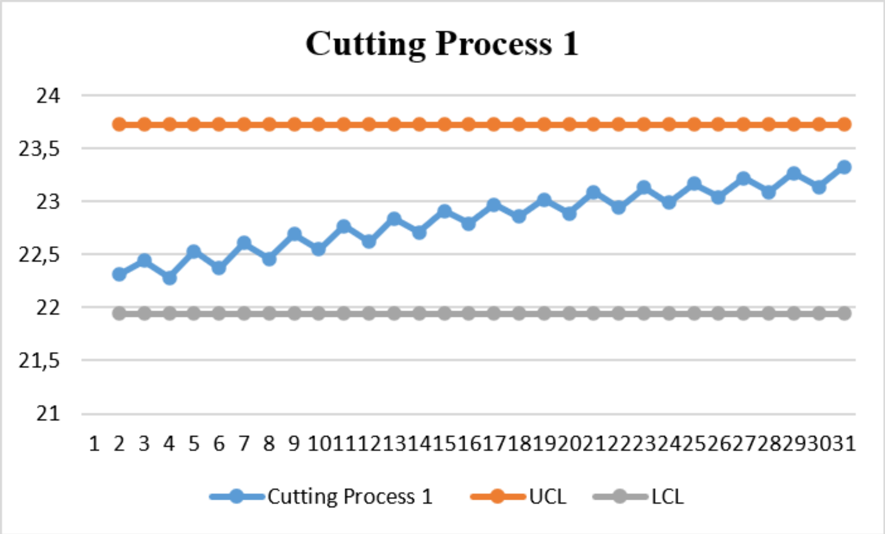


Figure 2. Cutting data uniformity test control chart 1

3.3 Data Adequacy Test

The following is the calculation of the process data adequacy test for cutting 1:

1. Calculating the level of accuracy (S)

$$s = \frac{\sigma}{\bar{x}}\,x\,100\% = \frac{0{,}2968}{22{,}83}\,x\,100\% = 1{,}30\% \quad (14)$$

2. Calculating the level of confidence

CL = 100% - S (15)

The constant value (k) is determined based on the confidence level (CL) obtained through the normal distribution calculation.

- 0% ≤ CL ≤ 68%, k value increases = 1
- 68% ≤ CL ≤ 95%, k value increases = 2
- 95% ≤ CL, k value increases = 3

CL = 100% - 1.30% = 98.7% (16)

Therefore, at a 98.7% confidence level, K = 3

3. Data Adequacy Test

$$N' = \left[\frac{\frac{k}{s}\sqrt{N\Sigma X_i^{\,2} - (\Sigma X_i)^2}}{\Sigma X_i}\right]^2 = \left[\frac{\frac{3}{1{,}30}\sqrt{30\,x\,15.644{,}76 - 469.266{,}10}}{685{,}03}\right]^2 = 0{,}00087 \quad (17)$$

Based on the calculation results above, the value of N' is 0.00087, which shows that the data for cutting Raw Material 1 is sufficient because $N' < N$ (Wignjosoebroto, 2008).

3.4 Performance Rating

Performance ratings are used to evaluate an operator's performance based on factors such as skill, work effort, working conditions, and consistency during work. One widely used method for determining performance ratings is the Westinghouse method (Suryaningrat et al., 2021). The following is the performance rating calculation for cutting process 1:

$$Performance\ Rating\ (PR) = 1 + ratting\ factor$$
$$= 1 + (0{,}06 + 0{,}05 + 0{,}02 + 0{,}01) = 1{,}14 \quad (18)$$

3.5 Allowance

After determining the performance rating, the next step is to determine the allowance value. The allowance value is determined based on direct observation of worker activities during the work process. PT XYZ implements a work duration of 7 hours or 420 minutes. The following is an example of calculating allowances for Raw Material Cutting Worker 1.

$$Allowance = \frac{10 + 9 + 12}{7\ x\ 60}\ x\ 100\% = \frac{31}{420\ menit}\ x\ 100\% = 7{,}4\% \quad (19)$$

3.6 Normal Time Calculation

Normal time is working time adjusted to the worker's performance level or work speed based on a predetermined rating. This calculation ensures that the time used in the analysis reflects working conditions that meet normal performance standards. The following is an example of calculating normal time for cutting process 1.

Raw material cutting process worker 1:

$$Wn = Ws\ x\ Pf = 22{,}83\ x\ 1{,}14 = 26{,}02\ second = 0{,}43\ minutes \quad (20)$$

3.7 Standard Time Calculation

The standard time value is obtained from normal time adjusted by adding a leeway factor (leniency), namely additional time given to meet personal needs, overcome fatigue, and prevent obstacles that may occur during the work process. The following is an example of calculating standard time for cutting process 1.

Raw material cutting process worker 1:

$$Wb = Wn\ x\ \frac{100\%}{100\% - Allowance} = 26{,}03\ x\ \frac{100\%}{100\% - 7{,}4\%} = 28{,}10\ sec = 0{,}47\ min \quad (21)$$

The table below is a summary of the calculation results from 27 workers producing woven aluminum chairs, which includes calculations of performance ratings, allowances, normal time and standard time.

Table 5. Recapitulation of the results of calculating PF, Allowance, Wn, Wb for 27 workers

No	Production Activities	Performance Rating (PF)	Allowance (%)	Normal Time (Wn) (Second)	Standard Time (Wb) (Minutes)
1	Cutting Process 1	1,14	7,4	26,03	0,47
2	Cutting Process 2	1,07	7,9	24,4	0,44
3	Bending Process 1	1,14	8,1	42,52	0,77
4	Bending Process 2	1,11	8,3	41,35	0,75
5	Bending Process 3	1,1	8,3	41,11	0,75
6	Mig Welding Process 1	1,21	8,8	411,69	7,52
7	Mig Welding Process 2	1,23	8,8	418,7	7,65
8	Tig Welding Process 1	1,23	9	631,22	11,57
9	Tig Welding Process 2	1,21	8,8	621,27	11,35
10	Sanding Process 1	1,05	8,3	812,74	14,78
11	Sanding Process 2	1,11	8,6	859,04	15,66
12	Sanding Process 3	1,03	8,8	797,27	14,57
13	Sanding Process 4	1,14	8,8	882,19	16,12
14	Sanding Process 5	1,09	9	843,92	15,46
15	Sanding Process 6	1,05	9	812,41	14,89
16	Sanding Process 7	1,11	9,3	859,22	15,79
17	Sanding Process 8	1,02	9,3	789,55	14,51
18	Sanding Process 9	1,07	9,3	828,67	15,22
19	Weaving Process 1	1,09	9	2872,55	52,64
20	Weaving Process 2	1,05	9,3	2766,9	50,84
21	Weaving Process 3	1,16	9,5	3057,04	56,31
22	Weaving Process 4	1,06	9,5	2793,2	51,45
23	Weaving Process 5	1,1	9,5	2898,73	53,4
24	Weaving Process 6	1,03	9,8	2714,39	50,13

No	Production Activities	Performance Rating (PF)	Allowance (%)	Normal Time (Wn) (Second)	Standard Time (Wb) (Minutes)
25	Weaving Process 7	1,16	9,8	3057,3	56,47
26	Weaving Process 8	1,13	10	2977,73	55,14
27	Weaving Process 9	1,02	10	2688,53	49,79

3.8 Work Load Analysis (WLA) Calculation Bsed on Standard Time

PT. XYZ implements a work system with 26 effective working days per month. Each workday lasts 8 hours with a 1-hour break, resulting in a total of 7 hours of effective working time per day.

Given:

$$\textit{Working hours per day} = 7 \textit{ hours x } 60 \textit{ minutes} = 420 \textit{ minutes} \quad (22)$$

$$\textit{Working hours per month} = 7 \textit{ hours x } 26 \textit{ days} = 182 \textit{ hours x } 60 \textit{ minutes} = 10{,}920 \textit{ minutes} \quad (23)$$

$$\textit{Highest Demand} = 2{,}080 \textit{ units} \quad (24)$$

Next, a Work Load Analysis (WLA) calculation is performed to identify the workload level of each worker at each workstation. This WLA calculation is based on standard time, production output per operator, and effective working time available during production activities. The following is the workload calculation using the Work Load Analysis (WLA) method for cutting process 1.

Raw material cutting process worker 1:

$$WLA = \frac{Standard\ Time \times Demand}{Working\ days/month\ x\ working\ hours\ x\ 60\ minutes} = \frac{0{,}47 \times 480}{10.920} = 0{,}02 \approx 1 \quad (25)$$

The following is a recapitulation of the WLA calculation results for 27 workers.

Table 6. Results of labor calculation using the WLA method

No	Production Activities	Wb (minutes/pcs)	WLA	Category	Actual workforce	WLA Calculation Labor
1	Cutting Process 1	0,47	0,02	Low	1	1
2	Cutting Process 2	0,44	0,02	Low	1	1
3	Bending Process 1	0,77	0,03	Low	1	1
4	Bending Process 2	0,75	0,03	Low	1	1
5	Bending Process 3	0,75	0,03	Low	1	1
6	Mig Welding Process 1	7,52	0,33	Low	1	1
7	Mig Welding Process 2	7,65	0,34	Low	1	1
8	Tig Welding Process 1	11,57	0,51	Low	1	1
9	Tig Welding Process 2	11,35	0,5	Low	1	1
10	Sanding Process 1	14,78	0,65	Low	1	1
11	Sanding Process 2	15,66	0,69	Low	1	1
12	Sanding Process 3	14,57	0,64	Low	1	1
13	Sanding Process 4	16,12	0,71	Low	1	1
14	Sanding Process 5	15,46	0,68	Low	1	1
15	Sanding Process 6	14,89	0,65	Low	1	1
16	Sanding Process 7	15,79	0,69	Low	1	1
17	Sanding Process 8	14,51	0,64	Low	1	1
18	Sanding Process 9	15,22	0,67	Low	1	1
19	Weaving Process 1	52,64	2,31	High	1	2
20	Weaving Process 2	50,84	2,23	High	1	2
21	Weaving Process 3	56,31	2,48	High	1	2
22	Weaving Process 4	51,45	2,26	High	1	2
23	Weaving Process 5	53,4	2,35	High	1	2
24	Weaving Process 6	50,13	2,2	High	1	2
25	Weaving Process 7	56,47	2,48	High	1	2
26	Weaving Process 8	55,14	2,42	High	1	2
27	Weaving Process 9	49,79	2,19	High	1	2
		Total			27 Workers	36 Workers

Based on the Work Load Analysis (WLA) calculation results, the actual number of workers at all work stations is currently 27 worker, while the calculation results for labor requirements show the ideal number is 36 worker. The difference in the number of workers occurs in the weaving process, where actual conditions show that each work station is only operated by 1 worker, while based on the calculation results, 2 workers are needed at each work station.

3.9 Workforce Planning Based on Cost Analysis

The company implements an 8-hour workday with 26 workdays per month. Actual labor costs are Rp5,200,000 per worker per month. The following is a calculation of labor costs under the company's actual conditions.

1. **Calculating of the cost of adding permanent workers after calculating the WLA**

   Regular Time = Rp 28,571

   Overtime = Rp 35,000/hour

   $$Regular\ Time = 27\ workers\ x\ 26\ days\ x\ 7\ hours\ x\ Rp\ 28{,}571 = Rp\ 140{,}397{,}894 \quad (26)$$

   Cost of Adding Permanent Workers :

   $$Additional\ cost = 9\ workers\ x\ 26\ days\ x\ 7\ hours\ x\ Rp\ 28{,}571 = Rp\ 46{,}799{,}298 \quad (27)$$

   $$Total\ Cost = Rp\ 140{,}397{,}894 + Rp\ 46{,}799{,}298 = Rp\ 187{,}197{,}192 \quad (28)$$

2. **Calculation of labor costs for overtime systems**

   The following is the calculation of labor costs using an overtime system for the weaving process.

   a) Overtime labor costs before calculating the WLA

      Overtime = Rp 35,000/hour

      $$Overtime = 9\ workers\ x\ 1\ day\ x\ 3\ hours\ x\ Rp\ 35{,}000 = Rp\ 945{,}000 \quad (29)$$

      $$Regular\ Time = 27\ workers\ x\ 26\ days\ x\ 7\ hours\ x\ Rp\ 28{,}571 = Rp\ 140{,}397{,}894 \quad (30)$$

      $$Total\ Cost = Rp\ 140{,}397{,}894 + Rp\ 945{,}000 = Rp\ 141{,}342{,}894 \quad (31)$$

3. **Daily Worker Cost Calculation**

   Labor cost calculation using daily workers for weaving work stations based on WLA calculation results.

   The highest number of unmet requests = 15 units (December 2025)

   Production capacity per day = 4 units

   $$Labor\ requirement\ calculation = \frac{15}{4} = 3{,}75 \approx 4\ people/day \quad (32)$$

   $$Additional\ capacity\ (4\ worker/day) = 4\ worker\ x\ 4\ units/day = 16\ units/day \quad (33)$$

   $$Production\ duration = \frac{15}{16} = 0{,}93 \approx 1\ day \quad (34)$$

   So, the additional production of 15 units can be completed in 1 day with 4 additional daily workers.

   a) Daily Labor Costs

      $$Regular\ Time = 27\ workers\ x\ 26\ days\ x\ 7\ hours\ x\ Rp\ 28{,}571 = Rp\ 140{,}397{,}894 \quad (35)$$

      $$Daily\ Labor\ Costs = 4\ workers\ x\ 1\ day\ x\ 7\ hours\ x\ Rp\ 28{,}571 = Rp\ 799{,}988 \quad (36)$$

      $$Total\ Cost = Rp\ 140{,}397{,}894\ x\ Rp\ 799{,}988 = Rp\ 141{,}197{,}882 \quad (37)$$

The results of the cost comparison of each alternative can be seen in the following table.

Table 7. Cost Comparison Results of Each Alternative

No	Alternative	Number of Workers	Work System	Total Cost		Information
1	Additional Permanent Workforce	9 worker	Additional Permanent Employees	Rp	187.197.192	Used to meet fixed production needs
2	Application of Over Time (Overtime)	9 worker	3 hours of overtime	Rp	141.342.894	Used to meet unmet targets
3	Additional Daily Casual Energy	4 worker	1 day off	Rp	141.197.882	Used when production demand increases

Based on the results of the cost comparison, the use of casual daily labor is the most efficient alternative because it has the lowest total cost, namely Rp 141,197,882, compared to adding permanent labor and the overtime system.

4. Conclusion

The results of the study indicate that the weaving process is the work station with the highest standard time, which is 56.47 minutes per unit, thus resulting in the highest workload. The Work Load Analysis (WLA) results indicate the optimal labor requirement of 36 workers, while the actual number of workers is only 27 workers, so an additional 9 workers are needed. In addition, the results of the cost comparison show that the use of casual daily workers is the most efficient alternative with a total cost of Rp141,197,882 compared to the overtime system and the addition of permanent workers. Therefore, the company is advised to optimize the number of workers in the weaving process and consider the use of casual daily workers when production demand increases.

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