



Analysis of the Influence of Competence, Workload and Job Stress on the Implementation of Occupational Safety and Health (OSH) among Employees at the Ngadirejo Sugar Factory in Kediri

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Abstract: *The successful implementation of an Occupational Safety and Health Management System (OSHMS) in high-risk industries, such as sugar manufacturing, is determined not only by the completeness of formal systems but also by human factors at the operational level. This study aims to analyze the influence of competence, workload, and job stress on the implementation of OSHMS among production employees at the Ngadirejo Sugar Factory in Kediri. A quantitative research design with a cross-sectional approach was employed. A total of 109 employees were selected from a population of 150 using simple random sampling. Data were collected through structured questionnaires and analyzed using multiple linear regression. The results indicate that job stress has a positive and significant effect on OSHMS implementation ($\beta = 0.329$; $p = 0.004$), whereas competence ($\beta = -0.062$; $p = 0.643$) and workload ($\beta = 0.119$; $p = 0.275$) do not show significant effects. Simultaneously, the three variables explain 10.1% of the variance in OSHMS implementation ($R^2 = 0.101$), suggesting that other factors outside the model play a more dominant role. The findings suggest that job stress may function as a driver of alertness that enhances compliance with safety procedures in the operational context of Ngadirejo Sugar Factory. Managerial implications emphasize the importance of adaptive stress management, not to eliminate stress entirely, but to maintain it at an optimal level that supports safe work behavior while preventing long-term fatigue and burnout.*

INTRODUCTION

Occupational Safety and Health (OSH) is a fundamental element in creating a safe, healthy, and productive work environment. However, the global implementation of OSH continues to face serious challenges. Data from the International Labour Organization (ILO, 2023) indicate that occupational accidents and work-related diseases cause approximately 2.78 million deaths annually, with economic losses reaching 4% of the world's Gross Domestic Product (GDP). This situation reflects a gap between OSH policies at the macro level and safety practices at the operational level, particularly in the Industry 4.0 era, which is characterized by high work pressure and psychosocial risk factors.

In Indonesia, the sugar industry is classified as a high-risk sector for occupational accidents. Data from BPJS Ketenagakerjaan (2022) report that sugarcane processing ranks third in the highest number of workplace accidents, with 34,892 cases. These risks are influenced by the use of heavy machinery, exposure to hazardous chemicals, and seasonal production systems that significantly increase workload intensity. Approximately 45% of occupational accidents are attributed to human factors, such as low competence, work fatigue, and job stress (Ministry of Manpower of the Republic of Indonesia, 2023).

Ngadirejo Sugar Factory in Kediri is one of the oldest sugar factories in Indonesia, with production processes involving high-pressure machinery, flammable materials, and hazardous chemicals. Its seasonal production system increases work intensity by up to 70% during the milling season (April–October), accompanied by extended shifts, including 12-hour night shifts. Internal company data from 2022–2024 indicate that 30% of workplace accidents were caused by competence deficits, a decline in compliance with personal protective equipment (PPE) usage from 85% to 52%, and a job stress level reaching 7.8/10 based on DASS-42 measurements.

Although the factory has implemented a documented Occupational Safety and Health Management System (OSHMS), workplace accidents continue to occur. This indicates that OSHMS implementation has not been fully effective at the operational level. The situation underscores the importance of addressing individual employee factors that directly interact with workplace hazards.

Competence, workload, and job stress are interrelated factors that influence employees' safe behavior. Competence serves as a fundamental prerequisite for understanding and implementing OSH procedures. Excessive workload may hinder the effective application of competence, while job stress can impair cognitive functioning and decision-making quality. These three factors directly contribute to unsafe acts, which are the primary causes of workplace accidents.

Based on this background, it can be concluded that the implementation of OSHMS at Ngadirejo Sugar Factory still faces several challenges despite the presence of documented policies and systems. The high incidence of workplace accidents suggests the influence of individual-level factors at the operational stage. Therefore, this study aims to analyze the influence of competence, workload, and job stress on the implementation of the Occupational Safety

and Health Management System (OSHMS) among employees at Ngadirejo Sugar Factory. The findings are expected to serve as a basis for formulating more effective and context-specific workplace safety improvement strategies.

RESEARCH METHODS

Research Design

This study employed a quantitative analytical observational design with a cross-sectional approach, in which data were collected at a single point in time to examine the relationship between independent and dependent variables. The quantitative approach was selected because the study aims to statistically test the influence of competence, workload, and job stress on the implementation of the Occupational Safety and Health Management System (OSHMS) among employees of Ngadirejo Sugar Factory.

Research Subjects

1. Population and Sample

The population of this study consisted of all permanent production employees at Ngadirejo Sugar Factory, totaling 150 individuals. The sample size was determined using the Slovin formula with a 5% margin of error, resulting in 109 respondents.

2. Sampling Technique

The sampling technique applied was simple random sampling, ensuring that each member of the population had an equal opportunity to be selected as a respondent.

Research Variables

The variables examined in this study consisted of:

1. Independent variables: competence, workload, and job stress.
2. Dependent variable: implementation of the Occupational Safety and Health Management System (OSHMS).

Data Analysis Technique

Data analysis was conducted through several stages as follows:

1. Univariate analysis, to describe respondents' characteristics and the distribution of responses using descriptive statistics (frequency, percentage, mean, median, and mode).
2. Classical assumption tests, including tests of normality, heteroscedasticity, and multicollinearity as prerequisites for regression analysis.
3. Multiple linear regression analysis, to determine the influence of competence, workload, and job stress on OSHMS implementation, both partially and simultaneously.

Validity and Reliability Testing

The research instrument was tested for construct validity by correlating each item score with the total score using SPSS software. An item was considered valid if the calculated r-value exceeded the r-table value at a 5% significance level. Subsequently, reliability testing was conducted to ensure the internal consistency of the instrument, confirming that the questionnaire was reliable in measuring the research variables.

RESULTS AND DISCUSSION

Respondent Characteristics

1. Respondent Characteristics Based on Gender

The distribution of respondents based on gender is presented in the following table:

Table 1. Respondent Characteristics by Gender

Gender	Number	Percentage
Male	101	93%
Female	8	7%
Total	109	100%

Source: Processed primary data (questionnaire), 2025

As shown in table 1, of the 109 production employees included in the sample, 93% (101 respondents) were male, while only 7% (8 respondents) were female. This indicates that the respondents were predominantly male, reflecting the typical gender composition commonly found in the operational sector of the sugar industry in Indonesia.

2. Respondent Characteristics by Age

The distribution of respondents by age is presented in table 2 below.

Table 2. Respondent Characteristics by Age

Age Group	Number	Percentage
< 30 years	35	32%
30 - 40 years	45	41%
> 40 years	29	27%
Total	109	100%

Source: Processed primary data (questionnaire), 2025

Table 2 illustrates that the largest proportion of respondents belonged to the 30–40 years age group, accounting for 41% (45 respondents), followed by those aged under 30 years at 32% (35 respondents) and those over 40 years at 27% (29 respondents). Overall, the majority of respondents were within the early to middle productive age range. This age variation provides an important basis for analyzing the effects of competence, workload, and job stress on OHSMS implementation.

3. Respondent Characteristics by Education Level

The educational background of respondents is shown in table 3.

Table 3. Respondent Characteristics by Education Level

Education Level	Number	Percentage
Junior High School	5	5%
Senior High School/Vocational School	90	83%
Diploma (D3)	2	2%
Bachelor's Degree (S1)	12	11%
Total	109	100%

Source: Processed primary data (questionnaire), 2025

Table 3 indicates that most respondents had a senior high school or vocational education background (83%). This dominance reflects the typical workforce profile in traditional manufacturing industries such as sugar factories. Consequently, OHS training and socialization programs should be designed using practical methods and easily understandable language.

These findings highlight the importance of continuous training focused on enhancing technical competence and safety awareness, given the limited formal education background in OHS among employees.

4. Respondent Characteristics by Length of Service

The distribution of respondents based on length of service is presented in table 4.

Table 4. Respondent Characteristics by Length of Service

Length of Service	Number	Percentage
< 5 years	20	18%
5 - 10 years	45	41%
> 10 years	44	40%
Total	109	100%

Source: Processed primary data (questionnaire), 2025

The data show that most respondents had moderate to long work experience, with 41% having worked for 5–10 years and 40% for more than 10 years. This indicates workforce stability in the production department. Employees with extensive experience are generally familiar with operational procedures and safety culture, suggesting that OHS interventions should focus on refresher training, procedural updates, and reinforcement of safe behavior.

5. Respondent Characteristics by Job Position

The distribution of respondents by job position is shown in table 5.

Table 5. Respondent Characteristics by Job Position

Position	Number	Percentage
Coordinator	34	31%
Manager	1	1%
Staff/Operator	68	62%
Supervisor	6	6%
Total	109	100%

Source: Processed primary data (questionnaire), 2025

Most respondents were Staff/Operators (62%), indicating that the data strongly represent the perceptions and experiences of frontline workers who directly face occupational risks. This strengthens the practical relevance of the findings for improving operational-level safety practices.

Results of Instrument Validity and Reliability Testing

Validity and reliability tests were conducted to ensure that the questionnaire accurately and consistently measured the research variables. Instrument testing was carried out prior to distributing the questionnaire to the study respondents. The validity test was conducted empirically using 30 pilot respondents who had characteristics similar to those of the main study participants. Item validity was assessed using the Corrected Item–Total Correlation (CITC) method with the assistance of SPSS software. An item was considered valid if the CITC value exceeded the r-table value at a 5% significance level. With 30 pilot respondents, the r-table value used was 0.361 (df = 28) (Singarimbun, 2000).

Subsequently, reliability testing was performed to determine the internal consistency of the research instrument. The instrument was

considered reliable if it achieved a Cronbach's Alpha value greater than 0.70, indicating good reliability and suitability for research use. Prior to empirical testing, the questionnaire was reviewed and consulted with the academic supervisor and experts in research instrument development. Based on the results of the validity and reliability tests, all questionnaire items were declared valid and reliable, and therefore appropriate for use as data collection instruments in this study.

Table 6. Results of Validity and Reliability Testing of the Questionnaire

Variable	Number of Items	CITC Range	r-table	Validity	Cronbach Alpha	Reliability
Competence (X ₁)	15	0.379 – 0.625	0.361	Valid	0.746	Reliable
Workload (X ₂)	15	0.363 – 0.858	0.361	Valid	0.920	Highly Reliable
Job Stress (X ₃)	15	0.389 – 0.766	0.361	Valid	0.825	Highly Reliable
OSHMS Implementation (Y)	15	0.369 – 0.758	0.361	Valid	0.806	Highly Reliable

Source: Processed from primary data analyzed using SPSS version 26.

Based on the summary table of validity and reliability testing using the Corrected Item–Total Correlation (CITC) and Cronbach's Alpha, it was found that all 60 questionnaire items had CITC values greater than the r-table value (0.361). In addition, all variables demonstrated Cronbach's Alpha values greater than 0.60. Therefore, all questionnaire items were considered valid and reliable, indicating that the instrument was appropriate for use in this study.

Classical Assumption Tests

1. Normality Test

The Kolmogorov–Smirnov (K–S) test was used to assess data normality. The results indicated an Asymp. Sig. value of 0.200 (> 0.05), confirming that the data were normally distributed. Histogram and Normal Probability Plot analyses further supported the normality assumption, as the data followed a bell-shaped distribution and clustered around the diagonal line.

2. Multicollinearity Test

Multicollinearity was assessed using Variance Inflation Factor (VIF) values. All independent variables had VIF values below 10, indicating no multicollinearity among competence (X₁), workload (X₂), and job stress (X₃).

3. Heteroscedasticity Test

Scatterplot analysis showed that residuals were randomly distributed above and below zero, indicating the absence of heteroscedasticity. Thus, the regression model met the homoscedasticity assumption.

4. Hypothesis Testing

a. Model Summary and Simultaneous Test (F-test)

Multiple linear regression analysis was conducted to examine the influence of competence, workload, and job stress on the implementation of the Occupational Safety and Health Management System (OSHMS).

Table 7. Model Summary and Simultaneous Test Results

Model	R	R Square	Adjusted R Square	F	Sig.
Regression Model	0.318	0.101	0.075	3.937	0.010

Source: Processed primary data using SPSS version 26, 2025

Based on table 7, the R Square value is 0.101, indicating that competence, workload, and job stress collectively explain 10.1% of the variance in OSHMS implementation. The remaining 89.9% is influenced by other factors outside the research model, such as leadership, safety culture, supervision, and organizational policies. Furthermore, the ANOVA test shows an F-value of 3.937 with a significance level of 0.010 ($p < 0.05$), indicating that competence, workload, and job stress simultaneously have a statistically significant effect on the implementation of OSHMS. This result confirms that the regression model is appropriate and can be used for further analysis.

b. Multiple Linear Regression Analysis

Table 8. Results of Multiple Linear Regression Analysis

Variables	B	Std. Error	Beta	t	Sig.
Constant	23.620	6.108	—	3.867	0.000
Competence (X_1)	-0.062	0.133	-0.047	-0.465	0.643
Workload (X_2)	0.119	0.109	0.113	1.098	0.275
Job Stress (X_3)	0.329	0.110	0.283	2.977	0.004*

*Significant at $p < 0.05$

Source: Processed primary data using SPSS version 26, 2025

Based on table 8, the multiple linear regression equation can be formulated as follows:

$$Y = 23.620 - 0.062X_1 + 0.119X_2 + 0.329X_3$$

Where:

Y = Implementation of OSHMS

X_1 = Competence

X_2 = Workload

X_3 = Job Stress

The regression equation indicates that competence has a negative regression coefficient ($\beta = -0.062$), suggesting that competence does not significantly influence OSHMS implementation. Workload has a positive regression coefficient ($\beta = 0.119$), but its effect is not statistically significant. Meanwhile, job stress has a positive regression coefficient ($\beta = 0.329$), indicating that job stress has a positive influence on OSHMS implementation.

c. Partial Test (t-test)

Based on the regression results:

1) Effect of Competence on OSHMS Implementation

Competence has a regression coefficient of -0.062 with a significance value of 0.643 ($p > 0.05$). This indicates that competence does not have a significant effect on OSHMS implementation. Therefore, the hypothesis stating that competence affects OSHMS implementation is rejected.

2) Effect of Workload on OSHMS Implementation

Workload has a regression coefficient of 0.119 with a significance value of 0.275 ($p > 0.05$). This result indicates that workload does not have a significant effect on OSHMS implementation. Thus, the hypothesis stating that workload affects OSHMS implementation is rejected.

3) Effect of Job Stress on OSHMS Implementation

Job stress has a regression coefficient of 0.329 with a significance value of 0.004 ($p < 0.05$). This indicates that job stress has a positive and significant effect on OSHMS implementation. Therefore, the hypothesis stating that job stress affects OSHMS implementation is accepted.

Among the independent variables, job stress has the strongest influence on OSHMS implementation, as indicated by the highest standardized coefficient (Beta = 0.283).

Discussion

1. Discussion of Hypothesis Testing Results

a. The Effect of Competence on the Implementation of the OHS Management System (OHSMS)

The results of the analysis indicate that, overall, employee competence is at a moderate level (index = 54.41), with the highest scores observed in cognitive aspects, such as understanding of OHS policies (index = 52.80) and awareness of safety rights (index = 59.00). According to the Safety Competency Pyramid theory (Zhang, 2024), cognitive competence constitutes the foundation of safe behavior. However, this finding is not aligned with the hypothesis testing results, which reveal that competence does not have a significant effect on the implementation of the OHSMS ($\beta = -0.062$; sig = 0.643).

Adequate theoretical understanding does not automatically guarantee effective implementation of the OHSMS in practice, as there exists a gap between knowledge and the willingness as well as the opportunity to apply such knowledge in real working conditions. Furthermore, weaknesses are evident in the applicative and behavioral aspects of competence, such as the ability to evacuate accident victims (index = 45.8) and consistency in adhering to standard operating procedures (index = 48.0).

The Theory of Planned Behavior (Ajzen, 1991) explains that the intention to engage in safe behavior—shaped partly by competence—can be hindered by low perceived behavioral control. Thus, it can be concluded that competence unaccompanied by sufficient practical skills and systemic support prevents OHS knowledge from being translated into concrete actions. Consequently, strengthening simulation-based training and adopting behavioral approaches are urgently required to bridge this gap.

b. The Effect of Workload on the Implementation of the OHSMS

Descriptive analysis shows that employee workload is generally at a moderate level (index = 58.59), with the highest indicators related to the perceived need for specialized skills (61.4) and feelings of helplessness (61.0). Workload Theory (Hart & Staveland, 1988) and the Job Demands–

Resources Model (Bakker & Demerouti, 2007) suggest that excessive workload can deplete cognitive and emotional resources, potentially disrupting compliance with safety procedures.

However, the “moderate but manageable” workload level observed suggests that employees may have adapted and become habituated to the extreme seasonal work patterns typical of the sugar manufacturing industry. As a result, such pressures are not necessarily perceived as absolute barriers to OHS implementation.

Hypothesis testing confirms that workload does not have a significant effect on the implementation of the OHSMS ($\beta = 0.119$; sig = 0.275). This finding contradicts the theoretical assumption that high workload reduces safety compliance. The researcher argues that this insignificance may be explained by moderating factors such as a strong safety culture, effective supervisory mechanisms, or a sense of collective responsibility among experienced employees. Consequently, despite relatively high workloads, a process of normalization of deviance may have occurred, whereby demanding work conditions are perceived as normal and do not automatically compromise safety practices.

c. The Effect of Job Stress on the Implementation of the OHSMS

Descriptive analysis indicates that employees’ job stress levels are moderate (index = 57.88), with physical and emotional components dominating, including physical fatigue (63.2), work-related tension (63.2), and impacts on mental health (63.6). In contrast, cognitive stress indicators, such as difficulty in decision-making, are relatively low (45.6).

The Transactional Model of Stress (Lazarus & Folkman, 1984) explains that stress arises from individuals’ appraisal of environmental demands, which may elicit adaptive or maladaptive responses. This pattern suggests that stress at PG Ngadirejo is primarily physical and psychological, stemming from long shifts and production targets, but has not yet impaired core cognitive functions such as decision-making. As a result, employees remain capable of rational thinking in safety-related contexts.

Hypothesis testing further demonstrates that job stress has a positive and significant effect on the implementation of the OHSMS ($\beta = 0.329$; sig = 0.004). This finding supports the Yerkes–Dodson Law, which proposes an inverted U-shaped relationship between arousal (stress) and performance. The researcher concludes that moderate levels of job stress function as *eustress*, enhancing employees’ alertness to potential hazards and motivating greater compliance with OHS procedures as a self-protective mechanism. Nevertheless, this positive relationship may not be sustainable, as chronic stress can eventually reduce OHS compliance due to emotional and physical exhaustion (burnout).

d. Simultaneous Effects and Variable Contributions

The overall model significance confirms that competence, workload, and job stress collectively form part of the complex factors influencing safety behavior, although their individual contributions vary. However, the coefficient of determination (R^2) of 10.1% indicates that these three

variables explain only 10.1% of the variance in OHSMS implementation. The remaining 89.9% is explained by factors outside the research model.

This finding implies the presence of other influential factors, such as safety culture, transformational leadership, incentive systems, or ergonomic working conditions, which may exert a more dominant influence. Therefore, efforts to enhance the effectiveness of the OHSMS at PG Ngadirejo should adopt a more holistic and integrative approach, rather than focusing solely on individual employee factors.

2. Theoretical and Practical Implications

a. Theoretical Implications

This study contributes several important theoretical insights:

1) Complexity of Variable Relationships

The finding that only job stress has a significant—and positive—effect reinforces the view that relationships between individual factors and safety behavior are complex and non-linear.

2) Contextual Relevance of Theory

The Theory of Planned Behavior and the Safety Competency Pyramid may require modification when applied to industries with specific characteristics, such as the high-risk and seasonal nature of sugar factories.

3) The Unique Role of Stress

The positive effect of job stress on OHSMS implementation opens avenues for theoretical development regarding alertness mechanisms as mediators between stress and safety behavior.

Classical OHS management theory traditionally assumes that job stress undermines safety by disrupting concentration and triggering impulsive decisions, thereby increasing accident risk. However, empirical evidence from PG Ngadirejo challenges this assumption. Multiple linear regression analysis shows that job stress (X_3) positively and significantly influences OHSMS implementation (Y), with a regression coefficient of 0.329 and a significance value of 0.004. The average stress index (57.88) and OHSMS implementation index (56.99), both categorized as moderate, move in parallel rather than in opposition. This counterintuitive finding can be explained by psychological mechanisms operating among employees. Rather than inducing panic or negligence, moderate stress activates an internal alertness system.

1) Transactional Model of Stress (Lazarus & Folkman, 1984)

Employees cognitively appraise their hazardous work environment—characterized by heavy machinery, chemicals, and production pressure—as both a challenge and a real threat to personal safety. This appraisal triggers physiological and psychological alertness, transforming stress into an internal warning signal that motivates protective actions, such as more consistent use of personal protective equipment (PPE) and stricter adherence to standard operating procedures.

2) Yerkes–Dodson Law (1908)

The stress levels experienced by employees at PG Ngadirejo appear to fall within the optimal zone of the inverted U-shaped curve, where

stress functions as eustress, sharpening focus and situational awareness rather than causing cognitive overload.

3) Contextualization in the PG Ngadirejo Environment

PG Ngadirejo operates in a tangible high-risk environment, involving cane-cutting machines, high-pressure boilers, and hazardous chemicals such as sulfur dioxide. Daily exposure to these risks reinforces awareness of fatal consequences, making stress an adaptive self-defense mechanism. Previous internal data indicating that 30% of accidents stem from insufficient competence and declining PPE compliance during milling seasons further strengthens collective risk awareness.

The dominance of physical and emotional stress—rather than cognitive stress—supports the interpretation that stress enhances sensory alertness without impairing decision-making processes.

b. Practical Implications

Despite its significance, the positive relationship between stress and OHS implementation must be interpreted cautiously, as it represents a double-edged sword. In high-risk environments, feelings of tension and discomfort may serve as indicators of psychological sensitivity to danger. OHS programs should therefore aim not to eliminate stress entirely, but to manage it within an optimal alertness zone.

Long-Term Warning: Burnout Risk: Sustaining a constant state of high alert—especially under heavy physical workloads and 12-hour shifts—poses a serious risk of emotional and physical burnout. Long-term studies (Putra & Dewi, 2021) demonstrate that chronic stress eventually erodes mental resources, leading to apathy, cynicism, and a sharp decline in safety compliance.

Thus, these findings should not be interpreted as justification for tolerating excessive job stress. Instead, they call for smarter and more proactive stress management—maintaining stress as an ally rather than an enemy in creating a safe workplace.

For the management of PG Ngadirejo, the study offers several practical recommendations:

- 1) Restructuring OHS Training Programs: Shifting the focus from purely knowledge-based training to skill-based development through simulations and on-the-job training.
- 2) Proactive Stress Management: Implementing structured stress management programs, including stress monitoring, counseling, and ergonomically optimized shift systems.
- 3) Exploration of More Dominant Factors: Identifying and addressing other influential factors such as safety culture, supervisory leadership, and incentive systems.
- 4) Strengthening the Monitoring System: Enhancing consistent shop-floor supervision and OHS audits to compensate for the limited influence of competence and workload.

CONCLUSION

Based on the results of multiple linear regression analysis, it can be concluded that competence and workload do not have a statistically significant effect on OSHMS implementation. This finding indicates that the level of employee competence and workload does not directly determine the effectiveness of OSHMS implementation in the studied workplace context. In contrast, job stress was found to have a positive and statistically significant effect on OSHMS implementation. This result suggests that employees experiencing higher levels of job stress tend to demonstrate greater awareness and compliance with occupational safety and health procedures. This finding highlights the role of psychological factors in shaping safety-related behaviors, where a certain level of job stress may increase alertness and encourage employees to adhere more strictly to safety protocols.

Furthermore, the coefficient of determination (R Square) of 0.101 indicates that competence, workload, and job stress collectively explain 10.1% of the variance in OSHMS implementation. This suggests that other factors not examined in this study, such as safety culture, leadership, supervision, safety training, and organizational commitment, may play a more substantial role in influencing the effectiveness of OSHMS implementation. Overall, this study contributes to the understanding of behavioral and organizational factors affecting occupational safety and health management systems in industrial settings. The findings emphasize the importance of managing psychological and organizational factors to improve safety performance. Future research is recommended to include additional variables and broader organizational contexts to provide a more comprehensive understanding of the determinants of OSHMS implementation.

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