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Quantitative Research Article

Psychosocial Determinants, Physical Work Environment, and Workload on the Performance of Production Workers at PT X, Depok City in 2024

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Abstract

Background/ problem: Performance is a crucial factor in supporting the achievement of company goals. The average performance evaluation of PT X employees in 2024 decreased by 60 points compared to the previous year. Therefore, it is necessary to examine psychosocial factors, the work environment, and workload that are suspected to influence employee performance.

Objective/ purpose: This study aims to analyze the relationship between psychosocial determinants, the physical work environment, and workload on the performance of production workers at PT X Depok

Design and Methodology: Cross-sectional design was applied, involving 61 respondents of total workers. Primary data were collected via interviews and observations using Individual Work Performance Questionnaire (IWPQ), Workplace Stress Scale, Minnesota Satisfaction Questionnaire, and NASA-TLX questionnaire, Physical workload was measured by Pulse Oximeter assessment, WBGT meter to assess the physical work environment such as temperature, humidity, lux meter for lighting

Results: The results showed that psychosocial determinants, particularly job stress (p=0.042) and job satisfaction (p=0.013), were significantly related to performance. However, temperature (p=0.620), humidity (p=0.213), lighting (p=0.980), mental workload (p=0.441), and physical workload (p=0.451) did not show a significant relationship with performance.

Conclusion and Implications: The study concluded thats job stress and job satisfaction were recommended that companies conduct regular stress management training and conduct regular job satisfaction surveys.

Introduction

Human resources are a vital asset for a company and play a crucial role in achieving its goals, namely achieving maximum results to meet company targets. Effective HR management strives to

encourage employees to improve their performance. Employee performance is the actions taken by employees to achieve specific results within a specific period and can be measured by comparing the time they carry out tasks and complete assigned responsibilities (Hidayat and Taufiq, 2012; Arisanti, Santoso, and Wahyuni, 2019). High performance supports the achievement of company goals, while low performance can negatively impact the company, such as hindering the achievement of company goals and reducing desired target results (Kanda and Firmansyah, 2024). Employee performance can be influenced by various factors, including individual, organizational, and work-related factors. Other factors that influence performance include the physical and psychosocial work environment (Anissa and Soetjiningsih, 2022).

PT X, a clean water provider in Depok City, relies heavily on the performance of its production employees in providing clean water for customers to achieve its company targets. Management evaluation results showed that employee performance at PT X declined by 50 points in 2024. While this figure is not significant, it presents a challenge for the company to maintain targets and improve employee performance. According to Sihaloho, declining employee performance can be caused by an unsupportive physical and non-physical work environment (Sihaloho and Siregar, 2019).

An Observations PT X' employee work environment, which is suspected of affecting performance, included: the water treatment plant is located near a water source, but the space is enclosed and has limited ventilation, resulting in hot and humid temperatures. The laboratory unit, which monitors water production and quality, is considered poorly lit, raising employee concerns about workplace safety and doubts about the accuracy of water product test results, which can lead to customer complaints. The preliminary studies identified several factors affecting employee performance like as wark environment factor, psychosocial and stress factors. Based on this background, the purpose of this study is to determine psychosocial determinants, physical work environment, and workload on the performance of production workers at PT X, Depok City

Methods

Research Design

This study used a cross-sectional research design to determine the determinants of Psychosocial, Physical Work Environment, and Workload on the Performance of Production Workers at PT X, Depok City in 2024. This research design is considered appropriate because the assessment of related factors is carried out simultaneously so that data can be obtained quickly and remains accurate.

Research Setting

This study was conducted on production workers at PT X, Depok City, in March 2024. The research location is the centre of employee activities at work, so it is an appropriate reference location in describing the work and daily activities of employees.

Participants/ Sample

The population of this study was 61 employees in the production division who work in processing drinking water from the source into drinking water that is ready to be distributed to the community.

Sampling and Sample Procedures

Sampling was conducted using total sampling, meaning all production employees were recruited as respondents. This technique ensures that the sample is directly involved in the decline in the company's performance targets.

The number of employees (population) is only 61 people, so required to use the Lameshow Formula with Finite Population Correction for small populations. The first step is to calculate the sample size as if the population were large (infinite population). Based on data N: 61 df: 95%, P: 0,5 Z: 1,96, d:0,05 we found sample number n: 384. The second step is calculations for small populations. Because n (384.16) is much larger than the total population (N=61), so apply the Finite Population Correction. at the results of calculating the minimum sample size for the study is N: 52,6 or 53. Buit for increasing of validity and power,the final sample 61 respondents who agreed to this study.

Instruments and Procedures

Individual Work Performance Questionnaire (IWPQ) was measured using The IWPQ questionnaire. This questionare has been adapted into Indonesian by Widyastuti and Hidayat (2018) to measure employee performance. The questionnaire consists of 18 questions with answer options using a Likert scale from 0 to 4. Answer options include rarely (0), sometimes (1), often (2), very often (3), and always (4). The scores from the IWPQ questionnaire are grouped into 1) Very low performance (score ≤ 6.025) 2) Low performance (score 6.026-6.90) 3) Average performance (score 6.91-9.45)4) High performance (score 9.46-10.65) Very high performance (score ≥ 10.66)

Work stress was measured using The Workplace Stress Scale is a questionnaire for measuring work stress developed by The Marlin Company and the American Institute of Stress (2001). This questionnaire has been adapted into Indonesian by Putri Kinasih, Kinalih dan Yunia (Putri ,2024) for a screening tool for stressor and stress perception. This questionnaire consists of eight questions using a Likert scale of 1-5, namely never (1), rarely (2), sometimes (3), often (4), and very often (5). The score readings are: 1) No stress (score ≤ 15) 2) Low stress (score 16-20) 3) Moderate stress (score 21-25) 4) Severe stress (score 26-30) 5) Very severe stress (score 31-40)

Job satiffication was measured using Minnesota Satisfaction Questionnaire the Minnesota Satisfaction Questionnaire is a method created by Weiss et al. in 1967 to measure employee job satisfaction. This questionnaire has been adapted into Indonesian by Danang Jaka Sutama (Sutama, 2007). The questionnaire contains 20 questions related to intrinsic and extrinsic factors of job satisfaction. Questions are on a Likert scale of 1-5 consisting of 5 choices, including very dissatisfied (1), dissatisfied (2), neutral (3), satisfied (4), very satisfied (5). The results of filling out the questionnaire are calculated by adding up the average answers to each question item using the equation: Q = Q1 + Q2 + Q3 +…. + Q19 + Q20 Where: Q = total job satisfaction score.

Mental workload was measured using NASA-TLX Questionnaire The NASA-TLX questionnaire is a method used to measure mental workload in workers. This questionnaire has been adapted into Indonesian by local researchers. The NASA-TLX questionnaire used in this study consists of six subscales: mental demands, physical demands, temporal demands, own performance, effort, and frustrations. The NASA-TLX method involves weighting and rating. Weighting is done by each worker selecting one of two factors that they believe contributes to their workload. Rating is done by workers assessing each of the six available subscales. After all stages are completed, the results of the weighting and rating are entered into the workload formula to determine the extent of the mental workload experienced by the worker. After each worker's mental workload score is obtained, the next step is to categorize the results into the following categories: 1) Light (Score <50) 2) Moderate (Score 50-80) 3) Heavy (Score >80)

To measure temperature, humidity, and lighting, measuring instruments are used. The measuring instrument used is a Heat Stress WBGT Meter to measure temperature and humidity. Meanwhile, to measure lighting, a lux meter is used. In addition, to measure physical workload, pulse oximeters are also used.

Data Analysis

Univariate analysis was performed to see the distribution and frequency of each variable

Bivariate analysis was performed to see the statistical association (p-value) between the independent variables and dependent variables. The statistical test used was Chi-square with an alpha of 0.05.

Ethical Considerations

This research has been approved by the Research Ethics Committee of the Veteran National Development University, Jakarta, with the number: 468/XI/2024/KEP.

Results

This study sample consisted of all employees in PT X Depok City. The worker performance average is 33 (54,1) and work stress Low is 29 (47,5) (Table 1).

Table 1. Distribution and Frequency of The Variables

Variable	n (61)	Percentage (%)
Worker Performance		
Very Low	5	8.2
Low	10	16.4
Average	**33**	**54.1**
High	7	11.5
Very High	6	9.8
Work stress		
Not Stressed	14	23.0
Low	**29**	**47.5**
Moderate	17	27.9
Severe	1	1.6
Job Satisfaction		
Low	29	47.5
High	**32**	**52.5**
Temperature		
Not Standard Compliant	35	57.4
Standard Compliant	26	42.6
Humidity		
Not Standard Compliant	22	36.1
Standard Compliant	39	63.9
Lighting		
Below NAB (<300 lux)	**57**	**93.4**
Standard Compliant (300–500 lux)	4	6.6
Mental Workload		
Light	1	1.6
Moderate	15	24.6
Heavy	45	73.8
Physical Workload		
Light	59	96.7
Moderate	2	3.3

Univariat analysis

The distribution and frequency results show that 33 out of 61 respondents (54.1%) were in the Average performance category. The distribution and frequency results for work stress show that 29 out of 61 respondents (47.5%) experienced a Low level of work stress[50]. Meanwhile, the results for job satisfaction show that 32 out of 61 respondents (52.5%) indicated a high level of satisfaction with their jobs[51]. Variables of the temperature of the work environment show that 35 workers (57.4%) worked in conditions not compliant with the standard[53]. Conversely, 39 workers (63.9%) were in a workplace where the humidity was standard compliant[54]. It was also found that 57 workers (93.4%) worked in lighting intensity conditions below 300 lux (Below NAB)[55]. The results for mental workload show that 45 out of 61 respondents (73.8%) had a mental workload in the Heavy category[57]. Meanwhile, the results for physical workload indicate that 59 out of 61 respondents (96.7%) had a physical workload in the Light category[58].

Bivariate Analysis

Tabel 2. Bivariate Analysis

Variabel	Kinerja Pekerja						Total		P-value
	Rendah		Cukup		Tinggi				
	N	%	N	%	N	%	N	%	
Determinan Psikososial									
Stres Kerja								100	
Tidak Stres	1	7,1	7	50,0	6	42,9	14		0,042
Stres	14	29,8	26	55,3	7	14,9	47	100	
Kepuasan Kerja									
Rendah	12	41,4	13	44,8	4	13,8	29		0,013
Tinggi	3	9,4	20	62,5	9	28,1	32	100	
Lingkungan Kerja Fisik									
Suhu									
Tidak sesuai standar	8	22,9	18	51,4	9	25,7	35	100	0,620
Sesuai standar	7	26,9	15	57,7	4	15,4	26	100	
Kelembaban									
Tidak sesuai standar	6	27,3	14	63,6	2	9,1	22	100	0,213
Sesuai standar	9	23,1	19	48,7	11	28,2	39	100	
Pencahayaan									
Di bawah NAB (<300 lux)	14	24,6	31	54,4	12	21,1	57	100	0,980
Sesuai NAB (300– 500 lux)	1	25,0	2	50,0	1	25,0	4	100	
Beban Kerja									
Beban Kerja Mental									
Ringan	0	0	0	0	1	100	1	100	
Sedang	4	26,7	9	60,0	2	13,3	15	100	0,441
Berat	11	24,4	24	53,3	10	22,2	45	100	
Beban Kerja Fisik									
Ringan	15	25,4	32	54,2	12	20,3	59		0,451
Berat	0	0	1	50,0	1	50,0	2	100	

Discussion of Main Results

The bivariate analysis results for the psychosocial determinants show that 55.3% of workers experiencing work stress had average performance, with a *p- value* = 0,042 (< 0,05) indicating a statistically significant relationship between work stress and worker performance[61]. This finding is consistent with previous research stating that work stress has a significant relationship with worker performance (Arwidiana and Citrawati, 2023)[62]. Workers who continuously experience work stress over a long period can experience decreased performance due to a feeling of pressure in carrying out their work (Wirya, Andiani and Telagawathi, 2020) [63], often leading to a lack of enthusiasm, irritability, difficulty sleeping, and digestive problems, ultimately resulting in unproductivity and performance decline (Saragih and Siahaan, 2021)[64]. The level of stress varies among workers, and the impact, including the effect on performance, also differs (Valencia and Rinamurti, 2024)[65]. The influence of work stress on performance is highly affected by everyone's coping mechanism; if an individual's resistance to stress is low, it can negatively impact performance (Buulolo, Dakhi and Zalogo, 2021)[66]. Work stress is divided into adaptive stress, which encourages workers to have innovative ideas and enthusiasm, and maladaptive stress, which tends to cause under stimulation because the worker feels physically and mentally pressured, leading to a decrease in performance (Arwidiana and Citrawati, 2023)[67]. In the production workers at PT X, the majority (47.5%) experienced low work stress, likely because workers often have full control over their work, aligning with research indicating that job control can reduce the impact of work pressure that may cause work stress (Adithia and Widanarko, 2019)[68].

Additionally, the analysis of psychosocial determinants also shows that 62.5% of workers with a high level of job satisfaction had average performance, with a *p- value* = 0,013 (< 0,05) indicating a statistically significant relationship between job satisfaction and worker performance[69]. This result is consistent with previous research stating that job satisfaction is related to worker performance (Herman and Ardhyanie, 2019; Widayanti and Widiastini, 2021)[70]. Job satisfaction, as a worker's emotional feeling toward their work (Hendrayana, Wimba and Sugianingrat, 2021) [71], encourages workers who feel satisfied with their job to enjoy performing their tasks (Suryani, 2022)[72]. Job satisfaction can be achieved if workers feel they are receiving their rights after fulfilling their responsibilities to the company (Widayanti and Widiastini, 2021)[73]. Satisfaction is created by a good response from the company to the work results delivered by the worker (Paparang, Areros and Tatimu, 2021)[74]. Job satisfaction is influenced by financial satisfaction, physical satisfaction, social satisfaction, and psychological satisfaction; however, among these factors, the majority of job satisfaction is strongly influenced by financial satisfaction factors, such as allowances provided by the company, including salary, holiday, or position allowances[75]. This is in line with the research results showing that the majority of workers stated they were satisfied with the salary received according to the work performed, thereby increasing work productivity[76].

Meanwhile, the bivariate analysis results for the physical work environment variable, specifically temperature, show that 51.4% of workers working in conditions of non-standard compliant temperature had average performance, with a *p-value* = 0,620 (> 0.05) indicating **no statistically significant relationship** between temperature and worker performance[77]. This is possibly because workers have adapted to the environmental conditions[78]. Nevertheless, ambient temperature remains an aspect that needs attention in the workplace because different temperature levels have varying effects on workers, depending on each worker's adaptation capability (Tasyania *et al.*, 2022)[79]. Air temperature affects the human body as the body attempts to maintain a balance between body heat and the surrounding air temperature (Pratama and Siahaan, 2017)[80]. A consistently non-compliant working environment temperature forces the body to

adjust, which can lead to dehydration, fatigue, loss of focus, discomfort, and increased emotional levels, ultimately impacting worker performance (Saefullah and Basrowi, 2022)[81].

Air humidity, as another element in the physical work environment, also requires attention[82]. According to Minister of Manpower Regulation No. 5 of 2018, the standard range for workplace humidity is 40%-60%[83]. The analysis show that 48.7% of workers worked in standard compliant humidity conditions with average performance and a *p-value* = 0,213 (> 0.05) indicating that humidity met the standard and did not directly affect worker performance[84]. This finding is consistent with previous research stating that humidity does not have a direct effect on performance but still requires monitoring to prevent negative impacts on worker health (Lagu, Wahyuni and Joegjiantoro, 2024)[85]. This is because each worker has different levels of immune resistance, and non-compliant humidity can cause health problems (Pratama and Siahaan, 2017)[86].

Besides temperature and humidity, lighting is also an important aspect of the physical work environment[87]. The analysis results show that most workers (54.4%) worked in lighting conditions below the Threshold Limit Value (NAB) (<300 lux) with average performance[88]. A p-*value* = 0,980 indicates no statistically significant relationship between lighting and worker performance[89]. Workers who are accustomed to working with both ideal and non-ideal lighting tend to not have their performance affected (Ayu and Solo, 2023)[90]. Lighting below the NAB can be influenced by the amount of lighting, and the size and layout of the room, which affect the intensity level (Wijanarko *et al.*, 2024)[91]. Previous research also suggests that inadequate lighting can be caused by differences in bulb color or damaged lights, making the light less clear (Pratama and Siahaan, 2017)[92]. Although workers may be accustomed to it, the company must still pay attention to lighting to provide comfort for workers and ensure that the work environment does not cause negative impacts on worker performance (Fauziah and Isyanto, 2024)[93].

Furthermore, workload is a factor no less important in influencing worker performance, encompassing both mental and physical workload[94]. The workload received by workers is adjusted to their field of work and capability, so it is neither too little nor too much (Apriliani, Sutrisna and Asyiah, 2023)[95]. Continuous excessive workload risks performance decline because there are too many tasks to complete, causing workers to lose focus and experience stress (Latifa and Rojuaniah, 2022)[96]. Conversely, a workload that is too little can cause boredom, leading workers to lose motivation to improve their performance (Apriliani, Sutrisna and Asyiah, 2023)[97]. The analysis results show that average performance was found in workers receiving a heavy mental workload (53.3%) and a light physical workload (54.2%), with *p-value* masing-masing 0,441 dan 0,451 respectively, indicating no statistically significant relationship with worker performance[98]. Although most workers experienced a heavy mental workload, they were still able to complete their tasks because the job demands were not perceived as a heavy burden but rather as a responsibility (Nurwahyuni, 2019)[99]. Additionally, workers' adaptability plays a role in maintaining performance (Syam, Widiawati and Nurhaeda, 2023)[100].

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Limitations

Sources of information bias may occur when measuring variables such as Job Satisfaction questionnaires, works stress questionnaire, may be influenced by honesty and perceptions of severity, which may vary among respondents... There are still other important variables that may be theoretically related to work performance that were not measured in this study, such as salary, work regulation, daily working hours.

Conclusion

Based on the results of a study with 61 respondents regarding the psychosocial determinants, physical work environment, and workload on the performance of production workers at PT X, Depok City, in 2024, it can be concluded that production workers at PT X, Depok City, had an average performance of

54.1%. Most workers' work stress levels were in the low category, with high levels of job satisfaction. Most work environment temperatures and lighting did not meet applicable standards, although humidity levels did. Many mental workloads were heavy, while physical workloads were light.

This study found that psychosocial determinants, namely work stress (p-value = 0.042) and job satisfaction (p-value = 0.013), were related to worker performance. Meanwhile, the physical work environment, such as temperature (p-value = 0.620), humidity (p-value = 0.213), and lighting (p-value = 0.980), showed no relationship to worker performance. Furthermore, mental workload (p-value = 0.441) and physical workload (p-value = 0.451) also had no relationship with worker performance. These results indicate the importance of paying attention to psychosocial aspects to improve the performance of production workers at PT X, Depok City.

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Declarations

Conflicts of Interest: No conflicts of interest.

Ethical Approval Statement: The study was conducted in accordance with the Declaration of Helsinki and approved by the Research Ethics Committee of the Universitas Pembangunan Nasional Veteran Jakarta, number: 468/VI/2025/KEP for studies involving humans.

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