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Workload Analysis to Determine Optimal Labor Need in the Production Division at UD. XYZ

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ABSTRACT
The increasingly competitive manufacturing industry requires companies to manage the production process efficiently and optimally. This research aims to analyze workload and determine the optimal workforce needs at UD. XYZ, a wheeldop manufacturing company located in Sidoarjo, East Java. The main problem faced by the company is the repeated failure to achieve the 98% production target during the period from July 2025 to March 2026, with the realization only reaching 91%-95%. Data were collected through stopwatch time studies involving 20 worker across six worlstatoions. The observed time were proceses to determine cycle time, normal time using the Westinghouse Rating Factor method, and standard time by incorporating allowances. Furthermore, Workload Analysis (WLA) was applied to evaluate workforce adequacy based on actual workloads. The results indicate that the rolling workstation is overloaded, with a WLA value exceeding 1.0, while the other workstations fall within the normal to underloaded categories. To address this imbalance, two alternatives were evaluated: adding permanent workers and implementing an overtime system. Cost analysis revealed that the overtime system is more economical, with a monthly cost difference of IDR 9,360,000. The main contribution of this study lies in integrating workload assessment with a comparative cost analysis to identify a practical workforce adjustment strategy for wheel trim manufacturing. These findings provide an evidence-based recommendation for addressing workload imbalances, improving workforce utilization, and supporting the achievement of production targets.

INTRODUCTION

The increasingly intense competition in the manufacturing industry on a global scale encourages every company to manage all resources efficiently, including human resources as a component that determines production capacity and quality. The development of the manufacturing industry is getting more advanced, companies must be able to compete and compete in a healthy manner [1]. The imbalance between the actual workload and the amount of labor available is one of the most common sources of inefficiency found on the production floor, but it is often undetected because it is not systematically measured. Workload is a situation in which many or few tasks given to employees affect employee performance [2]. The level of labor productivity plays an important role in the sustainability of the company [3]. This condition has the potential to

cause bottlenecks at certain workstations, reduce overall productivity, and ultimately result in the failure to achieve the production targets that have been set by the company. UD. XYZ is a wheeldop automotive component manufacturing company located in Sidoarjo, East Java. The company's production process consists of 6 workstations with a workforce of 20 people. The company set a production target of 98% of production capacity, but during the period from July 2025 to March 2026 production realization was still below the specified target. The company's production target data and realization can be seen in Table 1.

Table 1. Production and Target

Month	Target (pcs)	Production (pcs)	Differences	Remarks
July - 2025	20700	19300	1400	Not reached
Ags - 2025	21000	19820	1180	Not reached
Sep-2025.	20700	19560	1140	Not reached
Oct - 2025	21000	19300	1700	Not reached
Nov - 2025.	20700	19820	880	Not reached
Dec - 2025.	21000	19560	1440	Not reached
Jan - 2026	20700	19300	1400	Not reached
Feb - 2026	21000	19820	1180	Not reached
Mart - 2026	20700	19560	1140	Not reached

Based on Table 1, the non-achievement of the production target lasted repeatedly for 9 consecutive months without any signs of recovery. This pattern indicates a systemic problem in the production process, not just a temporary disruption. Initial observations in the field identified the Rolling Station as a critical point that was suspected of experiencing overload, thus acting as a bottleneck that hindered the smooth flow of production as a whole. However, without standardized measurements, these allegations cannot be confirmed and used as a basis for appropriate managerial decision-making. To identify and address these problems scientifically, accurate measurement of working time and systematic workload analysis are needed. This work time measurement aims to get the standard time that workers must achieve in completing a job [4]. *Time Study is a way to determine the standard time whose observation is directly carried out in that place and the main tool is the stopwatch* [5]. This calculation is carried out gradually and repeatedly in order to get optimal time results. Optimization [6]. Employee performance optimization is also based on the standard time of workers in completing 1-unit sp1arepart, after which calculating optimal labor requirements in order to achieve production targets based directly on the capacity of each division. From the results of this time measurement, it can be known that the performance of a person [7]. In its application, normal time is obtained through adjustments using Rating Factors. Activities to assess or evaluate the operator's work speed are called performance ratings. By doing this rating, it is hoped that the measured working time can be normalized again [8]. From the normal time calculation, it will be followed by the standard time calculation. Standard time is the amount of time it takes for a worker with average ability to complete a job [9]. Furthermore, the Workload Analysis (WLA) method is used to evaluate the suitability of the number of workers to the actual workload at each workstation. The Workload Analysis method itself is a method used to describe the workload needed in a company unit, so as to provide information on how Human Resources (HR) can be appropriately allocated to complete the existing work [8]. This method is a process to calculate the workload of a specific function in the

company. From this calculation, it can then be determined how many ideal employee needs [10].

Various previous studies have examined the application of Stopwatch Time Study and WLA in the context of manufacturing workforce optimization. Finding that the mismatch between the number of workers and the actual workload causes significant idle time at some workstations, while other stations experience overload.similar industries shows that the implementation of WLA is able to comprehensively identify the labor needs at critical stations so that production targets can be achieved. Meanwhile, studies comparing solutions between the addition of permanent workers and the overtime system are still very limited, and most only produce qualitative recommendations without quantitative cost comparisons. There are three research gaps that are the main motivation for this study. First, empirical studies on the wheeldop automotive component industry are still very limited. Second, previous research generally did not include quantitative cost comparisons between alternative workforce management solutions, even though a concrete financial basis is needed for effective managerial decision-making. Third, there have not been many studies that explicitly integrate the Westinghouse Rating Factor method in the context of the automotive component industry in Indonesia, although this method is recognized to have a higher level of objectivity than other adjustment methods. To change the working time, an adjustment is made to the working time, where multiplying the average observation by the adjustment factor "P" [6].

Based on the description above, this study aims to: (1) measure cycle time, normal time, and standard time at work stations at UD. XYZ uses the Stopwatch Time Study method with Westinghouse Rating Factor adjustments; (2) analyze the workload level at each workstation using the Workload Analysis (WLA) method; and (3) determine the most efficient and economical solution between the addition of permanent workers and the implementation of an overtime system to increase the achievement of the company's production targets. The novelty of this research lies in the integration of the three methods in an empirical study on the wheeldop industry that has not been widely researched, accompanied by a comparison of quantitative costs between alternative solutions that produce data-based recommendations.

MATERIALS AND METHODS

The field study carried out is an observation or observation that is carried out deliberately, systematically, regarding employee activities to be recorded. This technique is done to find out the amount of labor in the actual situation. In its implementation, data collection is divided into 2, namely primary and secondary data. Primary data is data obtained from companies which are divided into 2 observations, namely, productive activities and unproductive activities [11]. Meanwhile, secondary data is data that contains information from theories used to support research such as documents and company records, including job descriptions and actualities as well as other data needed in research[11]. The following is an illustration of the procedure or research flow.

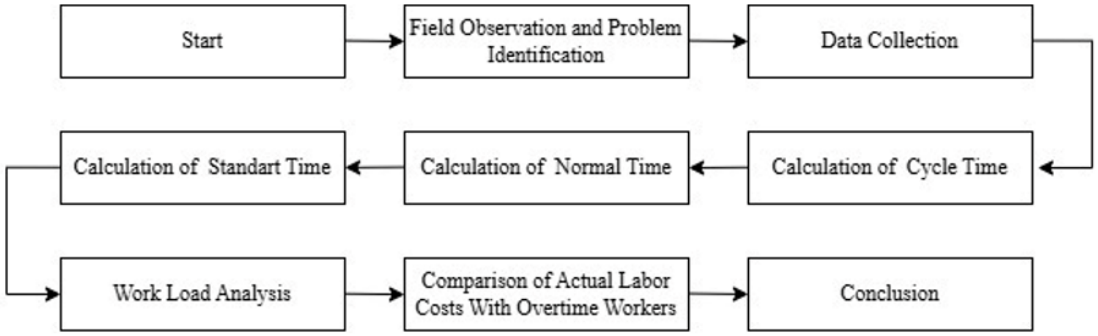

Figure 1. Research Flowchart

The study begins with a field observation at UD. XYZ to identify the problem, namely production realization that remained below the target. Data are then collected through direct stopwatch measurement of the operators' working time. The data are used to calculate the cycle time, which is adjusted with the performance rating to obtain the normal time. The allowance is then added to obtain the standard time. The standard time is used in the workload analysis to determine whether each workstation is overloaded, normal, or underloaded. Next, the actual labor cost is compared with the overtime cost to find the more economical solution. The study ends with a conclusion.

After all the data needed to perform the calculation is obtained, then data analysis related to the calculation can be carried out, following the steps:

1. Uptime data collection using stopwacth
   Data collection was carried out by measuring workers' working time when carrying out production activities for 20 times using a mobile phone stopwatch.
2. Data Sufficiency Test
   The data adequacy test is carried out to find out whether the data that has been taken is sufficient or not. A data is said to be sufficient if N'≤ N, but if it is N'>N, then the data is not enough. In work measurement activities, a confidence level of 95% and an accuracy level of 5% are usually used. To find the data adequacy test, the following formula is used:

$$N' = \left[\frac{\frac{k}{s}\sqrt{(N\sum(xi^2) - \sum(xi)^2)}}{\sum xi}\right]^2 \qquad (1)$$

   Description :
   Xi = Total observation value
   N = The number of observations made
   K = *Convendence Level*
   N' = Number of observations to be made
   s = Confidence level

3. Data Uniformity Test
   Data uniformity tests are carried out to ensure that the data obtained is uniform whether the data is within the control limit or outside the control limit with the control map. This test aims to ensure that the observed data obtained are in uniform conditions and that there is no data that deviates significantly from other data groups. To carry out the data uniformity test carried out is:
   a. Measurement with *a Stopwatch.*

b. Calculate averages to calculate data obtained in the field.

$$\bar{x} = \frac{\sum xi}{N} \quad (2)$$

c. Calculating the actual time Standard Deviation.

$$\sigma = \sqrt{\frac{\sum(X-\mu)^2}{N}} \quad (3)$$

d. Calculating the Upper Control Limit and the Lower Control Limit.

$$BKA = \bar{x} + k\sigma \quad (4)$$
$$BKB = \bar{x} + k\sigma$$

4. Standard Time
   a. Cycle Time
      Cycle time is a method to determine working time in measuring working time. Average cycle time is the length of time it takes to complete a single work cycle.

$$Ws = \frac{\sum xi}{N} \quad (5)$$

      Remarks:
      Ws = Cycle time
      N =The number of observations made
      $\sum xi$ =Number of observation values

5. Performance Rating

This assessment aims to adjust the actual cycle time to normal working conditions so that a representative normal time is obtained. There are four criteria to assess operator performance, namely: Skill, Effort, Condition, Consistency[12].

Table 2. Rating Performance

SKILL			EFFORT		
Class	**Code**	**Value**	**Class**	**Code**	**Value**
Super skill	A1	+0.15	*Excessive effort*	A1	+0.13
	A2	+0.13		A2	+0.12
Excellent	B1	+0.11	*Excellent*	B1	+0.10
	B2	+0.08		B2	+0.08
Good	C1	+0.06	*Good*	C1	+0.05
	C2	+0.03		C2	+0.02
Average / Fair	D	0.00	*Average / Fair*	D	0.00
	E1	-0.05		E1	-0.04
Poor	E2	-0.10	*Poor*	E2	-0.08
	F1	-0.16		F1	-0.12
	F2	-0.22		F2	-0.17
CONDITION			**CONSISTENCY**		
Class	**Code**	**Value**	**Class**	**Code**	**Value**
Ideal	A	+0.06	*Perfect*	A	+0.04
Excellent	B	+0.04	*Excellent*	B	+0.03
Good	C	+0.02	*Good*	C	+0.01
Average	D	0.00	*Average*	D	0.00
Fair	E	-0.03	*Fair*	E	-0.02
Poor	F	-0.07	*Poor*	F	-0.04

$$p = Rating\ normal\ operator + rating\ performance$$
$$p = 1 + rating\ performance$$

b. Normal Time

Normal time is the amount of time required under normal working circumstances and speed required by an operator to complete his work with average skill and skill [1]. Generally, normal time is set in minutes.

$$Wn = Ws \times (1 + Rating\ Factor) \quad (6)$$

$$Wn = Ws \times p \quad (7)$$

Remarks :

Wn = Normal time

Ws = Cycle time

P = Adjustment factors

c. Allowance

As is the case in the stop watch time study, here must also be estimated in advance the rating factor of the measured workforce and the existing allowance[13]. Allowance is obtained from observing the behavior of each worker regarding the time of relaxation of personal needs (Personal Allowance), relaxation to release fatigue (Fatigue Allowance), and relaxation of work paused due to something based on the available

information to find out the average allowance as a material for calculating time and output standards[14].

Allowance = $\left(\frac{Total\ Allowance\ Time}{Available\ Working\ Hours} \times 100\%\right)$

d. Standard Time

Standard time is the time used to complete a cycle of work performed according to a particular working method at a normal speed taking into account performance ratings and allowances.

$$Wb = Wn \text{ x } (1 + Allowance) \quad (8)$$

$$Wb = Wn + 1 \quad (9)$$

Keterangan:

Wb = Standard Time

Wn = Normal time

∫ = Allowance

6. Optimal Workload and Labor Count Using WLA

The WorkLoad Analysis method is used to determine the need for the number of workers based on the workload at a given time[15]. The formula used is as follows:

$$\text{Workload} = \frac{\text{Number of products x processing time}}{\text{Business day x working hours}}$$

RESULTS AND DISCUSSIONS

Results

This study comprehensively examines the efficiency of the production system by applying the technique of measuring working time directly to 20 operators at six workstations in the UD production division. XYZ. Given the functional interconnectedness between stations and the uniformity of their operational characteristics, the data obtained from each operator is then combined to produce a representative uptime metric for the entire production line. This merger process is carried out through the consolidation of a number of main parameters, including cycle time, normal time, standard time, and actual workload, which then becomes the basis for the implementation of Workload Analysis (WLA) as well as determining the optimal number of workers.

The results obtained in this study do not only reflect the performance conditions of each operator individually, but also present a comprehensive picture of the level of effectiveness and operational efficiency of the overall production line.

1. Stopwatch Time study.

Table 3. Working Time Measurement

No	Workstation	Workforce	Quantity (Seconds)	Average (Seconds)
1	Cutting	1	602	30,1
2		2	597	29,85
3	Print (Hidrolis)	1	1015	50,75
4		2	1013	50,65

5		3	1020	51
6	Cut the Edges	1	743	37,15
7		2	748	37,4
8		3	744	37,2
9	Rolling	1	1499	74,95
10		2	1510	75,5
11		3	1507	75,35
12	Variasi	1	901	45,05
13		2	900	45
14		3	900	45
15		4	900	45
16		5	901	45,05
17		6	900	45
18		7	899	44,95
19	Inspeksi	1	1079	53,95
20		2	1079	53,95

2. Data Sufficiency Test

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

$$N' = \left[\frac{\frac{2}{0,05}\sqrt{1276}}{602}\right]^2$$

N'= 5,63

The results of the recapitulation of the data adequacy test of all workers are presented in the Table

Table 4. Data Sufficiency Test Recapitulation

No	Workstation	Workforce	Quantity (Seconds)	Average (Seconds)	N	N'
1	Cutting	1	602	30,1	20	5,63
2		2	597	29,85	20	3,64
3	Print (Hidrolis)	1	1015	50,75	20	0,99
4		2	1013	50,65	20	1,05
5		3	1020	51	20	0,92
6	Cut the Edges	1	743	37,15	20	2,8
7		2	748	37,4	20	2,5
8		3	744	37,2	20	2,7
9	Rolling	1	1499	74,95	20	2,5
10		2	1510	75,5	20	2,3
11		3	1507	75,35	20	2,4
12	Variasi	1	901	45,05	20	1,8
13		2	900	45	20	1,7
14		3	900	45	20	1,7
15		4	900	45	20	1,7

16		5	901	45,05	20	1,8
17		6	900	45	20	1,7
18		7	899	44,95	20	1,9
19	Inspeksi	1	1079	53,95	20	2,1
20		2	1079	53,95	20	2

Based on Table 3, all workers at the six workstations have an N' value less than N = 20, so that all observation data is declared sufficient and can be used in the next stage of calculation.

3. Data Uniformity Test

BKA = $\bar{x}$ + k × STDEV

= 602 + 2 × 1,21

= 32,5

BKB = $\bar{x}$ - k × STDEV

=602 - 2 × 1,21 = 27,7

The results of the recapitulation of the calculation are presented in the following table.

Table 5. Recapitulation of Data Uniformity Tests

No	Workstation	Workforce	Quantity (Seconds)	Average (Seconds)	STDEV	BKA	BKB
1	Cutting	1	602	30,1	1,21	32,5	27,7
2		2	597	29,85	1,31	32,5	27,2
3	Cetak (Hidrolis)	1	1015	50,75	1,37	53,5	48,0
4		2	1013	50,65	1,18	53,0	48,3
5		3	1020	51	1,08	53,2	48,8
6	Cut the Edges	1	743	37,15	0,75	38,6	35,7
7		2	748	37,4	1,10	39,6	35,2
8		3	744	37,2	0,79	38,8	35,7
9	Rolling	1	1499	74,95	1,43	77,8	72,1
10		2	1510	75,5	1,00	77,5	73,5
11		3	1507	75,35	0,99	77,3	73,4
12	Variasi	1	901	45,05	0,83	46,7	43,4
13		2	900	45	0,73	46,5	43,5
14		3	900	45	0,73	46,5	43,5
15		4	900	45	0,73	46,5	43,5
16		5	901	45,05	0,76	46,6	43,5
17		6	900	45	0,73	46,5	43,5
18		7	899	44,95	0,76	46,5	43,4
19	Inspeksi	1	1079	53,95	0,83	55,6	52,3
20		2	1079	53,95	0,76	55,5	52,4

Based on Table, all observation time data on each worker at all workstations is between the BKA and BKB values respectively, so there is no *out-of-control* data. Thus, all data are declared uniform and valid for use in the calculation of normal time and standard time.

4. Cycle Time

Table 6. Cycle Time

No	Workstation	Workforce	Quantity (Seconds)	Cycle Time (sec)
1	Cutting	1	602	30,1
2		2	597	29,85
3	Cetak (Hidrolis)	1	1015	50,75
4		2	1013	50,65
5		3	1020	51
6	Cut the Edges	1	743	37,15
7		2	748	37,4
8		3	745	37,25
9	Rolling	1	1499	74,95
10		2	1510	75,5
11		3	1507	75,35
12	Variasi	1	901	45,05
13		2	900	45
14		3	900	45
15		4	900	45
16		5	901	45,05
17		6	900	45
18		7	899	44,95
19	Inspeksi	1	1079	53,95
20		2	1079	53,95

5. Performance Rating

Table 7. Performance Rating

Stasiun	Pekerja	Skill	Effort	Condition	Consistency	Total	Performance Rating
Pemotongan	P1	0,03	0,07	-0,01	0,01	0,1	1,1
	P2	0,02	0,07	-0,01	0,01	0,09	1,09
Cetak (Hidrolis)	P1	0,03	0,05	0	0,01	0,09	1,09
	P2	0,03	0,05	0	0,01	0,09	1,09
	P3	0,04	0,04	-0,01	0,01	0,08	1,08
Potong Pinggir	P1	0,03	0,04	0	0,01	0,08	1,08
	P2	0,04	0,04	0	0,01	0,09	1,09
	P3	0,03	0,03	0	0,01	0,07	1,07
Rolling	P1	0,04	0,04	-0,01	0,01	0,08	1,08
	P2	0,05	0,03	-0,01	0,01	0,08	1,08
	P3	0,04	0,04	-0,01	0,01	0,08	1,08
Variasi	P1	0,03	0,03	0	0,01	0,07	1,07
	P2	0,03	0,02	0	0,01	0,06	1,06
	P3	0,03	0,03	0	0,01	0,07	1,07
	P4	0,02	0,02	0	0,01	0,05	1,05
	P5	0,03	0,03	0	0,01	0,07	1,07
	P6	0,02	0,02	0	0,01	0,05	1,05
	P7	0,03	0,03	0	0,01	0,07	1,07
Inspeksi	P1	0,05	0,06	0	0,01	0,12	1,12
	P2	0,05	0,05	0	0,01	0,11	1,11

6. Normal Time

$Wn = Ws$ x p

Wn = 30,1 x 1,1

Wn = 33,11

Table 8. Normal Time Calculation

No	Workstation	Workforce	Performance Rating	Normal Time (sec)
1	Cutting	P1	1,1	33,11
2		P2	1,09	32,54
3	Cetak (Hidrolis)	P1	1,09	55,32
4		P2	1,09	55,21
5		P3	1,08	55,08
6	Cut the Edges	P1	1,08	40,12
7		P2	1,09	40,77
8		P3	1,07	39,86
9	Rolling	P1	1,08	80,95
10		P2	1,08	81,54
11		P3	1,08	81,38
12	Variasi	P1	1,07	48,20
13		P2	1,06	47,70
14		P3	1,07	48,15
15		P4	1,05	47,25
16		P5	1,07	48,20

17		P6	1,05	47,25
18		P7	1,07	48,10
19	Inspeksi	P1	1,12	60,42
20		P2	1,11	59,88

7. Allowance

Allowance = $\left(\frac{Total\ Allowance\ Time}{Available\ Working\ Hours} \times 100\%\right)$

Table 9. Allowance

No	Work Station	Allowance (minute)			Allowance			Total
		Fatigue	Personal	Delay	Fatigue	Personal	Delay	
1	Cutting	40	20	15	6%	4%	3%	14%
2	Print(Hidrolis)	38	20	20	8%	4%	4%	16%
3	Cut the Edges	42	20	20	9%	4%	4%	17%
4	Rolling	50	20	20	11%	4%	4%	19%
5	Variasi	30	20	15	6%	4%	3%	14%
6	Inspeksi	45	20	10	9%	4%	2%	16%

8. Standard Time

Wb = *Wn* x (1+ *Allowance*)

Wb = 33,11 x (1+ 11%)

Wb = 36,90 detik

Table 10. Standard Time Calculation

No	Workstation	Workforce	Performance Rating	Normal Time (sec)	Standard Time (Sec)
1	Cutting	P1	1,1	33,11	36,90
2		P2	1,09	32,54	36,40
3	Cetak (Hidrolis)	P1	1,09	55,32	63,73
4		P2	1,09	55,21	63,83
5		P3	1,08	55,08	63,46
6	Cut the Edges	P1	1,08	40,12	46,56
7		P2	1,09	40,77	47,14
8		P3	1,07	39,86	46,17
9	Rolling	P1	1,08	80,95	95,28
10		P2	1,08	81,54	96,49
11		P3	1,08	81,38	95,96
12	Variasi	P1	1,07	48,20	54,23
13		P2	1,06	47,70	53,36
14		P3	1,07	48,15	53,97
15		P4	1,05	47,25	52,86
16		P5	1,07	48,20	54,03
17		P6	1,05	47,25	53,06
18		P7	1,07	48,10	54,31

19	Inspeksi	P1	1,12	60,42	69,24
20		P2	1,11	59,88	68,62

9. Workload Analysis (WLA)

Workload analysis is performed using *the Workload Analysis* (WLA) method based on a comparison between the total work time required and the available effective working time. Effective working time is set at 28,800 seconds per day (8 hours × 3,600 seconds), or the equivalent of 480 minutes. The monthly effective working time used as a divisor in the WLA calculation is 26 working days × 480 minutes = 12,480 minutes. The WLA assessment criteria used: < value 0.8 is categorized as *underloaded*; 0.8–1.0 is categorized as normal; and > 1.0 is categorized as *overload*. Workload calculation using WLA, can be calculated with the following formula:

$$\text{Workload} = \frac{\text{quantity of products x processing time}}{\text{working days x working hours}}$$

$$= \frac{12.000 \text{ x } 0{,}62}{12480}$$

$$= 0{,}59 = 1$$

The recapitulation of the results of the WLA calculation of all workers is presented in the following Table

Table 11. WLA Calculation

No	Workstation	Workforce	WLA	Category	Actual Number of Employees	WLA Recommendations
1	Cutting	P1	0,59	Low	1	1
2		P2	0,58	Low	1	1
3	Cetak (Hidrolis)	P1	0,68	Low	1	1
4		P2	0,68	Low	1	1
5		P3	0,68	Low	1	1
6	Cut the Edges	P1	0,81	Normal	1	1
7		P2	0,82	Normal	1	1
8		P3	0,80	Normal	1	1
9	Rolling	P1	1,02	High	1	2
10		P2	1,03	High	1	2
11		P3	1,03	High	1	2
12	Variasi	P1	0,25	Low	1	1
13		P2	0,25	Low	1	1
14		P3	0,25	Low	1	1
15		P4	0,25	Low	1	1
16		P5	0,25	Low	1	1
17		P6	0,25	low	1	1
18		P7	0,25	Low	1	1
19	Inspeksi	P1	0,18	Low	1	1
20		P2	0,18	Low	1	1

10. Cost Analysis

UD. XYZ has 20 workers spread across six different divisions. The analysis was carried out to find out the more efficient costs of adding workers or overtime costs.

Cost of Workers Per Day = Rp. 120.000

Monthly Worker Fees = Rp. 3.120.000 x 20 = Rp.62.400.000

a) Calculation of worker additions according to Workload Analysis (WLA) In the WLA calculation, there was an additional workforce of 3 people at the rolling station. UD. XYZ will cost Rp. 3,120,000 x 3 = Rp. 9,360,000 per month
b) Calculation of overtime costs
   The calculation of soft costs in the rolling division consisting of 3 members with 4 hours of work per day and a salary of Rp. 20,000 is as follows:
   Overtime = 3 TK x 26 days x 4 hours x Rp. 20.000
   = Rp. 6.240.000

Wages for overtime workers are less than wages for additional workers at rolling stations.

Discussions

The results of the study showed that among the six workstations analyzed, the Rolling Station was the only station experiencing overload, with WLA values of 1.02, 1.03, and 1.03 for its three workers, respectively. This confirms preliminary field observations identifying the station as a potential bottleneck. During the nine-month observation period, production realization remained below the company's 98% target, reaching only approximately 91%–95%. Although workload imbalance cannot be established as the sole cause of this shortfall, the findings identify the Rolling Station as a priority for improvement.

The overload at the Rolling Station is consistent with earlier applications of WLA in manufacturing, where the method was used to show that headcount and actual workload are often poorly matched. All used workload analysis to determine labor requirements, and in each case the result showed workstations whose staffing did not match their load.The uneven pattern found here, with one overloaded station and several underloaded ones, follows the same logic.The present study differs in that it uses Westinghouse rating on each operator and then goes one step further. The workload result is used to compare two ways of closing the gap, hiring permanent workers or paying overtime, in rupiah. The studies cited above stop at the recommended headcount. This cost comparison is what turns the WLA result into a decision, and it is the main addition of this study to practical workforce planning.

Conversely, the Cutting, Hydraulic Press, Variation, and Inspection Stations exhibited relatively low workloads, with the Variation Station recording a WLA value of approximately 0.25. The Edge Cutting Station was relatively balanced, with WLA values of 0.80–0.82. These results indicate that the workforce problem involves uneven workload distribution rather than simply insufficient staffing. Scientifically, this study demonstrates the value of integrating standardized time measurement with WLA to identify both overloaded and underutilized workstations.

The cost comparison shows that overtime for three Rolling Station workers costs IDR 6,240,000 per month, compared with IDR 9,360,000 for recruiting additional workers. Overtime therefore saves IDR 3,120,000 monthly, or approximately 33.3% of recruitment costs, making it the more economical short-term alternative under the study's cost assumptions. Nevertheless, long-term implementation should consider worker fatigue and applicable labor regulations.

The main scientific contribution of this study is the integration of Stopwatch Time Study, the Westinghouse Rating Factor method, WLA, and quantitative cost comparison into a single workforce-management framework for wheeldop manufacturing. This approach connects workload measurement with economically informed decision-making. Practically, the findings provide a basis for prioritizing critical workstations, improving workforce utilization, and selecting cost-effective interventions to support production target achievement.

CONCLUSION

This study analyzes the performance of working time and labor needs in the UD production division. The research was conducted in the production division of UD. XYZ successfully maps the actual workload conditions and determines the most suitable number of workers through the Stopwatch Time Study and Workload Analysis approaches. Direct measurements of 20 operators at six workstations produced standard time data which then became a reference in calculating the load level of each station. From this process, it was found that the rolling station consistently bears loads beyond its normal capacity, and this is the root of the repeated failure to achieve production targets.

Based on cost calculations, the implementation of overtime is considered much more efficient than adding new employees with a savings difference of around Rp.3,12,000 per month. Thus, overtime is the main recommendation as a short-term solution that is practical and does not burden the cost structure. But going forward, management also needs to consider a comprehensive rearrangement of workforce distribution, considering that a number of stations are still operating well below their optimal capacity. This step is important to ensure that efficiency is not confined to a single point, but is instead distributed evenly across the entire production line.

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