

## The Effect of Noise and Work Fatigue on Work Productivity: Work Stress as a Mediator Among Airport Workers

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### KEYWORDS

Noise, work stress, work fatigue, work productivity

### ABSTRACT:

**Introduction:** One of the main problems at the airport is noise, which is an irregular wave that can endanger workers and the environment.

**Objectives:** The purpose of this research is to determine the effect of noise on work productivity through work stress and work fatigue as intervening variables among apron workers at Airport.

**Methods:** The method used is a quantitative research method with a cross-sectional study approach. Data collection from 101 respondents using the Depression Anxiety Stress Scales (DASS)-21 questionnaire, the Work Fatigue Scale questionnaire, the productivity questionnaire, and noise measurement using a Sound Level Meter. (SLM).

**Results:** The results show a significant direct effect of noise on work stress (C.R=3.261) and (p=0.001) indicating a significant effect, then a direct effect of work stress on work productivity (C.R=-3.056) and (p=0.002) indicating a significant negative effect. Additionally, there is a direct effect of work fatigue on work stress (C.R=2.519) and (p=0.012) indicating a significant effect. Meanwhile, through the analysis of indirect effects with work stress as a mediator, it was found that there is a significant effect of noise on work productivity (p=0.026) and (z-sobel= -2.232).

**Conclusions:** work stress has a significant influence in mediating the effect of noise on work productivity.

### 1. Introduction

Noise is an irregular, unwanted wave that is generally unavoidable and often generated and disseminated in industries, which can affect human health and environmental comfort, as well as cause discomfort to workers who hear the sound (Alimoradi et al., 2020). Noise is the most common source of disturbance in the workplace, and the environmental noise perceived by workers has a negative impact on their performance (Otterbring et al., 2020).

The World Health Organization (WHO) estimates that 100 million EU citizens, or one in five persons, are exposed to aviation traffic noise, which can impair hearing, impair performance, provoke disturbance responses, and alter social behavior. Both industrial operations and modes of mobility are

the sources of noise (WHO, 2010). According to the National Occupational Safety and Health Administration (OSHA, 2008) and the National Institute for Deafness and Communication Disorders (2008), about 30–40 million Americans are subjected to noise that disrupts their hearing.

One stressor that has been shown to have an effect on people's social behavior and general well-being is aircraft noise, especially for airport workers and the surrounding community. Among all other modes of transportation, aircraft noise remains the most harmful cause of noise pollution to human health (Faiyetole, 2021). Continuous noise exposure has an influence on workers' psychological health in addition to their hearing, therefore the negative health effects of noise are not just restricted to hearing impairment (Alves et al., 2020).

The psychological impact of noise can cause stress if the sound is unwanted and disturbing, leading to unpleasant feelings and potentially causing workers to experience fatigue. This triggers emotional disturbances due to the stress experienced by workers, thereby endangering the safety of the workforce (Lawn et al., 2020). Fatigue shows physical and mental differences, but all of its consequences lead to a decrease in energy and a reduction in the body's endurance at work. In the apron area, the noise intensity is quite high due to several types of work that generate noise. Workers will feel fatigued if exposed to noise (Syamsiar et al., 2019). Such working conditions can cause stress among workers, impacting their health, reducing flight efficiency and safety, as well as organizational performance (Amornpipat, 2020). According to a Families and Work Institute poll, 25% of employees frequently experience stress or weariness at work. According to research from Yale University, noisy machinery causes 29% of employees to feel extremely anxious at work (Ningrum et al., 2021). Starting with their job procedures, equipment, and surroundings, Apron employees are exposed to a considerable risk of dangers. This section's work environment requires care because of the high level of noise, which calls for safeguards to shield employees from health issues brought on by workplace noise (Syafitri et al., 2021). A company that focuses on safety protects its workers and creates a positive work culture, which can enhance job satisfaction and performance (Bhatti, 2024). The need for supervision when workers are performing their tasks to ensure that they are following the work instructions set by the company. Sanctions can make workers pay attention to their health while working (Bakhtiar et al., 2023).

Research (Lewandowska et al., 2020) reveals that noise originating from the environment significantly affects workers' health and fatigue, indicating the need for effective noise management. Research (Monazzam Esmailpour et al., 2022) reveals that noise in the workplace can cause workers to experience stress and a decline in health, which can result in decreased concentration and productivity among workers. Consequently, the study's findings show a strong correlation between noise levels and productivity at work. The work ability index drops by 0.157 for every dB increase in noise exposure. This is further supported by research (Rahayu & Cahyadi, 2020), which found that noise has a significant impact on job productivity (98.3%). Occupational diseases and work-related dangers may rise as a result of aviation's quick expansion. Equipment, industry, materials, procedures, labor practices, and the workplace all provide potential risks. With work stress acting as a mediator among airport employees, the study aims to investigate the effects of noise and weariness on productivity.

## **2. Objectives**

The purpose of this research is to determine the effect of noise on work productivity through work stress and work fatigue as intervening variables among apron workers at Airport

## **3. Methods**

### **Type of Research**

The type of research used in this study is quantitative research using a cross-sectional study approach. This research was conducted over a period of 60 days.

### **Participants**

Apron workers experience noise impact due to activities at the airport, so the research was conducted at one of the airports in Makassar City (Indonesia) with 101 apron worker respondents. This research was conducted in accordance with the principles of the National Commission for Health Research

Ethics and approved by the ethics committee of Hasanuddin University, Indonesia. After the research is completed, the researchers provide their respective results.

### Study environment

The apron work environment at the airport is an area filled with aircraft activities during landing and takeoff. The airport that is the location of this study has a work environment noise level that exceeds the Threshold Limit Value (TLV), and the workers are insufficiently using Hearing Protection Devices (HPD) while working. Additionally, the workers also work under poor weather conditions.

### Data Collection

The data collected in this study includes secondary and primary data. Secondary data was obtained from literature studies or institutions related to this research. Primary data is data obtained directly by the researcher and from respondents (samples), specifically in measuring the noise level of the work environment. The instrument used in this study is the Sound Level Meter (SLM)

### Questionnaire

#### Work Stress

The measurement of work stress is to observe the interaction between workers and the environment that affects emotions, restlessness, tension, and also feelings of worry, measured using the Depression Anxiety Stress Scales (DASS)-21 questionnaire with a total of 21 questions. This questionnaire was developed by the researcher and several related lecturers, and has undergone validity and reliability tests before being given to respondents.

#### Work Fatigue

Work fatigue in this study refers to complaints related to work fatigue experienced by workers, measured using the Work Fatigue Measurement Tool Questionnaire (KAUPK2) with a total of 17 questions. This questionnaire was developed by the researcher and several related lecturers, and has undergone validity and reliability testing before being administered to respondents.

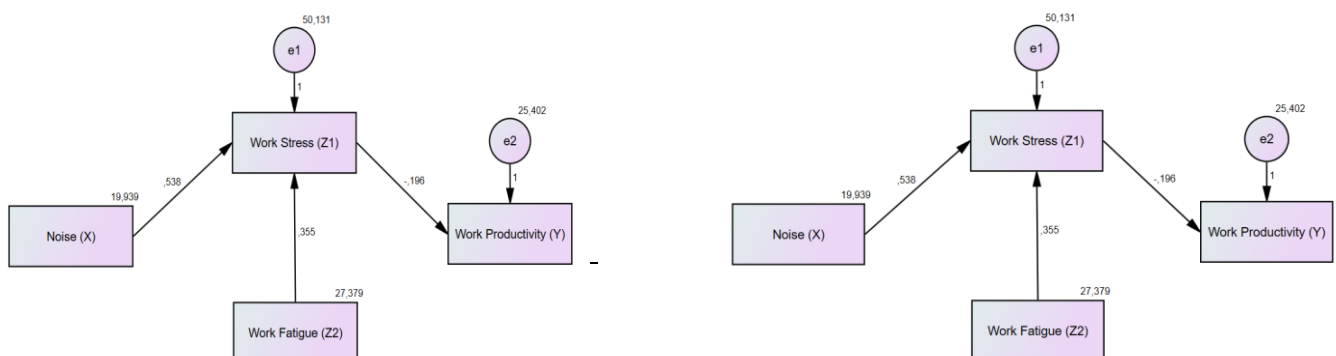
#### Work Productivity

Work productivity in this study examines the ability, quality, work enthusiasm, self-development, quality, and efficiency of workers with a total of 12 questions. This questionnaire was prepared by the researcher and several related lecturers, and validity and reliability tests were conducted before it was given to the respondents.

### Data Analysis

Excel software was used for data administration. IBM SPSS Statistics software version 22 was used to perform univariate and bivariate statistical analyses. In the meantime, multivariate analysis was utilized to ascertain the direct influence of these variables using the Z-Sobel value for indirect influence and the Critical Ratio value for direct influence, as well as the bidirectional influence of variables using the AMOS application.

## 4. Results



Noise -> Work Stress	0,538	0,165	3,261	<b>0,001</b>
Work Stress -> Work Productivity	-0,196	0,064	-3,056	<b>0,002</b>
Work Fatigue -> Work Stress	0,355	0,141	2,519	<b>0,012</b>

Source: Primary Data, 2024

Based on the analysis results using the AMOS application in Table 1, it is evident that there are 3 Research Hypotheses that can be answered.

### Noise on Work Stress

Based on Table 1, it shows that the estimate value of the noise variable on the work stress variable is positive, namely  $3.261 > 1.96$  and p-value  $0.001 < 0.05$ , so it is concluded to have a significant positive effect. This indicates that the higher the noise in the work environment perceived by workers, the higher the work stress experienced by workers.

### Stress on Work Productivity

Based on Table 1, it shows that the estimated value of the work stress variable on the work productivity variable is negative, namely  $-3.056 > 1.96$  and the p-value is  $0.002 < 0.05$ , thus concluding a significant negative effect. This indicates that the higher the work stress of employees, the more it will decrease their work productivity.

### Fatigue on Work Stress

Based on Table 1, it shows that the estimated value of the work fatigue variable on the work stress variable is positive, namely  $2.519 > 1.96$  and the p-value is  $0.012 < 0.05$ , thus concluding a significant positive influence. This indicates that the higher the work fatigue felt by workers, the higher the work stress experienced by workers.

**table 2. Significant Test of Indirect Influence**

	<i>T</i> Count	<i>T</i> table	<i>P</i> Values
Noise -> Work Stress -> Work Productivity	-2,232	1,96	<b>0,026</b>

\*t count > t table: There is a significant influence

Based on Table 2 above, we can see that the variable of workplace noise on productivity through work stress is  $-2.232 > 1.96$ , which can be considered significantly negative. Therefore, the hypothesis regarding the influence of workplace noise on work productivity through work stress is accepted. In conclusion, workplace noise has a negative and significant impact on work productivity through work stress.

## 5. Discussion

### The Influence of Noise on Work Stress

The results of the hypothesis testing analysis show that workplace noise has a significant impact on work stress, measured using the DASS -21 questionnaire. The analysis results indicate an Estimate value of 0.546; a Std Error value of 0.211; a C.R value of 2.593; and a P-value of 0.010. The positive Estimate value indicates that an increase in workplace noise will correspondingly increase the work stress felt by employees.

Apron workers experience high levels of noise due to aircraft engines during loading and unloading, causing the environmental noise levels to exceed the Threshold Limit Value. (NAB). The interpretation of these results indicates that noise acts as a source of stress that can cause psychological changes in workers. Noise leads to an increase in adrenaline hormones, which can provide energy to

individuals and prepare them physically and psychologically. The increase in adrenaline hormones causes biochemical dysregulation in the body, resulting in physical tension in the workers. The impact of this physiological process can manifest in daily behavior. If workers perform their tasks under uncomfortable conditions, it can lead to work-related stress. According to (Robbins & Judge, 2008). This is in line with the research (Candraditya & Dwiyanti, 2017) which shows that the results of the Spearman correlation statistical test indicate a significant relationship between noise levels and work stress. The strong relationship has a positive correlation with a value of 0.903, indicating that the relationship is one-way. The higher the intensity of noise, the heavier the work-related stress experienced, or the greater the likelihood that the worker will experience work-related stress. In line with the research (Amartya Caesara et al., 2024), it shows that the relationship between noise and work stress is unidirectional, where an increase in noise leads to an increase in work stress. This is because high noise intensity causes workers to find it difficult to concentrate, feel uncomfortable working, experience dizziness and headaches, fatigue, anxiety, and irritability.

Inconsistent with the research (Annur Aini et al., 2021) which shows no relationship between noise and work stress among workers ( $p = 0.570$ ). This is because in that area, there is work involving removing rust from materials by spraying silica sand with high pressure. When performing the work, the workers use ear plugs as protection against noise.

### **The Influence of Work Stress on Work Productivity**

This study aims to analyze the impact of work stress on work fatigue. Work stress is defined as the emotional, restless, tense, and also anxious feelings experienced by workers. The measurement tool used to assess work stress is the DASS -21 questionnaire, which must be filled out by employees, along with several open-ended questions included in the questionnaire that explain the conditions of each employee. The results of the hypothesis test analysis indicate that work stress has a negative impact on productivity. The analysis results show an Estimate value of -0.250, a Std Error value of 0.069, a C.R value of -3.615, and a P-value of 0.000. The negative Estimate value indicates that an increase in work stress felt by employees will lead to a decrease in their work productivity. A C.R value greater than 1.96 and a P-value less than 0.05 indicate that this effect is statistically significant. Workers are provided with materials related to Airside Safety Training based on their respective job duties, and they are required to have licenses and bear significant responsibilities for their work. This leads to heavy work demands, an unsupportive work environment, and pressure from numerous regulations, causing workers to experience worry and anxiety that result in work-related stress, ultimately leading to a decrease in productivity. High aircraft engine noise, moving machinery, and unfavorable weather conditions like extreme heat and precipitation are all linked to the apron. Employees who work in such settings are therefore vulnerable to high levels of stress, which have an impact on people's physical and mental health and reduce productivity (Musonda, 2021). Workplace stress is a state of tension that leads to physical and psychological imbalances, impacting an employee's emotions, mental processes, and overall health. In order to control and boost productivity, job stress might act as a regulator of worker circumstances. A person who is under stress might attempt to individually lower their stress levels by managing their schedule, increasing their physical activity, finding support and relaxation, exercising frequently, maintaining a healthy diet, and relaxing (Rukhayati & Prihatin, 2023). Stress is an unpleasant experience for most people caused by the accumulation or buildup of work, which triggers feelings of stress (Sinclair et al., 2020). The condition of healthy workers can support the effectiveness of the company, which will impact the maximization of the company's profits (Nidya Wisudawati & Dodi Aprianto Pratama, 2021). At the age of 40 and above, a person's immune system begins to decline, causing their health to deteriorate and making them more susceptible to various diseases such as fatigue, aches, reduced vision, and other health issues that can disrupt and decrease work productivity (Reza Ramadhani et al., 2020).

The results of this study indicate the importance of workplace policies and support to help employees balance job demands and responsibilities. With appropriate support such as training to enhance workers' skills and expertise, as well as increasing their knowledge to make them love their jobs, and



for leaders to provide motivation, enthusiasm, and appreciation to workers so that they are directed towards achieving the company's goals. The results of this study align with the research by (Eka Safitri & Gilang, 2021), which reinforces the finding that work stress has an impact on work productivity where  $t\text{-count} < t\text{-table}$  ( $-8.320 < -2.048$ ). This is not in line with the research by (Rahmawati et al., 2021), which found that the work stress variable has a non-positive and non-significant effect on employee productivity with a  $t\text{-count}$  value of  $-0.773$ , meaning that if work stress decreases, company productivity increases, and vice versa. So far, workers do not feel that the workplace atmosphere is uncomfortable and that the goals set by the company align with the workers' expectations.

### **The Influence of Work Fatigue on Work Stress**

In this study, there is a decrease in the efficiency and endurance of a worker when performing their job, measured using the Work Fatigue Feelings Measurement Tool Questionnaire, which must be filled out by workers, along with several open-ended questions included in the questionnaire that explain the condition of each worker. The results of the hypothesis test analysis show that work fatigue has a significant impact on work stress, measured using DASS -21 questionnaire. The analysis results indicate an Estimate value of 0.355; a Std Error value of 0.141; a C.R value of 2.520; and a P-value of 0.012. The positive Estimate value indicates that an increase in work fatigue will correspondingly increase the work stress felt by employees. The C.R value greater than 1.96 and the P-value less than 0.05 indicate that this influence is statistically significant.

Based on the results of the Work Fatigue Measurement Tool Questionnaire, the statement with the highest value, "do you feel you are not diligent in carrying out your work," was answered by workers as follows: Yes, often by 51 workers (50.5%), Yes, rarely by 17 workers (16.8%), and never by 33 workers (32.7%). The interpretation of these results indicates that workers do not feel diligent in performing their tasks due to the heavy physical workload they experience, and they are also pressured to work quickly. This causes workers to feel fatigued due to the physical workload they encounter in the Apron area, which in turn will reduce their productivity. Workers who feel tired from the workload will experience work-related stress due to the tasks and responsibilities that cannot be fulfilled.

The work environment is also a factor that increases work stress; it can be said that work stress can arise if job demands are not balanced with the ability to meet those demands, which can trigger work stress in employees (Nidya Wisudawati & Dodi Aprianto Pratama, 2021). The feeling of fatigue that occurs repeatedly can cause individuals to stop their tasks or take breaks. The fatigue experienced by respondents indicates a decrease in energy when performing a job, leading to a sense of unfulfilled responsibility, which can trigger stress. Seeing the high and continuously accumulating work demands, and the resources needed to meet those demands, this causes workers to feel stressed (Maslach & Leiter, 2022).

In line with the research (Tonapa et al., 2022), the analysis results show a significant relationship between work fatigue and work stress among healthcare workers. The calculated  $r$  value in the analysis of the two variables, as seen in the table, is 0.893 and the  $p$  value is 0.000. Therefore, based on the research, a significant relationship was found between work fatigue and work stress because the  $p$ -value is  $<0.05$ , the relationship is positive, and the level of the relationship is very strong. When someone experiences prolonged and unmanaged work fatigue, it will trigger work stress. In the study (Salim et al., 2019), it was shown that the strength of the relationship between work fatigue and work stress is moderate, and the direction of the correlation is positive, which means that the lighter the work fatigue experienced by the respondents, the lighter the work stress will be.

### **The Influence of Noise on Productivity Through Work Stress as a Mediator**

The results of this study show that work stress has a significant mediating effect between workplace noise and employee productivity. The  $t$  value for work stress ( $-2.232$ ) is greater than the  $t$  table value (1.96), indicating that the mediating effect of work stress is significant. The negative value of the  $t$  value indicates an inverse direction in influencing the variables; the higher the environmental noise and work stress on workers, the lower the workers' productivity will be, and vice versa. This finding has theoretical implications indicating that work stress mediates the relationship between workplace

noise and productivity in the context of this research. This indicates that workers in a noisy work environment will experience increased stress, leading to a decrease in worker productivity. Work-related stress does not occur suddenly; generally, workers will experience disturbances that will trigger stress.

Long-term exposure to loud environments, particularly at work, can lead to disruptions or hearing loss. This is a serious issue for employees who work in noisy settings. Stress from noise pollution can result in a number of stress-related conditions, including anxiety, depression, and a general deterioration in mental health (Hemmat et al., 2023). Workplace stress is the feeling of strain that employees go through. Poor working conditions are one of the many things that might lead to stress at work (Sianturi & Pramukty, 2023). According to a study on "The effect of noise on the human body (Staseva et al., 2020), workers may become stressed out by noise, which can lead to irritability, sleep deprivation, memory loss, and attention problems. These factors ultimately result in a 10-15% decrease in labor productivity. According to (Musonda, 2021) study, "An Evaluation Of The Effect Of Job Stress On Workers Performance-Case Study Of Kenneth Kaunda International Airport, Lusaka," the apron is linked to a number of negative weather conditions, including high jet engine noise, moving machinery, and extreme temperatures and precipitation. Because of this, employees who work in such settings are susceptible to high levels of stress, which can have an adverse effect on a person's physical and mental health and cause pressure that lowers productivity.

This is in line with the research (Bilan, 2024) on "Impact of Noise Pollution on Aviation Workers," which reveals that prolonged exposure to high noise levels in the aviation environment causes stress disturbances that adversely affect worker productivity. The research results state that a less supportive work environment can cause workers to experience stress and health deterioration, which can lead to a decrease in their productivity.

## 6. Conclusions

Based on the research results, it can be concluded that noise affects productivity due to work stress as a mediating variable. The detailed conclusions are as follows: (1) Noise directly affects work stress; (2) Work stress directly affects work productivity; (3) Work fatigue directly affects work stress; (4) Noise indirectly affects work productivity through work stress.

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