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Research Article

Analysis of The Influence of Work Environment Factors on Work Productivity Through Work Stress Workers In Nickel Mines In 2024

Ananda Tamalya Ningrum Pratiwi[1*], Yahya Thamrin[2], Lalu Muhammad Saleh[3], Atjo Wahyu[4], Suriah[5]

[1,2,3,4] Department of Occupational Health and Safety, Faculty of Public Health, Hasanuddin University, Indonesia

[5]Department of Health Promotion, Faculty of Public Health, Hasanuddin University, Indonesia

*Corresponding Author: anandatamalyaningrumpratiwi@gmail.com

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ABSTRACT

This study analyzes the influence of work environment factors on work productivity by examining work stress in nickel mines in 2024. This study employs a mixed-methods approach with a sequential explanatory design. The quantitative phase involved 161 respondents selected using the total sampling technique, while the qualitative phase included 10 informants chosen through purposive sampling. Data were collected through questionnaires and interview guidelines, with analysis conducted using univariate, bivariate, multivariate, and content analysis for qualitative data. Mental workload (p = 0.006), social support (p = 0.033), noise (p = 0.020), work climate (p = 0.020), and work stress (p = 0.000) significantly affect work productivity, while satisfaction with superiors and coworkers (p = 0.264) does not. In the multivariate test, only mental workload (p = 0.036), social support (p = 0.000), and work stress (p = 0.000) remain significant factors influencing work productivity. Mental workload and social support and work stress have a significant effect on work productivity from both bivariate and multivariate tests. This is also supported by the results of interviews related to the 2 factors, namely working time, mental activity, time pressure, performance, physical activity, business needs, emotional support, reward support and instrumental support.

Keywords: Work Environment, Productivity, Work Stress.

INTRODUCTION

Accident Occupational and occupational diseases often occur in the workplace, especially in companies with high hazard potential, resulting in economic and non-economic losses, such as equipment damage, lost time, and even worker injury or death. Designing a comfortable and high-standard work environment can increase productivity, especially for office workers who spend a lot of time indoors, where environmental quality can affect their performance and mental well-being [1]. Five joint WHO/ILO systematic reviews of estimates aimed to synthesize studies estimating the prevalence of exposure (in short, “exposure prevalence studies”) to occupational risk factors: ergonomic risk factors, dust and/or fibers, solar ultraviolet radiation, noise, and long working hours [2].

Psychosocial risk factors in the workplace are the factors that are most present in the work environment because they are intrinsic to the person. In other words, these risk factors are only present when the worker interacts with psychosocial hazards in a specific work context, because they are the result of the characteristics of the worker, interpersonal work relationships, mental workload, social support, employment relationships, among other aspects [3]. Mental health issues can have significant implications for the wellbeing and safety of mining workers, yet little is known about this in diverse geographical and cultural contexts [4].

The Social Security Administering Agency (BPJS) for Employment noted that the number of work accidents in Indonesia was 234,270 cases in 2021. This number increased by 5.65% from the previous year which was 221,740 cases. According to BPJS Employment, the majority of these accidents occurred at the workplace. This also mostly occurred in the morning from 06.00 to 12.00. For these various work accidents, BPJS Employment has spent IDR 1.79 trillion to pay claims in 2021. This amount has increased by 14.97% compared to the previous year which was IDR 1.56 trillion [5]. Competitive industrial companies need to optimize quality human resources and supporting technology to ensure smooth production and produce high-quality products. The comfort of the work environment has a major impact on productivity, with an environment that suits employee needs increasing work enthusiasm, while a toxic environment can reduce productivity, with work stress as the main mediator of its impact [6]. Employment is regulated in Law Number 6 of 2023 which replaces the Government Regulation in Lieu of Law Number 2 of 2022 concerning Job Creation. This law covers worker protection, minimum wages, job loss insurance, and working hours. The work environment, as one source of occupational health hazards, includes risk factors such as noise.

Noise is any unwanted sound originating from production process equipment and/or work tools which at a certain level can cause hearing loss [7]. Noise, apart from being able to cause temporary or permanent hearing loss, is also a source of stress that causes increased alertness and psychological imbalance [8]. The physiological effect of low intensity noise does not cause hearing loss, but causes decreased work performance as one of the causes of stress and other health disorders. Stress caused by noise exposure can cause fatigue, anxiety and depression. Stress due to noise can cause unstable emotions, headaches, sleep disorders, psychomotor reaction disorders, loss of concentration, communication disorders, decreased work productivity [9]. Lower ambient noise levels in the workplace may mitigate the negative impact of work psychosocial stress on job satisfaction, well-being, and organizational commitment.

Extreme heat exposure can lead to adverse health effects, so it is important to balance preventive measures such as adequate hydration, work pacing, and adequate facilities with improvements in psychosocial conditions, including optimal working hours and social support. Workers are more susceptible to heat stress than the general population, especially when they must wear protective clothing that inhibits sweat evaporation and increases the risk of heat stress [10].Workers in low-middle income tropical and subtropical countries are vulnerable to the impacts of heat stress that worsen health and productivity, especially without effective adaptation measures. A good occupational safety and health climate is positively associated with physical activity, optimal sleep, general health, job satisfaction, and reduced depression and productivity losses [11].

Job satisfaction, which reflects an individual's attitude toward his/her job, affects work productivity, where high satisfaction encourages optimal effort in completing tasks. Conversely, low job satisfaction is often related to stress due to tension and disharmony with the work environment, which has a negative impact on individual behavior [12].Workload affects productivity and job satisfaction, both directly and through the mediation of job stress. In addition to the number of tasks, workload includes mental and physical demands that can reduce job satisfaction if not managed well. Surveys in Europe, the United States, Australia, Japan and Korea show high levels of work stress, with up to two-thirds of workers in some regions reporting work-related stress. Data from the Labor Force Survey

(2018/2019) recorded 602,000 cases of work-related stress, depression or anxiety, with workload being the leading cause [13].

Office workers engage in focused activities, knowledge sharing, and social interaction, with a supportive work environment that increases productivity. Social support at work is positively associated with high job control, low depression, and high performance, although it does not completely dampen the negative impact of job factors on depression and organizational productivity.This company includes processing nickel ore into ferronickel through the stages of drying, melting, reduction and separation of metal phases, producing ferronickel with high or low carbon content, according to industry needs.

Work stress caused by unhealthy working conditions, such as high noise, extreme temperatures, and physical fatigue, can reduce productivity by making employees less focused and more prone to errors. Good work environment management, including work safety, is essential to reduce stress, improve employee well-being, and productivity. Work accidents caused by unsafe behavior or substandard equipment can also hinder productivity, so work safety should be a top priority to improve efficiency and work results. Research shows that occupational safety has a direct effect on work productivity. Good work environment conditions can improve work health, which in turn increases productivity. Research also found that factors such as workload, work discomfort, work-related stress, and fatigue can affect work productivity [14]. Based on the background description, the study analyzes the influence of work environment factors on work productivity through work stress on workers in nickel mines".

2. MATERIALS AND METHODS

This study uses a combination method (Mixed Method), starting with the collection of quantitative data through measurements, and questionnaires analyzed using the amos application to see the relationship between variables. Qualitative data were collected through in-depth interviews with informants selected by purposive sampling, namely permanent employees with a minimum of five years of experience who are responsible for occupational safety and health. The population of this study was 161 nickel mining employees working in the factory area, and the instruments used included the 2018 Permenaker questionnaire for work stress, productivity questionnaire, NASA-TLX for mental workload, Sound Level Meter for noise, and Questem Test for thermal comfort. The collected data were analyzed using SPSS and the amos application to identify the relationship between work stress, productivity, and work environment conditions

3. RESULTS

The study was conducted at the nickel mine from September to October 2024, with 161 respondents representing the entire area of the company's factory.

Table 1. Distribution of Respondent Characteristics from Each Unit

Respondent Characteristics	Criteria	Diesel Power Plant	Rotary Dryer	Rotary Clinic	Smelting	Casting
Noise	Very high	30	32	33	33	33
	Tall	0	0	0	0	0
Working Climate	Very high	30	32	33	33	33
	Tall	0	0	0	0	0
Mental Workload	Heavy	10	22	28	30	28
	Light	20	10	5	3	5
Satisfaction with Superiors and Coworkers	Less satisfied	8	18	18	10	22
	Satisfied	22	14	15	23	11

Respondent Characteristics	Criteria	Diesel Power Plant	Rotary Dryer	Rotary Clinic	Smelting	Casting
Social Support	Not good	21	6	20	21	14
	Good	9	26	13	12	19
Job Stress	Severe Stress	12	6	31	29	16
	Mild Stress	18	26	2	4	17
Work Productivity	Low	10	12	29	22	17
	Tall	20	20	4	11	16

Table 1 shows data from five units in the nickel mine showing that the majority of respondents in each unit were exposed to working conditions that exceeded the threshold of noise and climate that were not in accordance with standards, with the percentage reaching 100% in each unit. This shows that noise and poor working climate can contribute to high mental workload, which is reflected in the large number of workers who experience high risk based on mental workload scores (≥50), especially in units such as Smelting and Casting, with a percentage reaching more than 90%. Although there are variations in the level of satisfaction with superiors and coworkers, social support, and work stress between units, most workers feel lesssatisfiedwith these conditions, and this has an impact on lower work productivity in many units, where most respondents rated their productivity as poor. This analysis highlights the importance of paying more attention to work environment factors, such as noise and climate, as well as stress management to improve worker well-being and productivity in companies.

3.1 Bivariate Analysis

The results of the crosstab between the independent variables and dependent variables are as follows.

Table 2. The relationship between noise and productivity

Occupational Noise	Work Productivity	
	Low	Tall
Very high	60	35
Tall	30	36
P-value	0.881	

Table 2 shows no significant relationship between noise exceeding NAB with level of work productivity, where the majority of respondents experienced very high levels.

Table 3. Relationship between work climate and productivity

Working Climate	Work Productivity	
	Low	Tall
Very high	60	35
Tall	30	36

P-value	0.599

Table 3 shows that the work climate that exceeds NAB is not significantly related to the level of work productivity, where the majority of respondents experienced very high levels, because the P value for work productivity is 0.599, which is greater than the significance limit (0.05).

Table 4. Relationship between Mental Workload and Productivity and Work Stress

Mental Workload	**Work Productivity**	
	Low	**Tall**
Heavy	74	45
Light	16	26
P-value	0.006	

Table 4 shows that high-risk mental workload is significantly associated withproductivitywork. The p-value for work stress is 0.006, which is smaller than 0.05, indicating a significant relationship between mental workload and job stress levels.productivity.

Table 5. Relationship between Satisfaction with Superiors and Coworkers with Productivity and Work Stress

Satisfaction with Superiors and Colleagues	**Work Productivity**	
	Low	**Tall**
Less satisfied	40	36
Satisfied	50	35
P-value	0.264	

Table 5 shows that satisfaction with superiors and coworkers does not have a significant relationship with productivity work stress, with a P-value of 0.264, which is greater than 0.05. This means that satisfaction with superiors and coworkers does not have a significant effect on productivity.

Table 6. Relationship between Social Support and Work Productivity and Stress

Social Support	**Work Productivity**	
	Low	**Tall**
Good	42	39
Not good	51	29
P-value	0.033	

The table shows that social support has a significant relationship with work productivity. The p-value of 0.033 shows that good social support is related to better work productivity. Conversely, poor social support is related to lower productivity, indicating that strong social support is essential to maintaining well-being and improving work performance.

Table 7. Relationship between Work Stress and Work Productivity

Job Stress	Work Productivity		P-Value
	Low	Tall	
Severe Stress	68	25	0.000
Mild Stress	22	46	
Total	90	71	

The table shows that there is a significant relationship between the level of work stress and work productivity with a P-value of 0.000 for productivity heavy.

3.2 Multivariate Analysis

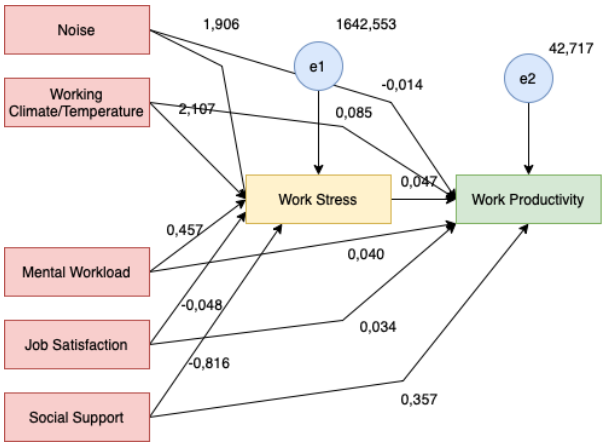

Figure 1. Direct Influence Model Construction

In seeing the significance of the direct influence on the structural model can be seen from the statistical value or p value in the table below

Table 8. Results of the Analysis of the Direct Influence

Influence	Estimate	SE	CR	P-Value
Noise → Job Stress	1,906	0.542	3,519	0,000
Working climate/temperature → Job Stress	2,107	0.991	2,126	0.033
Mental Workload → Work Stress	0.457	0.113	4,050	0,000
Job satisfaction → Work Stress	-0.048	0.150	-0.319	0.750
Social Support → Work Stress	-0.816	0.525	-1,556	0.120
Noise → Work Productivity	-0.014	0.091	-0.149	0.881

Working climate/temperature → Work Productivity	0.085	0.162	0.526	0.599
Mental Workload → Work Productivity	0.040	0.019	2,100	0.036
Job satisfaction → Work Productivity	0.034	0.024	1,386	0.166
Social Support → Work Productivity	0.357	0.085	4,190	0,000
Job Stress → Work Productivity	0.047	0.013	3,712	0,000

Table 8 shows the results of the analysis of the direct influence between independent variables, intervening variables, and variable dependent in nickel mining. The results of the analysis showed that noise has a significant positive effect on work stress (p-value 0.000) and a near significant effect on work productivity (p-value 0.881). Work climate shows a significant negative effect on work stress (p-value 0.000), but does not have a significant effect on work productivity (p-value 0.599). Mental workload shows a significant effect on work stress and work productivity, with p-values of 0.000 and 0.036, respectively. Satisfaction with superiors and coworkers does not have a significant effect on work productivity (p-value 0.166), and does not have an effect on work stress (p-value 0.750). Social support does not have a significant effect on work stress (p-value 0.120) and has a significant effect on work productivity (p-value 0.000), while work stress has a significant positive effect on work productivity (p-value 0.000). Overall, noise, work climate, mental workload, and social support affect work stress and work productivity, with social support and work stress having a significant impact on productivity.

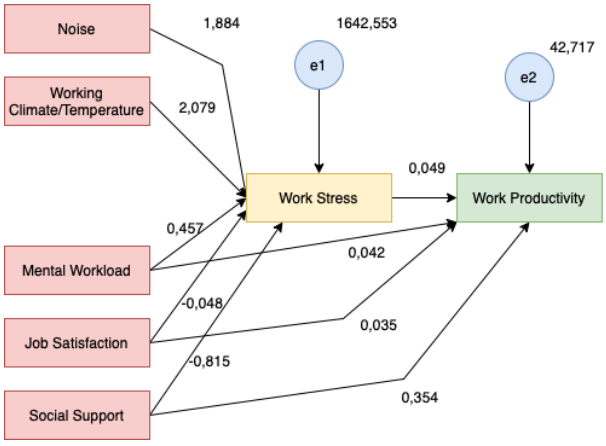

Figure 2. Inirect Influence Model

Table 9. Results of the Analysis of the Indirect Influence

Influence	Coefficient Path	P-value
Noise → Stress → Productivity	-0.090	0.003
Working climate/temperature → Stress → Productivity	0.100	0.008
Mental Workload → Stress → Productivity	0.022	0.003
Job satisfaction → Stress → Productivity	-0.002	0.631
Social Support → Stress → Productivity	-0.039	0.135

Table 9 shows the results of the analysis of the indirect influence between the independent variables and the dependent variables through the intervening variables on nickel mine workers. The results show that noise has a significant negative effect on work productivity through work stress (p-value 0.003), indicating that noise can affect work productivity by increasing work stress. Work climate also has a significant positive effect on work productivity through work stress (p-value 0.008), indicating that although work climate has a negative impact on stress, it leads to increased work productivity. Mental workload has a significant effect on work productivity through work stress (p-value 0.003), while satisfaction with superiors and coworkers also does not show a significant effect (p-value 0.631). Social support has a negative but insignificant effect on work productivity through work stress (p-value 0.135). Overall, noise, work climate, and mental workload show an indirect effect on work productivity through work stress, while social support and satisfaction with superiors and coworkers do not have a significant effect.

3.3 Qualitative Results

Based on the table above, it is known that the key informants in this study were 5 informants who were the five operational supervisors in each section of the nickel mine factory, while the 5 main informants were senior workers in each section of the nickel mine factory.

This study analyzed the mental workload of factory employees with a focus on working hours, common problems, mental activity, time pressure, and the effect of physical activity on stress. Working hours consisted of 3 shifts of 8 hours, with overtime as needed. Common problems included machine breakdowns, dust, and production failures, while mental activity was greater than physical, with high time pressure to achieve targets. Informants stated that work involving heavy lifting, extreme temperatures, and confined spaces contributed to physical stress. A balance between mental and physical work was considered important to maintain optimal productivity and performance, with informants stating: "Mental and physical work must go hand in hand so that work is completed efficiently and productivity is maintained" (MK, 38 years old), and "Heavy physical work in extreme temperatures causes stress and fatigue" (SP, 39 years old).

Social support received by factory employees includes emotional, appreciation, and instrumental support from family, friends, and coworkers, which help reduce stress and provide encouragement. Informants expressed that support such as "friends give encouragement and understanding" (S, 36 years old) and "family is always there to provide emotional support" (MK, 38 years old) are very meaningful in dealing with work pressure and personal problems.

Informants stated that although they tried hard to meet the targets, the results were not always as expected, as expressed by MK (38 years old), who said, “We try hard to comply with every regulation so that all machines can operate properly, but sometimes we cannot meet the targets due to technical problems.” In addition, the ability and professionalism of workers in completing tasks also greatly affect productivity. Most informants felt that they were not burdened by their tasks because they were used to it and had a sense of responsibility, as expressed by VM (48 years old), “The existing targets are not a burden for me, because I am used to the demands of the job and always try to be professional in completing tasks.” However, although some informants reported an increase in productivity, many felt that productivity remained stable without any significant changes in the past year.

Several informants revealed that they often felt irritable, annoyed, and anxious due to problems at work that were often exacerbated by time pressure and high workloads. For example, MK (38 years old) stated, "I feel annoyed at work, especially when there are problems at home and at work too," while S (36 years old) felt annoyed because of the difficulty in coordinating with coworkers. In addition, difficulty in relaxing was also a problem, where informants revealed that anxiety about unfinished work interfered with their rest time, both at work and at home. MAS (38 years old) said, "Stress and worry about work often make it difficult for me to sleep or really rest." The

pressure to complete work quickly also caused some informants to feel impatient and anxious, as expressed by SP (39 years old) who stated, "The work here has to be fast, but when technical problems arise, I get frustrated and impatient." All of these factors indicate that excessive work stress can interfere with workers' physical and mental well-being, which in turn affects their productivity.

DISCUSSION

4.1 The Effect of Noise on Work Productivity Through Work Stress in Nickel Mines

Noise in the workplace can come from various sources, such as machinery and heavy equipment, and can be above or below the threshold limit value (TLV). This noise has the potential to cause hearing loss and other health problems, such as Noise-Induced Hearing Loss (NIHL), stress, anxiety, impaired concentration, and decreased productivity. Daily exposure to noise above 65 dBA can affect the autonomic nervous system and effective communication. Noise factors in the work environment are influenced by acoustic and non-acoustic aspects. This study measured noise in five factory areas using a sound level meter at certain distances, with the results averaged to determine the noise point that affects worker productivity [15].

Noise in factories, caused by machines, equipment, production processes, and factory layout, can affect workers' health, including hearing loss and stress. Research in nickel mines shows that all workers are exposed to noise exceeding the NAB, with no significant relationship between noise and work productivity (p-value = 0.881) This is in line with research [16] that there is no relationship between noise and work productivity because the p value = 0.898 > 0.05 shows that noise does not contribute positively to productivity. Research results [17] shows thatNoise exposure in the workplace causes workers to feel more tired, lethargic, and sleepy, which impacts productivity. In factories, workers use ear plugs as hearing protection because they are more comfortable and allow them to hear communications, although ear muffs are more effective in reducing overall noise. Ear protection is essential to prevent noise-induced hearing loss.

4.2 The Influence of Work Climate on Work Productivity Through Work Stress in Nickel Mines

Working climate, Whichinfluenced by temperature, humidity, air velocity, and radiation, have a significant effect on worker health and performance. Comfortable temperatures for workers in Indonesia are between 24°C and 28°C, while temperatures above this limit can cause heat stress that reduces work efficiency. High humidity can worsen discomfort, especially in poorly ventilated environments (Asri et al., 2024). Research in nickel mines showed that all workers were exposed to temperatures exceeding the NAB, with 161 respondents exposed to hot temperatures, which have the potential to cause work stress. The results of the bivariate analysis showed no significant relationship with work productivity (p-value = 0.599).

This research is in line with research [18], that there is no significant influence of the work environment on labor productivity (p-value = 0.291 > 0.05). Although there is an influence of climate on productivity, the test results show that the physical environment does not support employees to work more optimally, so it does not have a significant effect. In addition, the study [19] also found that there is a significant relationship between work climate and work stress with (p-value = 0.022 < 0.05) the results show that work climate has an effect on work stress.

4.3 The Influence of Mental Workload on Work Productivity Through Work Stress in Nickel Mines

Workload in the workplace, whether light, moderate, or heavy, involves cognitive demands that affect individual performance. Mental workload, which includes decision-making, problem-solving, and stress management, is increasingly important in the modern technological era that increases cognitive demands on workers. Research at the Nickel Mine showed that the majority of respondents (92.5%) experienced heavy mental workload, which was significantly related to work productivity (p-value = 0.020). The results of the multivariate test showed that mental

workload had a direct effect on work productivity (p-value = 0.036).

This is in line with research [20] which states that mental workload is not a factor causing work stress, with a very weak correlation coefficient value of (p-value = 0.186 > 0.05). This research is in line with (Dewi et al., 2023) which shows a p-value of (p-value = 0.052 > 0.05), which shows that there is no significant relationship between mental workload and work stress. This study is not in line with the research [22] with path analysis where the influence of mental workload on work productivity was obtained that mental workload has a significant positive impact on work productivity on meter reading operators at PDAM Tirta Palembang. Mental workload is a mental condition experienced by workers when carrying out tasks, which includes cognitive aspects such as concentration, decision making, and attention. In addition, the study [23] also shows that mental workload has a significant effect on employee productivity, where high mental workload can reduce concentration and productivity. This is contrary to the results of other studies which state that mental workload does not have a significant effect on work stress and productivity.

4.4 The Influence of Superior and Co-Worker Satisfaction on Work Productivity Through Work Stress in Nickel Mines

The results of the analysis in Table 5 show that satisfaction with superiors and coworkers does not have a significant influence on the level of work productivity, because the P-value of 0.166 is greater than 0.05, which indicates that this factor does not contribute significantly to the stress experienced by workers.

The results of this analysis indicate that a good relationship between employees and their superiors and coworkers can contribute significantly to increasing work productivity. The higher the level of employee satisfaction with their superiors and coworkers, the more motivated they are to work more efficiently and enthusiastically. This satisfaction creates a more harmonious and supportive work atmosphere, so that employees feel appreciated and encouraged to give their best performance. Conversely, low satisfaction, either due to dissatisfaction with superiors or poor relationships with coworkers, can lead to decreased productivity. Discomfort in the work environment often gives rise to frustration, stress, and even reduces the desire to contribute optimally.

4.5 The Influence of Social Support on Work Productivity Through Work Stress in Nickel Mines

Social support plays an important role in individual well-being, especially infacestress and challenges, including emotional, informational, or instrumental support from family, friends, or colleagues. In a nickel mining factory, most workers (54%) felt that the social support they received was inadequate, which impacted their emotional and psychological well-being. The results of the analysis showed that social support had a significant relationship with work productivity (p-value = 0.000). Multivariate analysis revealed that social support directly increased work productivity (coefficient = 0.000).

This means that increasing social support can increase work stress, which in turn also increases work productivity. Multivariate analysis shows that social support has a direct effect on work productivity and also through work stress, which illustrates a partial mediation relationship. Although social support can reduce stress, sometimes its increase actually encourages workers to meet higher expectations, causing work stress to increase but still motivating them to be more productive. Lack of social support often occurs due to limited interaction with coworkers or superiors, lack of attention to emotional well-being, and a work culture that emphasizes results rather than worker life balance.

The results of Putriana et al.'s (2023) study also showed that the higher the social support received, the higher the work productivity, because social support increases workers' sense of connectedness, motivation, and emotional well-being, which encourages them to work more efficiently and reduces stress. Other research by[24]shows that social support not only increases job satisfaction but also contributes to overall employee performance.

4.6 The Effect of Work Stress on Work Productivity in Nickel Mines

Work stress has a significant impact on employees' physical and mental health, as well as productivity. Research at Nickel Mine shows that most employees experience moderate to severe work stress, caused by additional tasks, excessive working hours, and production target pressure. Symptoms of stress include physical fatigue, sleep disturbances, anxiety, and difficulty concentrating. Work stress has been shown to have a significant relationship with work productivity. Although it can boost motivation, excessive stress is detrimental to employee health and performance. Therefore, companies need to manage stress-causing factors and provide social support to maintain employee well-being and performance. This study shows that the third shift, from 12 midnight to 8 am, causes the highest work stress due to sleep pattern disturbances, changes in biological clocks, and quieter working conditions that increase physical and mental fatigue.

This research is not in line with research [25], where based on the results of the analysis it shows that work stress does not have a significant effect on work productivity, which can be seen in several studies with (p-value = 0.645 > 0.05). This is also not in line with research [26], found a very significant negative relationship between work stress and productivity with (p-value = 0.514 > 0.05), where the higher the stress level, the lower the employee productivity. This shows a difference in results between the study and studies that stated no significant effect.

5. CONCLUSION

The study concludes that mental workload, social support, and work stress significantly influence work productivity, as evidenced by both bivariate and multivariate analyses. These findings are further reinforced by qualitative data from interviews, which highlight key contributing factors. Mental workload is shaped by aspects such as working time, mental activity, and time pressure, all of which impact performance and physical exertion. Meanwhile, social support plays a crucial role through emotional encouragement, reward recognition, and instrumental assistance, which help employees manage stress and maintain productivity. The interplay of these factors underscores the importance of a well-balanced work environment that mitigates excessive mental strain while fostering supportive workplace relationships.

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REFERENCES

[1] X. Zhang, J. Du, and D. Chow, “Association between perceived indoor environmental characteristics and occupants ’ mental well-being , cognitive performance , productivity , satisfaction in workplaces : A systematic review,” *Build. Environ.*, vol. 246, no. June, p. 110985, 2023, doi: 10.1016/j.buildenv.2023.110985.

[2] F. Pega *et al.*, “Assessing the quality of evidence in studies estimating prevalence of exposure to occupational risk factors: The QoE-SPEO approach applied in the systematic reviews from the WHO/ILO Joint Estimates of the Work-related burden of disease and Injury,” *Environ. Int.*, vol. 161, no. February 2020, p. 107136, 2022, doi: 10.1016/j.envint.2022.107136.

[3] H. V. Neto, “Assessment of psychosocial risks at work in supervisors of clothing stores during the pandemic context,” *Saf. Sci.*, vol. 175, no. March, 2024, doi: 10.1016/j.ssci.2024.106484.

[4] O. Rikhotso, T. J. Morodi, and D. M. Masekameni, “Health risk management cost items imposed by Occupational Health and Safety Regulations: A South African perspective,” *Saf. Sci.*, vol. 150, p. 105707, 2022, doi: 10.1016/j.ssci.2022.105707.

[5] M. Syahrul, M. N. M. R, and M. Irfan, “Efforts to Improve the Feasibility and Comfort of PPE Use in School

Building Construction Project Workers," *Semin. Nas. Pengabdi. Kpd. Masy. 2022*, 2022.

[6] A. Anjum and X. Ming, "Combating toxic workplace environments," *J. Pemodelan dalam Manaj.*, vol. Vol. 13 No, pp. 675–697, 2018.

[7] F. I. K. Ningrum, A. S. Marsanti, and P. A. Wibowo, "Relationship between Noise Intensity and Work Stress among Production Workers," *Open J. Syst.*, vol. 17, no. 1978, pp. 253–262, 2022.

[8] H. ALI and S. MULYATI, "Analysis Of Engine Noise Level Of Stone Crusher And Work Stress Year 2018," *JNPH*, vol. 8, no. 1, pp. 37–42, 2020.

[9] Tarwaka, S. HA.Bakri, and L. Sudiajeng, *Ergonomics for Occupational Safety, Health and Productivity*. Surakarta, 2004.

[10] C. Z. De Lima, J. R. Buzan, F. C. Moore, U. L. C. Baldos, M. Huber, and T. W. Hertel, "Heat stress on agricultural workers exacerbates crop impacts of climate change," *Environ. Res. Lett.*, vol. 16, no. 4, 2021, doi: 10.1088/1748-9326/abeb9f.

[11] A. S. Katz, N. Pronk, D. Mclellan, J. Dennerlein, and J. Katz, "Perceived Workplace Health and Safety Climate: Associations with Worker Outcomes and Productivity.," *Am. J. Prev. Med.*, 2019.

[12] P. D. Adriyani and I. G. A. M. Dewi, "The Effect of Organizational Climate, Work Motivation, and Job Stress on Employee Job Satisfaction," vol. 9, no. 10, pp. 3463–3485, 2020.

[13] R. N. Siswadi, M. Muis, Y. Thamrin, and S. Syamsiar. (2024). The Effects Of Work Stress And Workload On Job Satisfaction With Its Impact On Employee Performance At Pt . Industrial Kapal Indonesia (Persero)," pp. 1–13, 2024.

[14] Selviana, "The Importance of OHS (Occupational Health and Safety) in Improving Work Productivity," *Jurnal Ilmiah Terapan 2477-1686*, 2017. .

[15] H. Sasmita, S. Sapriana, H. Hasanudin, and E. Agustina, "Overview of Noise and Community Complaints around PT. Martadinata Indah Mine Alindau Donggala Regency," *Banua J. Kesehat. Lingkung.*, vol. 1, no. 2, pp. 40–45, 2021, doi: 10.33860/bjkl.v1i2.630.

[16] N. Nasrullah, "The Effect of Noise Intensity and Hearing Loss on Work Productivity at Pt. Pln (Persero) Punagaya Generating Sector," *J. Ilm. Kesehat. Diagnosis*, vol. 14, no. 2, pp. 113–117, 2019, doi: 10.35892/jikd.v14i2.136.

[17] R. F. Madvari, H. Bidel, A. Mehri, F. Babaee, and F. Laal, "Analysis of the Relationships between Noise Exposure and Stress/Arousal Mood at Different Levels of Workload," *Sound Vib.*, vol. 58, pp. 119–131, 2024, doi: 10.32604/sv.2024.048861.

[18] R. Purwati and D. Damayanti, "The Effect of Wages, Work Environment and Work Climate on Labor Productivity at PT. BPR Prima," *J. Ilm. Bid. Manaj. dan Bisnis*, vol. 6, no. 10, pp. 4–7, 2023.

[19] M. Setiani and S. Samsiyah, "The Effect of Workload and Organizational Climate on Job Stress of Production Employees Pt. Surya," *J. Sustain. Bus. Res.*, vol. 2, no. 1, pp. 119–126, 2021.

[20]Hanif Rizqi Diniari, "Analysis of Work Stress Due to Mental Workload on Pt. Kerta Rajasa Raya," *MTPH J.*, vol. 3, no. 2, pp. 133–140, 2019.

[21] A. B. C. Dewi, S. Rachmawati, and A. F. K. Wardani, "Mental Workload ' S Impact On Work Stress Among Women," *J. Ind. Hyg. Occup. Heal.*, vol. 8, no. 1, pp. 50–62, 2023.

[22] M. R. Octaviaji and R. A. Hidayati, "Mental Workload Analysis of Employees in Pt. Abc Using the Nasa-Tlx

Method," *J. Ilm. Manaj.*, vol. 5, no. 1, pp. 44–53, 2024.

[23] O. C. T. Hartati, L. D. Fathimahhayati, and S. Gunawan, "Analysis of the Effect of Workload on Plywood Employee Productivity by Energy Consumption Method and Nasa-Tlx," *Arika*, vol. 16, no. 2, 2022.

[24] R. Loliyani, R. Loliyana, and S. Enzovani, "The Effect of Social Support, Perceived Organizational Support on Job satisfaction and Performance at PT. Budi Berlian Sejahtera," *J. Manaj. dan Bisnis*, vol. 5, no. April, pp. 101–119, 2024.

[25] A. R. Kamiluddin and Fitriyani Syukri, "The Effect Of Work Spirit And Work Stress On The Work Productivity Of Employee At Pt Pln (Persero) Unit Pelaksana Pelayanan Pelanggan (Up3) Pinrang," *J. Ekon. dan Bisnis*, vol. 3, pp. 164–170, 2022.

[26] N. E. Saputri, "Relationship between Job Stress and Employee Productivity," 2012.