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Employee Workload Analysis Using the Full-Time Equivalent Approach at PT Pupuk Sriwidjaja Palembang

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Abstract

This study aims to calculate and analyze workload at PT Pupuk Sriwidjaja Palembang, specifically within the Field Technical Inspection Group II of the Technical Inspection department. The research was conducted by determining the appropriate number of workers based on their work output and effective working hours. The study was motivated by the observation that there is often idle time and a high frequency of off-site activities among employees in the technical inspection section. The Full-Time Equivalent (FTE) method was used to analyze the workload distribution and employee productivity. Based on the 2019 data, effective working hours were calculated to be 5.6 hours per day, with a total of 238 working days in the year. The results show that employee productivity is generally high. However, three employees were found to be overloaded, with FTE index values of 1.281, 1.327, and 1.302, indicating excessive workload. Meanwhile, eight employees had normal FTE index values ranging from 1.054 to 1.255. The findings can be used to improve workload distribution and staffing decisions within the department.

Keywords : effective working hours; employee productivity; full-time equivalent; technical inspection department; workload analysis

INTRODUCTION

Workload analysis is a method for calculating workloads so that the number of workers needed to complete the workload can be calculated. The unit used to calculate the need for labor or people to complete a job is called the Full-Time Equivalent (FTE) (Kurniawan *et al*., 2022; Mazitah *et al*., 2023; Maryani et al., 2025; Kanya *et al*., 2023). Previous research using the Full-Time Equivalent method was carried out in Norway regarding changes in nurses' work schedules related to the COVID-19 pandemic and its relationship with sleep and turnover intentions, resulting in the conclusion that poor sleep quality influences changes in work schedules related to the pandemic, then poor working days. Length influences higher switching intentions (Djupedal *et al*., 2022; Blytt *et al*., 2022). Sari et al. analyzed workload using the FTE method to identify the optimal number of workers in the spare parts production line at PT X. The results showed an imbalance in workload among operators, with some experiencing overload while others were underloaded (Sari *et al*., 2022). Asyari *et al*. conducted a study comparing the W-FTE method, conventional FTE, and NASA TLX in analyzing mental workload in a steel manufacturing company. The findings indicated that the W-FTE method provided a more accurate picture of workload distribution compared to conventional FTE (Asyari *et al*., 2024). Apriadi then used the FTE method to analyze the workload of the legal settlement unit and its supporting unit at PT Telkom Indonesia (Persero) Tbk. The results showed that several units were overloaded, indicating the need for additional personnel to achieve workload balance (Apriadi, 2022).

The case study was conducted at the Technical Inspection Group II Inspection Department of PT Pupuk Sriwidjaja Palembang, so that it can be used as a reference and consideration in the policy of determining the number of employees during future recruitment. The authors observe that the employees of the Technical Inspection Department (inspectors) often spend time and many activities outside of their own workstations to help inspectors and other work units at their workstations. By looking at these problems, some inspectors become very busy at certain times such as on unscheduled shutdowns and on other evaluation or monitoring work, so it is feared that fatigue will occur and there will be more burdens due to unavoidable overtime. Calculating and analyzing workload per year is the aim of this research. Measuring and analyzing the workload of employees in the Field

Engineering Inspection. Evaluating workers based on workload analysis and calculating effective working hours using the Full-Time Equivalent approach.

METHODS

The Full-Time Equivalent (FTE) method is a widely utilized approach for assessing workload and determining optimal workforce requirements across various sectors. This method standardizes work hours to a common denominator, facilitating comparisons and ensuring balanced workload distribution.

Sari *et al* conducted a study at PT X, an automotive spare parts manufacturer, employing the FTE method to identify optimal staffing levels. Their findings revealed imbalances in workload distribution among operators, with some experiencing overload and others underloading. The study recommended adding two operators to achieve a balanced workforce (Sari *et al*., 2022). Similarly, Mazitah *et al* applied the FTE method in the production division of PT Indonesian Ship Industry (Persero) Makassar. Their analysis indicated that certain employees were overloaded, suggesting the need for additional personnel to optimize performance (Mazitah *et al*., 2023). In the logistics sector, Wicaksono and Fadlillah utilized the FTE method to analyze the workload of logistics administrative employees at PT X in Jakarta. The study found discrepancies in workload distribution, with some employees overloaded and others underloaded, highlighting the necessity for workload balancing (Wicaksono *et al*., 2022). Maryani *et al* employed the FTE method to assess the workload of financial service employees at PT XYZ. The results indicated that a significant portion of employees experienced overload, underscoring the importance of workload optimization in service industries (Maryani *et al*., 2025). Apriadi applied the FTE method to analyze the workload of the legal settlement unit and its supporting units at PT Telkom Indonesia (Persero) Tbk. The study identified several units with excessive workloads, recommending the addition of personnel to achieve workload balance. Taufan *et al* conducted a study at PT Mada Wikri Tunggal, employing the FTE method to determine the optimal number of employees required post-pandemic. Their findings emphasized the need for adequate staffing to Taufamaintain productivity levels. Wahyuni *et al* developed a Java-based application to facilitate FTE calculations, aiming to streamline workforce planning processes in manufacturing settings. The application assists in determining the number of employees needed based on workload assessments (Wahyuni *et al*., 2021).

Ramadhan and Hernadewita utilized the FTE method in conjunction with the Rating Scale Mental Effort (RSME) method to analyze workload in the packaging department of a pharmaceutical company. Their study highlighted areas with excessive workload, suggesting the need for staffing adjustments (Ramadhan *et al*., 2025). Hafizah and Azwir compared the FTE method with the NASA Task Load Index (NASA-TLX) to assess workload in a certification division. The study found that both methods identified overload conditions, supporting their applicability in workload analysis (Hafizah *et al*., 2022).

The object of research is the workload which is measured by determining the time of each activity element derived from the description of the tasks performed by employees (Azizy *et al*., 2024; Agungdiningrat *et al*., 2024). This study determines how long employees carry out the duties of each work element and determines the frequency of work in the last one year (Kanya, 2023; Sari *et al*., 2022). A total of 11 employees in the Technical Inspection Group were the samples used in this research.

Table 1. Research object workstation

No	Workstation name	Number of people
1	ITL II senior engineer	1
2	P-III engineer inspection engineer	3
3	P-IV engineer inspection engineer	3
4	Engineer inspection engineer NPK-1, NPK-2, NPK-3 & P-II utilities	2
5	STG coal & jetty technical inspection engineer	2
Amount		11

Table 1 explains that 11 employees were the objects of the study, details at station (1) there was 1 employee, at station (2) there were 3 employees, at station (3) there were three employees, at station (4) there were two employees, and at station (5) there were two employees.

Data Collection Method

Data collection is done in the following way:

1. Literature Study: namely reading from several literatures such as journals, books, internet, and thesis with relevant titles (Mukherjee, 2025; Ralph *et al*., 2022; Bolanos *et al*., 2024; Torre-Lopez *et al*., 2023; Sundaram *et al*., 2023; Basuki, 2021).
2. Observation: done by looking at the state of the company and paying attention to employees doing work (Nesterak *et al*., 2025; Permatasari *et al*., 2021; Korkeakunnas *et al*., 2025; Jayashankar *et al*., 2024).

3. Interview: conducted to employees and unit leaders to ensure the suitability of the job descriptions that are revealed to be elements of activities (Oldani *et al*., 2023; Sabrina *et al*., 2024).

Data Analysis Method

Data calculation is carried out after data collection, in the following way:

1. Calculating cycle time: time required to make one unit of product at workstation (Wobowo *et al*., 2024; Saputra *et al*., 2021). Or in a sense, the total productive time on each product produced.

$$Cycle\ time = \frac{\sum Xi}{N} \quad (1)$$

Where,
Xi : the observed number of completion times
N : number of observations made

2. Calculating normal time: determination of normal time is influenced by the magnitude of the rating factor and working time of each employee (Sari *et al*., 2022; Wobowo *et al*., 2024; Saputra *et al*., 2021).

$$Normal\ time = cycle\ time\ x\ rating\ factor \quad (2)$$

3. Standard time: the time it takes humans to complete a job completely Wobowo *et al*., 2024; Saputra *et al*., 2021).

$$Standard\ time = normal\ time\ x \frac{100}{(100 - allowance)} \quad (3)$$

4. Determination of FTE: calculation of workload through FTE is carried out after calculating the presentation of workload and determining the optimal number of workers from each workstation and each employee. The data is used to draw conclusions or recommendations to policymakers in the company. The calculation of FTE here is through an approach based on the number of work unit activities, activity frequency, and time for each activity (Mazitah *et al*., 2023; Maryani *et al*., 2025; Asyari *et al*., 2024; Taufan *et al*., 2023; Setiowati *et al*., 2023; Kartini *et al*., 2024; Triansyah *et al*., 2024; Gunawan *et al*., 2023).

$$FTE = \frac{total\ standard\ time\ total}{total\ effective\ working\ hours} \quad (4)$$

5. FTE Index: three categories of FTE index values, namely underload, normal, and overload (Asyari *et al*., 2024; Kartini *et al*., 2024; Triansyah *et al*., 2024; Gunawan *et al*., 2023).
   a. Underload = FTE index value between 0 – 0.99
   b. Normal = FTE index value between 1 – 1.28
   c. Overload = FTE index value greater than 1.28

RESULT AND DISCUSSION

Calculation of Working Time

The calculation of working time in 2019 after deducting national holidays and collective leave is 246 days. More details can be seen in Table 2 as follows:

Table 2. Working time

Working time		
No	Month	Working time (days)
1	January	22
2	February	19
3	March	20
4	April	19
5	May	21
6	June	15
7	July	23
8	August	22
9	September	21
10	October	23
11	November	21

Working time		
No	Month	Working time (days)
12	December	20
Total		246

Then it was reduced by 4 days of collective leave which cut the quota of 12 days of employee annual leave, so that it became 238 days. The total working days are obtained from the total of working days multiplied by the hours worked per day, which is 238 x 8 = 1904 hours a year.

Determining the Size of the Rating Factor and Allowance

Determination of normal time is influenced by the rating factor and working time of each employee. Barnes in 1980 determined the rating factor value using the Westinghouse System method (Kiraz *et al*., 2021). The rating factor is obtained from direct interviews with superiors at PT Pupuk Sriwidjaja Palembang.

Table 3. Rating factor calculation

	Rating factor				
	Skill	Effort	Condition	Consistency	Total
Engineer 1	0,13	0,12	0,05	0,04	0,35
Engineer 2	0,11	0,10	0,04	0,03	0,28
Engineer 3	0,10	0,09	0,03	0,02	0,24
Engineer 4	0,11	0,10	0,04	0,03	0,28
Engineer 5	0,10	0,09	0,03	0,02	0,24
Engineer 6	0,10	0,10	0,04	0,03	0,27
Engineer 7	0,09	0,12	0,03	0,02	0,26
Engineer 8	0,10	0,12	0,03	0,03	0,28
Engineer 9	0,10	0,12	0,04	0,03	0,29
Engineer 10	0,11	0,12	0,03	0,02	0,28
Engineer 11	0,10	0,12	0,02	0,03	0,27

Table 3 shows the factor ratings and working hours of 11 employees. The magnitude of the factor rating was obtained through direct interviews with superiors of PT Pupuk Sriwidjaja Palembang. As for determining factor rating values, the Westinghouse System method was used by Barnes in 1980 (Kiraz *et al*., 2021).

Table 4. Employee allowance value

Factor	**Category**	**Percentage (%)**
Energy expended	Can be ignored	3
Work attitude	Sit down, standing on two feet	1
Eye fatigue	Almost continuous view	3
Working temperature conditions	Normal	5
Atmospheric state	Enough	5
Allowance for personal gain	Reasonable	3
Total		20

Table 5. Calculation of cycle time per workstation

Workstation	∑ Xi	N	WS
ITL II	14400	15	960 minutes
P-III	30700	26	1180,769 minutes
P-IV	30700	26	1180,769 minutes
NPK	24600	20	1230 minutes
STG	25000	20	1250 minutes

Table 5 shows the results of calculating cycle time per workstation. Where the highest cycle time is at the STG workstation of 1250 minutes, and the lowest cycle time is at the ITL II station of 960 minutes.

Table 6. Normal Time Calculation

	Cycle Time	Rating Factor	Normal Time	Standard Time
Engineer 1	3080	0,35	1332,8	1666
Engineer 2	4683,718	0,28	1311,441	1639,301

	Cycle Time	Rating Factor	Normal Time	Standard Time
Engineer 3	4683,718	0,24	1124,092	1405,115
Engineer 4	4683,718	0,28	1311,441	1639,301
Engineer 5	4683,718	0,24	1124,092	1405,115
Engineer 6	4683,718	0,27	1264,604	1580,755
Engineer 7	4683,718	0,26	1217,767	1522,208
Engineer 8	4879	0,28	1366,12	1707,65
Engineer 9	4879	0,29	1414,91	1768,637
Engineer 10	4958,333	0,28	1388,333	1735,417
Engineer 11	4958,333	0,27	1338,75	1673,437

Table 6 is the result of calculating normal time and standard time for 11 employees.

Table 7. Calculation of effective working hours

Calculation	**Amount**	**Unit**
2019 weekdays	238	days
Working hours	47,6	hours/week
Formal working hours	40	hours/week
Working hours a year	1904	hours/week
Allowance factor	30	%
Average effectiveness factor	70	%
Effective working hours	1332,8	hours/year
	5,6	hours/day

According to Ministerial Decree KEP/75/M.PAN/7/2004, the total effective working hours is obtained from the working hours a year minus the allowances set by the government such as personal matters, praying, eating, going to the toilet, resting, etc. Table 7 shows that the total effective working hours are 5.6 hours per day. This calculation is in accordance with the Decree of the Minister of Manpower of the Republic of Indonesia Number 128 of 2016, where the total effective working hours are obtained from a year's working hours minus the allowance factor to obtain 1332.8 hours/year. Meanwhile, working hours per year are obtained from the number of working days divided by 5 weeks, then multiplied by the formal working hours per week.

Table 8. FTE calculation

	Standard Time	FTE value	Category
Engineer 1	1666	1,25	Normal
Engineer 2	1639,301	1,229	Normal
Engineer 3	1405,115	1,054	Normal
Engineer 4	1639,301	1,229	Normal
Engineer 5	1405,115	1,054	Normal
Engineer 6	1580,755	1,186	Normal
Engineer 7	1522,208	1,142	Normal
Engineer 8	1707,65	1,281	Overload
Engineer 9	1768,637	1,327	Overload
Engineer 10	1735,417	1,302	Overload
Engineer 11	1673,437	1,255	Normal

Table 8 shows that there are there employees who have an overloaded workload, namely employees 8, 9 and 10. Then eight other employees have a workload in the normal category. From these results, the company should be able to rebalance the workload of its employees, and pay more attention to employees 8, 9, and 10.

CONCLUSION

Based on research conducted at the Group II Inspection Engineering Field of PT Pupuk Sriwidjaja Palembang, it can be concluded that effective working hours are 5.6 hours/day, with a total of 238 working days in 2019. With no employees having an FTE underload index, it can be stated that employee productivity is high. Three employees who are overloaded, namely with FTE index values of 1.281, 1.327 and 1.302. Then there were eight employees with normal FTE index values, namely 1.25, 1.229, 1.054, 1.229, 1.054, 1.186, 1.142 and 1.255.

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