

The Influence Of Noise, Workload, Length Of Work And Employment Status On Work Productivity Through Work Fatigue Of PT. Indonesia Power UBP Tello In 2024

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ABSTRACT

Objective: This study aims to analyse the direct and indirect effects of noise, workload, work mass and work status on work productivity, with work fatigue as an intervening variable.

Methods: The research was carried out on all employees in the PLTD and PLTG units of PLN IP UBP Tello, a total of 84 people, using total sampling for data collection. Data was collected through interviews, noise level measurements using the Decibel X application, fatigue assessments using a reaction timer tool and productivity observation sheets. Data analysis was performed using path analysis with Smart PLS software.

Results: The results indicate that work mass (p-value = 0.008), work status (p-value = 0.003) and work fatigue (p-value = 0.000) have a significant direct effect on work productivity. Noise (p-value = 0.549) and workload (p-value = 0.151) have no significant direct effect on work productivity. For indirect effects, noise (p-value = 0.004), workload (p-value = 0.000) and work mass (p-value = 0.035) show significant indirect effects on productivity through work fatigue. However, job status does not have a significant indirect effect on productivity through work fatigue (p-value = 0.320).

Conclusions: PT. PLN IP UBP Tello is recommended to identify and fulfill the specific needs of its employees in order to improve job satisfaction and elevate productivity.

Keywords: Noise, Workload, Length of Work, Job Status, Work Fatigue, Productivity

INTRODUCTION

In the context of rapid globalisation, companies and organisations around the world are faced with the need to make the best use of resources to ensure superior product and service quality. In this context, productivity is a key indicator of industrial progress as it has a direct impact on competitiveness and economic growth. High productivity not only accelerates the growth of the industrial sector, but also ensures its long-term sustainability [1].

However, one of the major challenges often faced by industry is the management of noise in the working environment. Excessive noise is a significant problem that can affect the health and well-being of workers. Global data shows that approximately 250 million workers are exposed to noise at work, with hearing loss being one of the most common occupational diseases recorded, particularly in Europe and the United States [2]. In Indonesia, the issue of workplace noise is no less important, with many companies failing to keep noise below the safe limits set by the national standard of 85 dB for the permissible quality standard with a maximum working time of 8 hours per day [3]. High levels of noise can cause physiological, psychological and communication disorders that are detrimental to workers, as well as reducing the quality of work and overall productivity.

In addition to noise, workload is an important factor affecting productivity. Workloads that are high or incompatible with workers' capabilities can lead to physical and mental fatigue. This fatigue, in turn, has a negative impact on work performance and productivity [4]. Research shows that excessive workload can lead to decreased motivation, reduced performance and an increase in errors and accidents [5,6]. Work mass, or the duration of exposure to risk factors, also contributes to fatigue and reduced productivity [7].

Occupational fatigue is a significant issue that can affect worker performance in various industries. Fatigue caused by long working hours, heavy workloads, or unfavourable work environment conditions can reduce work efficiency and increase the risk of occupational accidents [8]. Research conducted in the power generation sector, specifically at PT PLN IP UBP Tello, shows that factors such as high noise and heavy workload are often associated with decreased productivity and increased workplace accidents.

PT. PLN IP UBP Tello is one of the Gas/Diesel Power Generation sectors that uses engines as a tool of work and causes noise in the workplace. Based on the data owned by the company, the results of the second semester of work environment measurements in September 2023 data show that noise in the work environment exceeds the standard limits set, with noise levels of up to 102 dBA recorded in some areas, well above the safe limit of 85 dBA. In addition, high workloads and pressure to achieve strict targets contribute to stress and fatigue among workers. Although performance targets have been set, productivity realisation often does not reach the target figures, with Equivalent Availability Factor (EAF) values showing a decline from year to year [9].

This study aims to identify and analyse the influence of noise, workload, length of work, and job status on work productivity through work fatigue at PT PLN IP UBP Tello. By exploring the relationship between these factors, it is hoped that this research can provide useful insights to improve human resource management and safety policies in the company, as well as mitigate the negative impact of noise and workload on employee productivity.

MATERIAL AND METHODS

This study uses a type of quantitative research. Quantitative research is a process of finding knowledge that uses data in the form of numbers as a tool to analyze information about what we want to know [10]. The type of research is observational analysis that uses a cross sectional design with primary and secondary data collection methods. Analytical research is research used to find out the causal relationship between two variables, where the form of the relationship can be such as, relationship, influence, or difference. Observational research is research where the researcher only makes observations without intervening on the variables to be studied. While cross sectional is a study where all variables are observed simultaneously in one period [11].

RESULTS AND DISCUSSION

Results of Path Analysis

After analyzing the data through univariate and bivariate tests, the next stage in this study is to conduct a multivariate test using 22 path analysis. This analysis aims to understand the complex relationship between several variables simultaneously, as well as to evaluate the direct and indirect influence between these variables. The results of this pathway analysis provide a deeper understanding of the structure of the relationship between variables, as well as identify significant pathways that affect dependent variables.

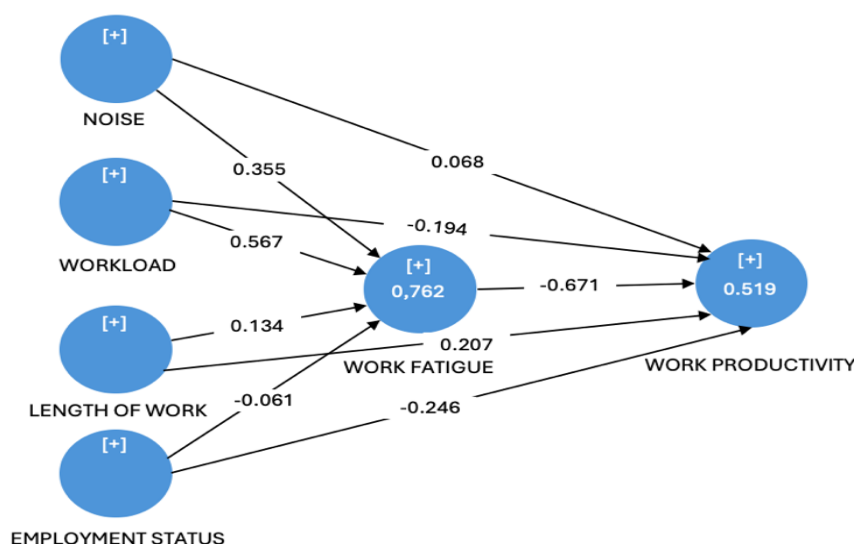


Figure 1: Path Analysis Model Construction

The figure above shows the complex relationship between various factors and work productivity, along with their values. The noise factor had a direct positive effect of 0.068 on work productivity. However, noise also contributed to an increase in work fatigue with an influence value of 0.355. Workload is the most influential

factor in work fatigue with a value of 0.567, which then negatively affects work productivity with a value of -0.671. The higher the workload, the higher the level of fatigue felt by workers, which directly decreases their productivity. In addition, the length of work had a positive effect of 0.134 on work fatigue. Although the direct effect on productivity is not seen in this diagram, fatigue caused by long hours of work has an indirect impact on decreased productivity. Employment status showed a negative effect on work fatigue with a value of -0.061, indicating that a more stable employment status tended to reduce fatigue. However, the overall effect on productivity through fatigue is still quite significant with a value of -0.246.

Overall, work fatigue with a coefficient value of 0.762 played an important role as a mediating variable that linked other factors such as workload, noise, length of work, and status of 23 jobs with work productivity. With a determination coefficient value of 76.2% for work fatigue and 51.9% for work productivity, it can be concluded that most of the variation in fatigue and work productivity can be explained by these factors.

Testing the Direct Influence Hypothesis

The noise variable had a significant influence on work fatigue with an f^2 value of 0.368 which showed a moderate to large effect. The total effect of 0.355 indicates that increased noise will increase work fatigue. A t-statistical value of 4.268 and a p-value of 0.000 indicate that this relationship is statistically significant, meaning that noise significantly affects work fatigue levels. Workload also showed a significant and strong effect on work fatigue with an f^2 of 0.818 (large effect) and a total effect of 0.567. This means that the higher the workload, the higher the fatigue felt by workers. A high t-statistics value of 5.878 and a p-value of 0.000 confirm that this relationship is statistically significant. Furthermore, the length of work had a smaller effect on work fatigue with an f^2 of 0.061 and a total effect of 0.134. Nevertheless, this relationship remained statistically significant with t-statistics of 2.368 and a p-value of 0.018, which suggests that there is an influence, albeit not as strong, as noise and workload. Then, the effect of occupational status on work fatigue was not significant, shown by an f^2 of 0.013 (very small effect) and a total effect of -0.061. A t-statistics value of 1.082 and a p-value of 0.280 indicate that this relationship is not statistically significant, so employment status does not significantly affect work fatigue in this context (see table 1).

Table 1: Testing Results of Direct Influence Hypothesis

	f^2	Total Effects	t-statistics	p-value
Noise → Work Fatigue	0,368	0,355	4,268	0,000
Workload → Work Fatigue	0,818	0,567	5,878	0,000
Length Of Working → Work fatigue	0,061	0,134	2,368	0,018
Employment status → Work fatigue	0,013	-0,061	1,082	0,280
Noise → Productivity	0,005	-0,170	0,599	0,549
Workload → Productivity	0,026	-0,575	1,440	0,151
Length Of Working → Productivity	0,068	0,118	2,679	0,008
Employment status → Productivity	0,106	-0,206	3,028	0,003
Work fatigue → Productivity	0,222	-0,671	4,694	0,000

The relationship between noise and productivity was also insignificant, with an f^2 of 0.005 and a total effect of -0.170. The t-statistics value of 0.599 and p-value of 0.549 indicate that noise has no significant influence on productivity in this model. Workload also showed no significant effect on productivity, with an f^2 of 0.026 and a total effect of -0.575. A t-statistical value of 1.440 and a p-value of 0.151 indicate that this relationship is not statistically significant. Working length had a significant influence on productivity with f^2 of 0.068 and total effects of 0.118. A t-statistical value of 2.679 and a p-value of 0.008 indicate that this relationship is statistically significant, although the effect is relatively small. Job status showed a significant influence on productivity with an f^2 of 0.106 and a total effect of -0.206. A t-statistical value of 3.028 and a p-value of 0.003 indicate that this relationship is statistically significant, although the effect is small to moderate. Finally, work fatigue showed a significant and negative influence on productivity with an f^2 of 0.222 and a total effect of -0.671. The t-statistics value of 4.694 and p-value of 0.000 indicate that work fatigue significantly decreases productivity.

Testing of Indirect Influence Hypothesis

Table 2: Testing Results of Indirect Influence Hypothesis

	T-Statistics	P-Value
Noise → Work Fatigue → Productivity	2,927	0,004
Workload → Work Fatigue → Productivity	3,813	0,000

Length Of Working → Work Fatigue → Productivity	2,116	0,035
Employment Status → Work Fatigue → Productivity	0,996	0,320

Noise shows a significant indirect influence on productivity through work fatigue. The t-statistics value of 2.927 and p-value of 0.004 indicate that this mediation effect is significant. This means that noise affects work fatigue, which then negatively impacts productivity. Workload also shows a significant indirect influence on productivity through work burnout. A t-statistics value of 3.813 and a p-value of 0.000 indicate that this relationship is very significant. This indicates that an increase in workload will increase work fatigue, which in turn decreases productivity. Furthermore, the length of work had an indirect influence on productivity through work fatigue with t-statistics of 2.116 and p-value of 0.035. This relationship can be said to be significant, showing that working length affects productivity indirectly by increasing work fatigue. Finally, the employment status showed no significant indirect influence on productivity through work fatigue, shown by t-statistics of 0.996 and p-value of 0.320. This means that job status does not significantly affect productivity through work burnout in this model.

Direct Relationship between Noise and Work Productivity

In the work environment, noise is one of the external factors that is often ignored but has a significant impact on employee productivity. Based on the results of the analysis that has been carried out, it is found that noise has a direct influence on work productivity, although this influence is not statistically significant. This can be seen from the t-statistics value of 0.599 and the p-value of 0.549, which shows that noise has no significant direct effect on productivity in this model.

In order to increase productivity, companies should conduct regular assessments of noise levels in the workplace and implement noise reduction measures if necessary. For example, using sound-absorbing materials, setting up workspace layouts, or providing a quiet workspace for employees who need high concentration. These measures will not only help in creating a more comfortable work environment, but also support an increase in overall employee productivity [12,13].

The Relationship between Noise and Work Productivity Through Work Fatigue

Based on the results of the study, it was found that noise has a significant indirect influence on work productivity through work fatigue. This means that noise not only affects productivity directly but also through increased employee fatigue levels, which in turn lowers their productivity. A study by [14] also supports this finding, by emphasizing that noise in the work environment, especially in heavy industries such as the Stamping Division at PT. X, has a significant correlation with work fatigue levels, which ultimately affects productivity. Noise that exceeds the threshold not only interferes with communication and concentration of workers, but can also lead to an increase in pulse rate and blood pressure, which contributes to physical and mental fatigue.

Managing noise is not just about meeting health and safety standards, it's also about maintaining employee productivity. Measures such as noise reduction through improved workspace design, the use of sound suppression, as well as the implementation of work policies that allow workers to take breaks from noise exposure can help reduce work fatigue and, in turn, increase productivity.

Direct Relationship between Workload and Work Productivity

Workload is one of the important factors that affect employee productivity. Workload refers to the number and intensity of tasks that must be completed by an employee within a given time frame. The results show that workload has a direct influence on work productivity, although this relationship is not always linear. This means that an increase in workload can affect productivity both positively and negatively, depending on various conditions and related factors.

Effective workload management is key to maintaining and improving employee productivity. The company must ensure that the tasks assigned are in accordance with the capacity and competence of the employees. Good scheduling, providing adequate downtime, and providing adequate resources are steps that can be taken to better manage the workload. When the workload is well managed, employees can work more focused, efficient, and motivated, ultimately increasing their work productivity.

The Relationship between Workload and Work Productivity Through Work Fatigue

The results of statistical analysis show that workload has a significant influence on work fatigue. This is indicated by a positive and significant path coefficient value, which means that the higher the workload faced by employees, the greater the level of fatigue they experience. Heavy workloads force employees to work harder, both physically and mentally, which in turn leads to faster burnout. Then, work fatigue plays a significant mediating variable between workload and work productivity. This means that fatigue resulting from a high workload indirectly affects work productivity. When employees feel tired, their ability to work efficiently

decreases, which is indicated by a decrease in speed, precision, and quality of work. Statistically, this is reflected in a significant decrease in work productivity when work fatigue increases[15,16].

These findings emphasize the importance of effective workload management in an effort to maintain and improve employee productivity. Organizations need to ensure that the workload assigned to employees is in accordance with their capacity, and that there are adequate measures in place to prevent or reduce work burnout. This can include adjusting the volume of work, providing additional support, and providing enough rest to help employees recover from the stress of work[17].

Direct Relationship between Length of Work and Work Productivity

The length of work or the duration of working time spent by employees in performing their tasks is an important factor that can affect work productivity. The length of work can be related to the experience employees have, the level of fatigue experienced, and the ability to complete tasks efficiently. The results of statistical analysis in this study show that the length of work has a positive and significant path coefficient on work productivity. This means that there is a direct correlation between the length of work and increased productivity. This means that employees who work for a sufficient duration of time tend to be more productive compared to those who have fewer hours, as long as the length of work does not cause excessive fatigue[18].

Companies must ensure that the working time allocated to employees is sufficient to complete their tasks efficiently, but still pay attention to the balance between work time and rest time to prevent fatigue that can reduce productivity. Good work scheduling, including providing ample breaks and flexible scheduling, can help employees maintain high productivity around the clock[19,20].

The Relationship between Length of Work and Work Productivity Through Work Fatigue

The length of work or the duration of time spent by employees in carrying out their tasks is one of the important factors that can affect work productivity. However, the relationship between work length and productivity is not always linear and can be influenced by mediating factors, such as work fatigue. In this context, work fatigue acts as a mediator that can clarify how the length of work affects employee productivity[18,21].

The results of the statistical analysis in this study support this view, showing that work fatigue mediates the relationship between work length and productivity. In other words, part of the effect of working length on productivity is explained by the level of fatigue experienced by employees. This means that efforts to increase productivity through additional working hours can be counterproductive if not accompanied by good management of work burnout[22,23].

Direct Relationship between Job Status and Work Productivity

Job status refers to the position or position of the employee in the organization, which can include aspects such as the type of employment contract (permanent or contract), seniority level, and job responsibilities held. Job status is often associated with work productivity, as it affects employees' motivation, commitment, and perception of their work.

This result is in line with research by [24] at PDAM Bengkulu City showing that there is a significant difference in work productivity among permanent, contract, and freelance daily workers (PHL). The results of the analysis using the one-way Anova test revealed that contract employees had the highest productivity with an average score of 98.14, followed by freelance daily workers with an average score of 97.53, while permanent employees had the lowest productivity with an average score of 91.75. This difference is thought to be because contract employees are more motivated to maintain their performance, given the higher risk of termination if they make a mistake, compared to permanent employees who have stronger job protections[25–27].

The Relationship between Job Status and Work Productivity Through Work Fatigue

The results of the indirect effect of employment status on productivity through work fatigue showed that this relationship was not significant, with a t-statistics value of 0.996 and a pvalue of 0.320. This means that job status does not have a strong enough influence on productivity through work burnout as a mediator. This could be due to other factors that are more dominant in influencing work productivity that is not measured in this mediation path.

From these results, companies or human resource managers may need to re-evaluate other factors that are more significant in influencing worker productivity. For example, providing greater support in terms of workers' mental and physical well-being, or creating a conducive work environment that can reduce fatigue without affecting productivity. Each work context has different dynamics[28–30].

CONCLUSION

Based on the results of the study on the effect of noise, workload, length of work and work status on work productivity through work fatigue at PLN IP UBP Tello in 2024, the conclusion of the research results is as follows: There is no direct effect between noise and work productivity, but it has an indirect effect through work

fatigue at PLN IP UBP Tello. There is no direct effect between workload and work productivity, but it has an indirect effect through work fatigue at PLN IP UBP Tello. The length of work has a direct effect on work productivity and indirectly through work fatigue at PLN IP UBP Tello. Job status has a direct influence on work productivity but there is no indirect influence through work fatigue at PLN IP UBP Tello.

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