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Workload Analysis of Subdivision Utility Engineering 2 Technicians at PT Konimex Using Full-Time Equivalent

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Abstrak

Perkembangan teknologi yang pesat memberikan dampak signifikan pada berbagai aspek kehidupan, termasuk produktivitas perusahaan. Produktivitas perusahaan sangat erat kaitannya dengan sumber daya manusia. Salah satu aspek penting dari sumber daya manusia dalam mendukung peningkatan produktivitas adalah beban kerja yang diterima karyawan. PT Konimex merupakan perusahaan yang berencana menerapkan strategi baru untuk menghadapi globalisasi Industri 4.0 yang memerlukan evaluasi terhadap sumber daya manusia. Penelitian ini bertujuan untuk menganalisis beban kerja teknisi di sub-departemen Utility Engineering 2 PT Konimex menggunakan metode Full Time Equivalent (FTE) serta memberikan rekomendasi perbaikan untuk mengoptimalkan beban kerja. Metode FTE digunakan untuk menghitung jumlah waktu yang dibutuhkan pekerja dalam menyelesaikan aktivitas pada periode tertentu. diperlukan data aktivitas dan penggunaan waktu karyawan. Oleh karena itu, pengumpulan data dilakukan dengan megumpulkan catatan historis perusahaan serta wawancara dengan teknisi. Setelah perhitungan dilakukan, analisis dilanjutkan menggunakan fishbone diagram untuk mengidentifikasi permasalahan dan alternatif solusi. Hasil penelitian menunjukkan adanya variasi nilai FTE di antara teknisi. Petugas Teknisi A, Teknisi Level 1 A, dan Teknisi Level 1 B berada pada kondisi overload; Petugas Teknisi B, Teknisi Level 4 B, serta Kepala Teknisi berada pada kondisi underload; sementara Teknisi Level 1 C dan Teknisi Level 4 A berada pada kondisi normal. Rekomendasi perbaikan meliputi penjadwalan kerja pemeliharaan preventif (preventive maintenance), optimalisasi lembur hanya pada situasi kritis, kepatuhan terhadap prosedur distribusi kerja sesuai SOP, pengembangan template input laporan kerja, serta evaluasi kegiatan pemeliharaan preventif.

Kata kunci: *beban kerja, evaluasi sumber daya manusia, full time equivalent, produktivitas, teknisi*

Abstract

Rapid technological advancement significantly impacts various aspects of life, including company productivity. Company productivity is closely related to human resources. A crucial aspect of human resources in enhancing company productivity is the workload received by employees. PT Konimex is a company planning to implement a new corporate strategy to face Industry 4.0 globalization, which requires evaluating human resources. This study aims to analyze the workload of technicians in the Utility Engineering 2 sub-department at PT Konimex using the Full Time Equivalent (FTE) method and to provide improvement recommendations to optimize workload. Full-time Time Equivalent (FTE) is used to calculate the amount of time required by workers to complete activities within a specific period. To calculate FTE, employee activity and time usage data are required. Therefore, data collection is conducted by compiling the company's historical records and conducting interviews with technicians. After performing calculations, a fishbone diagram is used to analyze the problem and identify alternative solutions. The results show significant variations in FTE values among technicians. Technician Officer A, Technician Level 1 A, and Technician Level 1 B are in an overload condition, Technician Officer B, Technician Level 4 B, and the Head Technician are underloaded. At the same time, Technician Level 1 C and Technician Level 4 A have a normal workload. Improvement recommendations include scheduling preventive maintenance work, optimizing overtime only for critical situations, adhering to work distribution procedures according to SOPs, developing work report input templates, and evaluating preventive maintenance activities.

Keywords*: full-time equivalent, human resource evaluation, productivity, technician, workload*

1. Introduction

The rapid development of technology has a significant impact on various aspects of life. Technological advancements encourage every individual to utilize every innovation that has been developed. (Danuri, 2019). One of the uses of technology is to support company productivity. Company productivity is closely related to human resource planning, which involves job descriptions and specifications. Human resource planning is a series of systematic activities aimed at allocating the human resources required by an organization using specific methods to ensure an efficient allocation of the company's owned resources. Human resource planning can influence company productivity through aspects such as employee age, education, work experience, and skills. This planning is divided into two:

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qualitative, which includes training and workforce development, and quantitative, which refers to the estimation of the number of employees based on workload (Yusnindar & Darmawan, 2021).

PT Konimex is transitioning to a new strategy to face the globalization of Industry 4.0. One of the measures to implement this strategy is evaluating various aspects, including human resources. Technicians are divided based on buildings and their functions, which are Production Engineering and Utility Engineering. The buildings at PT Konimex are divided into three based on the products they produce: the pharmaceutical building (producing chemical products), the Sobisco building (producing snacks), and the Natpro building (producing natural products). The function of the technicians is to ensure that machines and utility systems are always in a proper condition. This study discusses the workload of technicians in the Utility Engineering Subdivision 2, a subdivision in the Natpro building.

Workload was chosen as the subject of this study because, during the observation of company data, it was found that the working hours of each technician in Utility Engineering 2 vary significantly. Workload has a significant impact on employee performance, so if this condition continues, employee performance may decline, which will indirectly affect company productivity (Sugiharjo & Aldata, 2018).

Various methods can be used to evaluate workload, but since the observed issue relates to working hours, the workload evaluation method is based on time calculation. Several methods can be used to evaluate workload using a time-based calculation. The first method is the Full Time Equivalent (FTE) method. Full Time Equivalent (FTE) is a method used to complete various tasks and compare them to the available effective working hours. Full Time Equivalent (FTE) is a workload analysis method based on time measurement, where the duration of task completion will be converted into an FTE index. This method is used to evaluate various tasks by comparing them to the available effective working time (Sukirman et al., 2021).

The second method is workload analysis. Workload analysis is a process for determining the number of working hours required to complete a workload within a certain time frame (Ahmad et al., 2023). The number of working hours needed will then be used to determine the number of employees required.

The third method is work sampling. Work sampling is a method used to measure employee activities by calculating both working and non-working hours within the available working time and presenting them as a percentage (Maretno & Haryono, 2015)

The FTE method was chosen for its simplicity in calculation and because the data used is sourced from historical company records and interviews. Since data collection is based on the company's historical records and not collected directly in the field, workload analysis and work sampling methods are less applicable. Several previous studies have conducted the Full Time Equivalent (FTE) method for research and proposed recommendations regarding human resource allocation.

First, research conducted by Wijaya et al. (2024) on workforce determination using FTE in Company X had a result with a recommendation to reallocate workers into various fields to reduce excessive workload.

Second, a study by Setiowati et al. (2023) on determining physical workload and the ideal number of workers at Arsy Bakery, using the FTE method, reached a similar conclusion to the first research. The researcher suggested an addition in worker allocation due to FTE results indicating an overload.

Third, research by Kurniawan et al. (2022) on physical workload optimization at PT Telkom Indonesia recommended reallocating workers by distributing tasks more evenly for overloaded fields.

Despite these findings, none of the mentioned research has utilized analytical tools such as fishbone diagrams or root cause analysis to identify problems and propose solutions from different perspectives other than workforce allocation. Therefore, the present study will include a fishbone diagram as an analytical tool to identify the problems and develop recommendations based on the identified problems, ensuring a more optimal balance between workload overload and underload. This study aims to analyze the workload level of technicians in Utility Engineering 2 at PT Konimex and provide recommendations for improvement to optimize the workload, enhancing employee performance. By using the Full Time Equivalent (FTE) method, this study is expected to optimize human resources at PT Konimex, particularly the Utility Engineering 2 technicians.

2. Research Methods

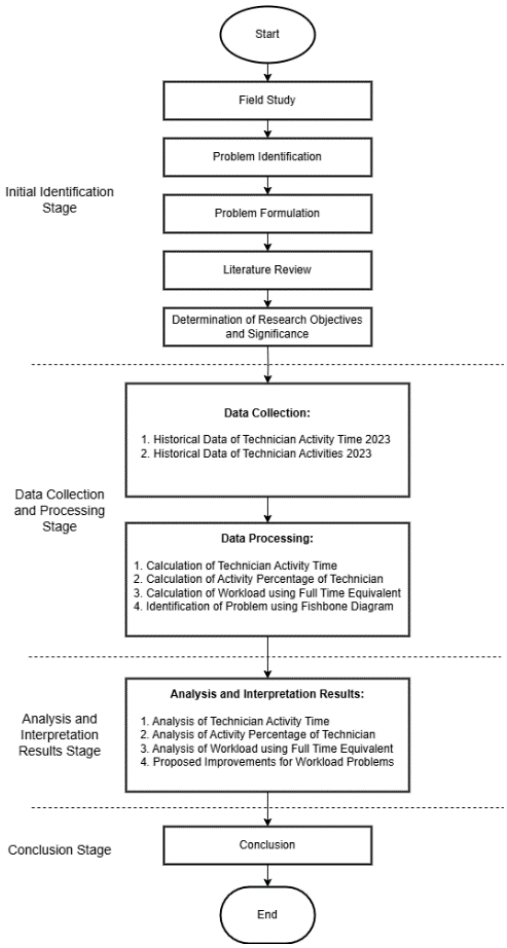

Figure 1. Research Flowchart

The research flow is represented in Figure 1. The research stages consist of four phases: the initial identification stage, the data collection and processing stage, the analysis and interpretation stage, and the conclusion stage. The research begins in the initial identification stage with a field study by conducting observations and interviews with relevant subjects, namely the head technician, several technicians, and one technician from each technician level. After the field study, a conclusion is drawn regarding the problems encountered. It was found that after conducting the field study, the technicians were working without a specific understanding of the workload they were receiving. Therefore, the research problem is to determine the workload received by each technician in Utility Engineering Subdivision 2 at PT Konimex. To address this issue, a literature review was conducted, and a solution was found using the Full Time Equivalent (FTE) method.

Full-time Equivalent (FTE) is a method of analyzing workload that uses time as the primary measurement. This method measures the duration of task completion and converts it into a Full Time Equivalent index. Full-time Equivalent is a method whose results are obtained from the time required by a worker to complete activities within a certain period (Sari et al., 2018). Full Time Equivalent is a method aimed at optimizing employee performance by determining the optimal number of employees needed by the company (Pambudi, 2017). To calculate the Full Time Equivalent (FTE) value, it can be done using the following formula (Hudaningsih et al., 2019):

$$FTE = \frac{Total\ Time\ Activities + Allowance}{Total\ Available\ Time} \quad (1)$$

Allowance is a flexibility factor that is given to workers for completing their tasks in addition to normal working time. This addition is provided for certain aspects of the job, such as disturbances that may occur and cannot be avoided, such as break time during working time (Widagdo, 2018). The allowance that is provided refers to the time allocated for activities not directly related to work, such as breaks during working sessions, prayer, etc. The total available time is derived from the total working time an employee has within a certain period. Since the Full Time Equivalent calculation is done over one year, the calculation formula can be simplified as follows.

$$FTE = \frac{Total\ Time\ Activities}{Total\ Effective\ Time/Year} \quad (2)$$

Sari et al. (2018) in their research stated that the classification of Full Time Equivalent values is divided into three categories as follows.

Table 1. Categories of *Full-Time Equivalent* (FTE) Value

FTE Value	Category
0 – 0.99	*Underload*
1 – 1.28	Normal
> 1.28	*Overload*

The Full Time Equivalent was calculated by conducting the data collection and compiling the company's historical data on technician activities in 2023. Additional data was gathered through field observations and interviews with the head technician and one technician from each level of the Utility 2 Engineering Department at PT. Konimex.

The data used in the calculations include technician activity data and the time spent by each technician. This consists of primary activities, which include breakdown maintenance, projects, and preventive maintenance. Furthermore, supporting activities are considered, including work preparation, transportation of technicians, monitoring & evaluation, and other miscellaneous activities of technicians.

In the data processing stage, calculations were done by determining the total time spent by technicians on certain activities and the percentage of each technician's involvement. The total time data and technician

involvement percentages were then used in the Full Time Equivalent (FTE) calculation. The company's predetermined allowance was also included in the calculations to get the total effective working time of the employees, which was calculated based on the FTE method.

After obtaining the Full Time Equivalent index for each technician, the next stage of the research is to identify the potential causes of the problem using a fishbone diagram. A fishbone diagram is a tool aimed at identifying the causes of a problem (Tague, 2023). The potential causes of the problem will be analyzed during the analysis and interpretation stage, leading to conclusions and recommendations for the company to address the issue based on the results obtained.

3. Results and Discussion

Before calculating the Full Time Equivalent value, it is necessary to first determine the total effective working time an employee has. To calculate the total effective working time, the working hours over the course of one year need to be identified. Below is the calculation table of working time for employees at PT Konimex.

Table 2. Total Work Time of Employee

Keterangan Waktu	Total Waktu
Work Time/Year	1 Year
Work Time /Day	299 Days
Work Time/Hour	1,993 Hours
Work Time /Minute	119,580 Minutes

The working time used to calculate the total effective time is the total working time in minutes, as the time unit in the technician activity data for the Full-Time Equivalent (FTE) calculation is expressed in minutes. The calculation of the total effective working time is shown below:

$$Total\ Effective\ Work\ Time = Total\ Available\ Time(minute) - (Total\ Available\ Time\ (minute) x\ Allowance)$$

$$Total\ Effective\ Work\ Time = 119{,}580 - (119{,}580\ x\ 5\%) = 113{,}601\ Minute$$

Based on the result, it was found that the total effective working time available for each technician is 113,601 minutes. Next, after obtaining the total effective working time, the value of Full Time Equivalent (FTE) for each technician can be calculated. Below is the number of technicians in Utility Engineering Subdivision 2 of PT Konimex.

Table 3. Number of Technicians in Utility Engineering Subdivision 2 PT Konimex

No	Position Name	Number of Employees
1	Chief Technician	1
2	Technician Level 1	2
3	Technician Level 4	3
4	Technical Officer	2

3.1. Calculation of Full Time Equivalent Value for Technician

To calculate the value of Full Time Equivalent for each technician, it is necessary to identify the activities performed by technicians. This is done to calculate the specific Full Time Equivalent value for each technician when performing certain activities. Below are the activities carried out by the Utility Engineering 2 technicians from January 2023 to December 2023.

Table 4. Table Type of Technicians Activities

No	Activities Type
1.	Work Preparation
2.	Transportation
3.	*Breakdown maintenance*
4.	Project
5.	*Preventive maintenance*
6.	Monitoring & Evaluation
7.	Supporting Activities
8.	Other Activities

Next, the workload of each technician is calculated using the Full Time Equivalent method. Using equation (2), the Full Time Equivalent can be calculated by dividing the activity time by the effective working time as follows.

A. Chief Technician

The following are the results of the calculation using the Full Time Equivalent (FTE) method for the chief technician position.

Table 5. Table FTE Value of Chief Technician Position

No.	Activities Type	FTE Value
1.	Work Preparation	0.2275
2.	Transportation	0.0027
3.	*Breakdown maintenance*	0.0002
4.	Project	0.0000
5.	*Preventive maintenance*	0.0000
6.	Monitoring & Evaluation	0.4306
7.	Supporting Activities	0.0164
8.	Other Activities	0.0222
Total Full Time Equivalent Value		0.6995

The Full Time Equivalent results indicate underload, as the total FTE value obtained is < 1.

B. Technician Level 1

The following are the results of the calculation using the Full Time Equivalent (FTE) method for the level 1 technician position.

Table 6. Table FTE Value of Technician Level 1 Position

No.	Activities Type	FTE Value		
		Technician A	Technician B	Technician C
1.	Work Preparation	0.2054	0.2054	0.2054
2.	Transportation	0.0441	0.0647	0.0229
3.	*Breakdown maintenance*	0.4800	0.3543	0.3326
4.	Project	0.0629	0.1434	0.1578
5.	*Preventive maintenance*	0.0396	0.2636	0.0065
6.	Monitoring & Evaluation	0.3406	0.3406	0.3406
7.	Supporting Activities	0.0164	0.0164	0.0164
8.	Other Activities	0.1017	0.0216	0.0524
Total Value of Full Time Equivalent		1,2906	1,4609	1,0892

The Full Time Equivalent value for each technician varies. Level 1 technician A and technician B have results exceeding 1.28, indicating overload. Technician C has a result between 1 and 1.28, indicating a normal workload.

C. Technician Level 4

The following are the results of the calculation using the Full Time Equivalent (FTE) method for the level 4 technician position.

Table 7. Table FTE Value of Technician Level 4 Position

No.	Activities Type	FTE Value	
		Technician A	Technician B
1.	Work Preparation	0.2111	0.1600
2.	Transportation	0.0456	0.0215
3.	*Breakdown maintenance*	0.2004	0.1452
4.	Project	0.0315	0.0117
5.	*Preventive maintenance*	0.1342	0.0402
6.	Monitoring & Evaluation	0.3406	0.3406
7.	Supporting Activities	0.0164	0.0164
8.	Other Activities	0.0462	0.0524
Total Value of Full Time Equivalent		1.0259	0.7880

Technician A, level 4, has a result between 1 and 1.28, indicating a normal workload, and technician B, level 4, has a result of < 1, indicating underload.

D. Technical Officer

The following are the results of the calculation using the Full Time Equivalent (FTE) method for the technical staff position.

Table 8. Table FTE Value of Technical Officer

No.	Activities Type	FTE Value	
		Technician A	Technician B
1.	Work Preparation	0.2224	0.1600
2.	Transportation	0.0470	0.0237
3.	*Breakdown maintenance*	0.0875	0.2503
4.	Project	0.0016	0.0550
5.	*Preventive maintenance*	0.5731	0.0049
6.	Monitoring & Evaluation	0.3406	0.3406
7.	Supporting Activities	0.0164	0.0164
8.	Other Activities	0.0031	0.0308
Total Value of Full Time Equivalent		1.2916	0.8816

Technical officer A has a result of > 1.28, indicating overload, and technical officer B has a result of < 1, indicating underload.

3.2. Analysis of Potential Problem Causes Using a Fishbone Diagram

The fishbone diagram is one of the seven tools used to identify the causes of problems. The fishbone diagram is used to determine the causes of workload being either overloaded or underloaded for technicians. Below is the fishbone diagram generated from the identification of potential causes of workload overload and underload.

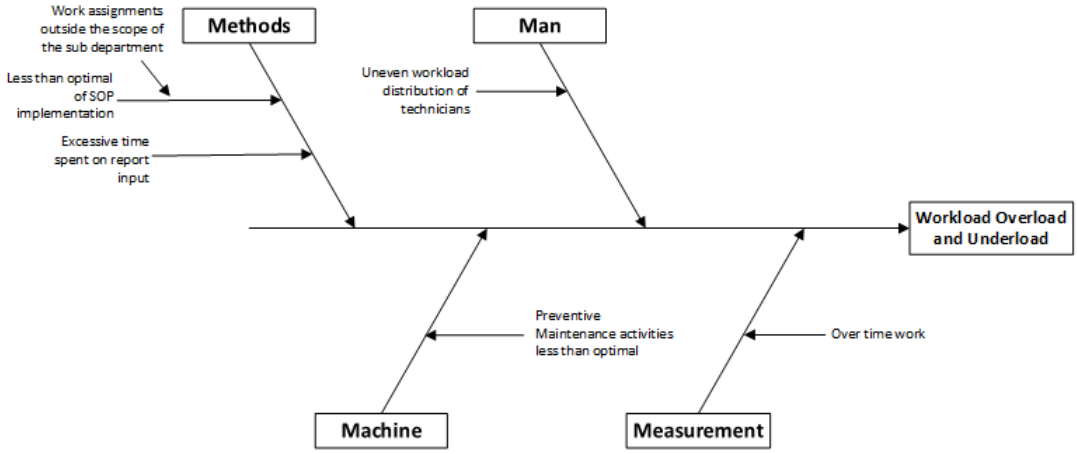

Figure 2: Fishbone Diagram Causes of Workload Variation

This research identifies potential problems in four main factors: human, working time, method, and machine. The first factor is the human factor (man), which may be caused by uneven work distribution from the head technician. This leads to results indicating excessive or insufficient workload, as evidenced by both

overload and underload, even among technicians at the same level. Past research conducted by several researchers has shown that uneven work distribution affects employees. First, a study conducted by Muchlisin (2021) on workload analysis using the Full Time Equivalent (FTE) for considerations of employee workload distribution showed that uneven work distribution is one of the main causes of workload imbalances, leading to both overload and underload conditions among employees. This imbalance in workload distribution results in overtime for some employees. Second, the research conducted by Sunaryo & Ratriwardhani (2022) on the effects of workload and length of work on the occurrence of fatigue in workers showed that workload is closely related to the occurrence of fatigue in workers. The heavier the workload, the greater the probability of fatigue appearing.

The second factor is measurement, involving technician overtime, where the Full Time Equivalent (FTE) method incorporates overtime into the calculation, increasing the workload for technicians working overtime compared to those who are not. Since Full Time Equivalent (FTE) calculations use time as a key attribute, formerly technicians who work overtime on certain activities may have higher workload values compared to those who do not. Essentially, technicians are responsible for production operations, meaning that when a machine experiences a malfunction, it must be repaired immediately to ensure optimal production performance. In the past research conducted by Widyaningrum et al. (2023) on workload analysis using the Full Time Equivalent (FTE) method at PT Beiersdorf Indonesia, it was found that overtime is one of the root causes of the increase in the FTE index. The longer the overtime hours, the higher the FTE value, indicating an increase in workload.

The third factor is the method, which is due to the suboptimal implementation of SOPs. This was identified through the recapitulation of technician activity data, which showed that some technicians were performing machine repair activities outside the responsibilities of the Technical Utilities 2 sub-division. As a result, the workload of these technicians increased, potentially leading to an overload. Another possible cause of the problem is the long report input time, which increases the workload. On average, a technician spends 90 minutes inputting their work. When converted into FTE units, this results in a relatively high value. Therefore, an evaluation is needed to determine the most effective approach for work report input so that time can be utilized more efficiently.

The fourth factor is the machine factor, which is potentially caused by a suboptimal preventive maintenance schedule. Since preventive maintenance is a type of repair with a measurable schedule, it is expected to follow a predetermined frequency. However, in reality, some preventive maintenance activities occur either more or less frequently than scheduled. This can lead to variability in the technicians' workload. Therefore, an evaluation of preventive maintenance activities is necessary to improve efficiency and productivity. This can be achieved by evaluating work distribution, overtime, and SOPs to balance the workload of technicians.

3.3. Recommendations for Improvements

The study by Sukirman et al. (2021) on Full Time Equivalent (FTE) recommends adding workers to sub-departments with overload FTE values and, conversely, reducing workers in sub-departments with underload FTE values. Similarly, the research by Kurniawan et al. (2022) also suggests reallocating workers by distributing tasks more evenly for overloaded fields. Full Time Equivalent is a method to measure how well employee composition matches the needs of a particular department. In cases of overload and underload, the logical solution is to equalize the workload by adding or reducing workers to control variable costs like labor expenses. However, if the overload and underload indicators are not far from the normal range, reducing or adding workers may not be the most cost-effective solution. In such cases, problem-solving analysis using a fishbone diagram is more appropriate.

The first recommendation is to evaluate work distribution, as significant differences in Full Time Equivalent (FTE) values exist between technicians. Work distribution needs to be balanced. A proposed solution is to schedule preventive maintenance since the schedule for this activity is already established.

The second recommendation is to evaluate technician overtime. Overtime should only be assigned when necessary, such as during critical machine repairs, to avoid unnecessary increases in workload. High working hours can inflate the workload as calculated by the Full Time Equivalent (FTE) method.

The third recommendation is to optimize the SOPs for work distribution between sub-departments. The data on repair activities performed by the Utility Engineering 2 technicians shows that some activities belonging to other sub-departments are being done by these technicians, which increases their Full Time Equivalent (FTE) workload while indirectly reducing the FTE workload in other sub-departments, potentially indicating underload in those areas.

The fourth recommendation is to improve the work report data input procedure by creating a template to make it easier for technicians to input work reports, thus reducing input time and decreasing the Full Time Equivalent (FTE) workload.

The final solution is to evaluate preventive maintenance activities. This includes more precise scheduling and optimizing preventive maintenance frequencies based on machine measurements. This way, the workload can be better balanced and optimized.

4. Conclusion

Based on the data processing, all technicians show significantly different Full Time Equivalent (FTE) results. Technicians in the technical staff position have a cumulative FTE of 2.1732, with Technical Staff A having an FTE of 1.2916 (overload) and Technical Staff B having an FTE of 0.8816 (underload). Level 1 technicians have a cumulative FTE of 3.8407, with Level 1 Technician A having an FTE of 1.2906 (overload), Level 1 Technician B having an FTE of 1.4609 (overload), and Level 1 Technician C having an FTE of 1.0892 (normal). Level 4 technicians have a cumulative FTE of 1.8139, with Level 4 Technician A having an FTE of 1.0259 (normal) and Level 4 Technician B having an FTE of 0.7880 (underload). The head technician has an FTE of 0.6995 (underload).

Recommendations for improving workload efficiency include scheduling preventive maintenance to balance the workload, limiting overtime to critical situations, following the SOPs for work distribution, developing a work report input procedure template to reduce input time, and evaluating preventive maintenance activities to optimize the frequency of necessary tasks.

In this study, workload measurement is based on time calculations and does not consider other factors. Other factors that could be used to measure workload include worker mentality and environmental conditions while performing the job. For future research, it is recommended to combine the FTE method with other methods, such as 360-degree Feedback, to measure mental workload and employee motivation, resulting in more comprehensive insights to improve decision-making in work distribution or system design.

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