

The Effect of Work Environment, OHS, and Job Satisfaction on Employee Performance: A Case Study of Private Defense Company in Indonesia

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ABSTRACT IN ENGLISH

Intense competition in Indonesia forces private companies in the defense industry to be more competitive. PT. Z is one of the largest private defense products and equipment manufacturer in Indonesia. To retain competitiveness, PT. Z must provide defense products and equipment with the best quality and deliver it on-time. The quality and on-time delivery of products and equipment fulfillment rely on the performance of employee at PT. Z. Over the last few years, employee performance at PT. Z constantly decreased. The decrease of employee performance can be caused by several factors including work environment, occupational health and safety, and job satisfaction. This research will examine the effect of work environment (WE), occupational health and safety (OHS) and job satisfaction (JS) on employee performance (EP). The analysis was carried out using the PLS-SEM with 120 samples taken from production and engineering division at PT. Z. The result shows that there are positive and significant effect of WE on EP, WE on JS, OHS on JS, and JS on EP. JS also mediates the effect of OHS on EP. On the other hand, OHS does not have a direct effect on EP and JS cannot mediate the effect of WE on EP.

1. Introduction

Self-reliance of the defense products and equipment is important to support the national defense system [1]. The Indonesia Ministry of Defense asked private defense company to help realize the self-reliance of the defense system [2]. Defense potential's general director, Bondan Tiara Sofyan, said that there are only 54 out of 102 private companies that registered in the ministry of defense were active [3]. In practice, defense industry requires strong competitiveness because it competes directly with both inside and outside the country [4]. PT. Z is one of the largest private defense products and equipment manufacturer in Indonesia. PT. Z conducts research, development and manufacture of defense products and equipment for the country since 2014. To retain competitiveness, the company must provide defense products and equipment with the best quality [5] and deliver it on time [6]. The quality and on-time delivery of products and equipment rely on the performance of employee at PT. Z. From fig.1 we can see that over the last few years, employee performance at PT. Z has constantly decreased thus affect the quality and on-time delivery of the products and equipment. This results to late delivery of products and equipment and PT. Z was ordered to pay some penalties. If this trend continues, it may harm PT. Z as it keeps losing its competitiveness due to the constant decrease of employee performance.

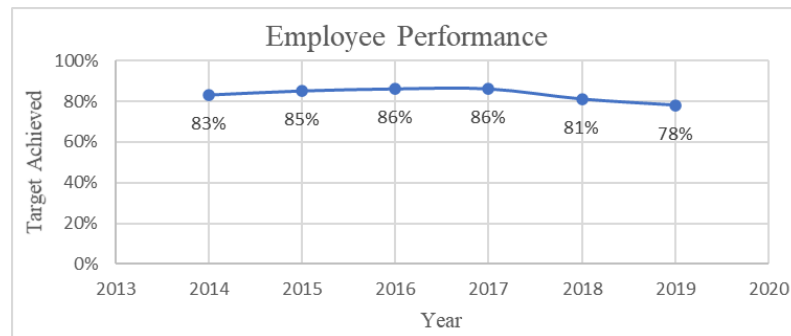


Fig. 1 - Employee Performance at PT.Z

From previous studies, there are variables that can affect employee performance. The variables including work environment [7][8][9], occupational health and safety [10][11], and job satisfaction [10][11]. This research aims to find out the relationship between these variables and find recommendations to increase PT. Z's employee performance.

2. Literature Review and Hypotheses

2.1 Employee Performance

Perera defines employee performance as all employee's working behavior that contribute to company or organizational objectives [10]. Mangkunegara [12] states that the definition of performance is the quality and quantity result of employee's work and their corresponding responsibilities. Siagian [13] states that performance is a universal concept consisting of the operational effectiveness of the organization based on criteria and standards that have been set. This research pays more attention to Perera's and Mankunegara's definition of employee performance. Indicator of employee performance in this research adapt from Antara et al. [14] and Dharmanegara et al. [8]: discipline, work quality, work quantity, work time, teamwork.

2.2 Working Environment

Nitisemo [14] define working environment as everything around the workers that capable to influence the task assigned to them. Sedarmayanti [15] states that working environment consist of physical and non-physical environment. Things that physically interact with the subject such as tools, table, room, temperature, air quality, noise, lighting, and facilities are defined as physical environment. Non-physical environment consists more like intangible things such as relationship between employees and also employee with their supervisor or organization. This research uses definition of working environment both from Nitisemo and Sedarmayanti. Indicator of work environment used in this research adapt from Sedarmayanti [15]: noise, air quality, relationship between employees, relationship between employee and supervisor or organization.

2.3 Occupational Work and Safety (OHS)

Galagher defines occupational health and safety (OHS) as a group of planning, managing, and reviewing of program that work together to improve health and safety performance [10]. Hasibuan [16] states that health and safety determine the physical and psychological condition of employee at work. If OHS well and effectively conducted by the company and the employee satisfied with it, the number of ill and injured employee will decrease [17]. This research define OHS as stated by Galagher. Indicator of OHS in this research adapt from Barphanda and Unnithan [11] and Ekowati and Amin [24]: health and safety inspections, health and safety response, equipment availability, and health and safety insurance.

2.4 Job Satisfaction

Perera et al. [10] define job satisfaction as employee's positive feeling toward their job. Ramli [9] states that job satisfaction is employee's positive feeling toward their job and its appraisal. Hasibuan [17] states that job satisfaction is positive emotional feeling of employee to their job and the feel of loving it. Antara et al. [14] and Dharmanegara et al. [8] states that job satisfaction consists of the employee's feeling about their workload, working condition, salary, appraisal, and career development. Khan and Aleem [18] and Kazi and Zadeh [19] stated that job satisfaction can be shown from employee's loyalty to stay working at the company. This research defines job satisfaction as employee's feeling about their job and the company's appraisal to their job. Indicator of job

satisfaction in this research adapt from Antara et al. [14], and Khan and Aleem [18]; workload, salary, incentive, and appraisal, career development, and loyalty.

2.5 Relationship between Working Environment and Employee Performance

Massoudi and Hamdi [7] in their research of the bank employee shows that working environment positive and significantly effect employee performance. Dharmanegara et al. [8] shows that there is positive and significant effect of working on performance of SME employees, which means better work environment in SME tend to increase employee's job performance. Ramli [9] also find that working environment has positive and significant effect on employee performance in healthcare workers. Research from Antara et al. [14] shows different result which find that work environment doesn't have strong effect on employee performance. Based on the majority of these studies and findings, hypothesis developed as follow:

H₁ : Working Environment has a positive effect on employee performance.

2.6 Relationship between Working Environment and Job Satisfaction

Working environment has positive and significant effect on employee's job satisfaction [20]. Their studies also find that employee agree that working environment is an important thing that play a role in job satisfaction. Antara et al. [14] and Atmaja et al. [21] also show the same result which environment has positive and significant effect on job satisfaction. Lee and Brand [22] shows that conducive working environment tend to increase employee's satisfaction. Based on the of these studies and findings, hypothesis developed as follow:

H₂ : Working Environment has a positive effect on employee performance.

2.7 Relationship between OHS and Employee Performance

The research conducted by Perera [10] show that OHS positively influenced employee performance. Employee's performance increases when they feel satisfied about their jobs. Barphanda and Unnithan's research [11] also shows that OHS has strong positive and significance effect on employee performance. Barphanda and Unnithan [11] also state that a good implementation of OHS would make employee feel secure and comfortable which help them avoid work injuries or accidents and can maintain their performance. Based on these studies and findings, hypothesis developed as follow :

H₃ : OHS has a positive and significant effect on employee performance.

2.8 Relationship between OHS and Job Satisfaction

Barphanda and Unnithan [11] shows that OHS play a positive and significant role affecting job satisfaction in manufacture company. Studies on Sri Lanka manufacturing companies by Perera [11] also shows that OHS positive and significantly affect employee's satisfaction. Perera's result showed that when machine operators feel satisfied, they tend to increase their job performance. Based on these studies and findings, hypothesis developed as follow:

H₄ : OHS has a positive and significant effect on job satisfaction.

2.9 Relationship between Job Satisfaction and Employee Performance

Studies conducted by Perera [10] on manufacturing company shows that there is positive and significant effect of job satisfaction on employee performance. When employee more satisfied with their job, they become more productive. Barphanda and Unnithan [11] also shows the same result. Chen et al. [23] states that satisfied employee will be motivated, more focus, and intend to not having a problem with their job. Studies from Ramli [9] also shows the same result. Based on these studies and findings, hypothesis developed as follow:

H₅ : Job satisfaction has a positive and significant effect on employee performance.

2.10 Mediating Effect of Job Satisfaction

Job satisfaction can be mediator of positive and significant effect of work environment on employee performance [9][14]. Dharmanegara et al. [8] also shows the same result that job satisfaction is mediator of relationship between work environment and employee performance in garment industry. But Atmaja et al. [21] have different result which shows that job satisfaction can't mediate work environment on employee performance. In term of mediating the effect of OHS on employee performance, Barphanda and Unnithan [11] and Perera [10] shows that job satisfaction can mediate the effect of OHS on employee performance. Different result achieved by Ekowati and Amin [24] which finds that job satisfaction can only mediate the effect of health on employee performance but not

the effect of safety on employee performance. Based on majority of these studies and findings, hypothesis developed as follow:

H₆ : Job satisfaction can significantly mediate positive effect of work environment on employee performance.

H₇ : Job satisfaction can significantly mediate positive effect of OHS on employee performance.

2.11 Conceptual Model

The conceptual model of this research developed based on the previous studies in study literature. Fig 2 is conceptual model of this research that shows the relationship between variable.

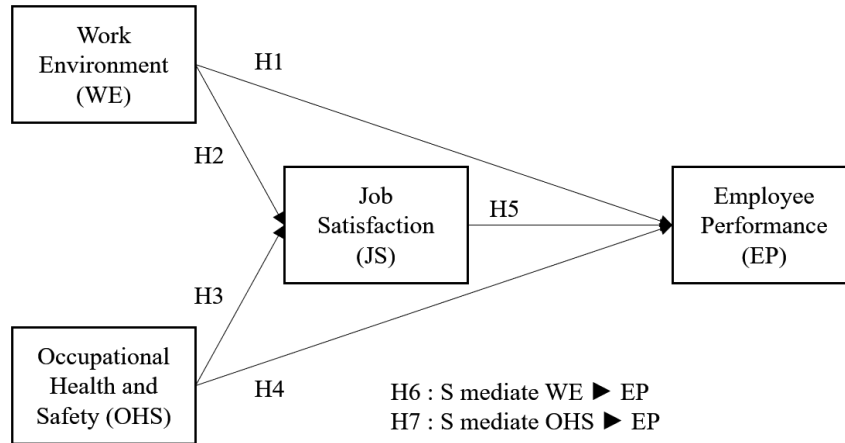


Fig. 2 - Conceptual model

2.12 Research Contribution

This paper aim to find the effect of work environment, OHS, and job satisfaction on employee performance with relationship model developed and enhanced from previous studies as shown in conceptual model. This paper also explains whether the findings of previous studies and researches have the same result when applied to this research’s company characteristic (research, development, and manufacturing company in defense sector). Theoretical implication and managerial recommendation also provided to help company to solve the problem.

3. Research Method

3.1. Data Source and Analysis Techniques

Sample for this research collected from 120 employees of engineering and production division in PT. Z. The data collected using questionnaire with 5-point Likert scale with the categories (1) strongly disagree, (2) disagree, (3) neither agree nor disagree, (4) agree, and (5) strongly agree. Since there are multiple variables and this research aim to find the relationship between these variables, multivariate data analysis technique is used. In the present, there are two popular methods in second generation multivariate data analysis: CB-SEM, and PLS-SEM [25]. While CB-SEM gives more accurate result when the sample size is large enough, PLS-SEM can provide better result in term of smaller sample size. CB-SEM also require normally distributed data sample while PLS-SEM can process non-normally distributed data [25]. Since the sample not large enough, and the result of data normality test in Table 1 show that the data is not normal, PLS-SEM technique is used in this research.

Table 1 – Test of Normality

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Work Environment	.160	120	0.000	.919	120	.000
OHS	.172	120	0.000	.892	120	.000
Job Satisfaction	.150	120	0.000	.916	120	.000
Employee Performance	.184	120	0.000	.881	120	.000

PLS-SEM is mostly used in exploratory research to develop theories [25]. This is achieved by describing the variance in the dependent variables while the model is examined. PLS-SEM can also be used to confirm theories. Researcher can use PLS-SEM when the CB-SEM assumptions are not met. PLS-SEM is non-parametric analysis thus data normality is not necessary. PLS-SEM can handle small amounts of samples with respectable result, and when the sample is large enough and normally distributed, it provides result as good as CB-SEM. Hair et al. [25] stated the step of PLS-SEM consists of 8 steps as showed in fig. 3.

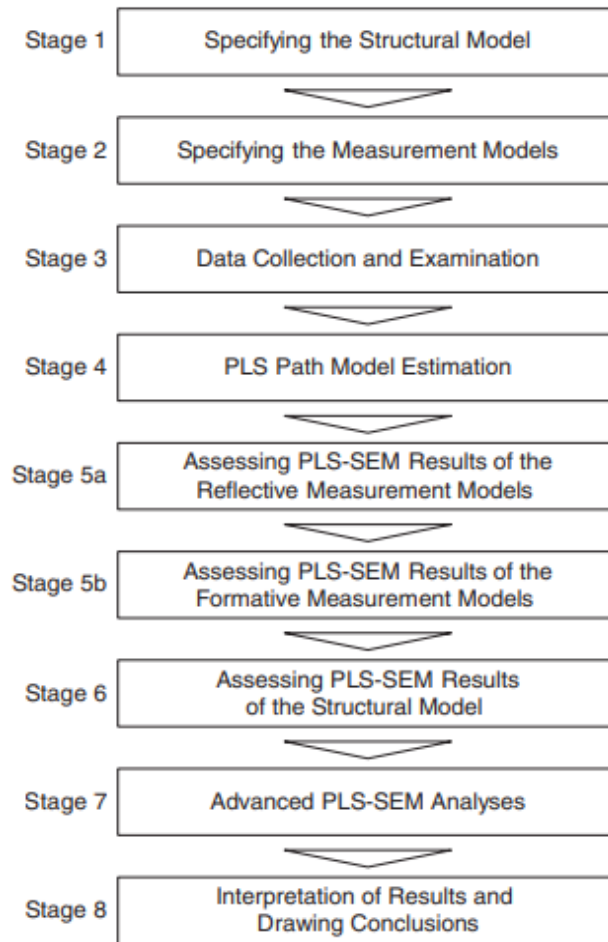


Fig. 3 - PLS-SEM procedure [25]

3.2. Measurement Model

Measurement model in this research refer to previous study conducted by several researchers as detailed in Table 2.

Table 2 – Variable and Indicator

Variable	Indicator	Source
Work Environment (WE)	Noise (WE1)	Sedarmayanti (2009)
	Air Quality (WE2)	Sedarmayanti (2009)
	Employee Relationship (WE3)	Sedarmayanti (2009)
	Employee-Supervisor Relationship (WE4)	Sedarmayanti (2009)
OHS	Inspection (OHS1)	Barpanda dan Unnithan (2019)
	Health and Safety Response (OHS2)	Barpanda dan Unnithan (2019)
	Equipment Availability (OHS3)	Ekowati and Amin (2018)
	Health and Safety Insurance (OHS4)	Ekowati and Amin (2018)

Job Satisfaction (JS)	Workload (JS1)	Antara et al. (2020)
	Salary, Incentive, Appraisal (JS2)	Antara et al. (2020)
	Career Development (JS3)	Antara et al. (2020)
	Loyalty (JS4)	Khan and Aleem (2014)
Employee Performance (EP)	Discipline (EP1)	Dharmanegara (2016)
	Work Quality (EP2)	Antara et al. (2020)
	Work Quality (EP3)	Antara et al. (2020)
	Work Time (EP4)	Antara et al. (2020)
	Teamwork (EP5)	Dharmanegara (2016)

Evaluation of measurement model criteria detailed in Table 3.

Table 3 – Measurement Model Evaluation Criteria [26]

Indicator	Cut-Off Value
Indicator Loading	≥ 0.708
Internal Consistency and Item Reliability	$0.7 \geq \alpha$ or ρ_A or $CR \geq 0.95$
AVE	≥ 0.5
HTMT	< 0.85

Reflective indicator loading and internal consistency value is used to evaluate the construct reliability [25]. Cronbach’s alpha or composite reliability or rho alpha values are used to evaluate internal consistency reliability. Construct validity is evaluated by AVE values. Discriminant validity evaluated by heterotrait-monotrait ratio [27]. All criteria of measurement model need to be achieved before continue to assess the structural model.

3.3. Structural Model

Structural path model in this research and relationship between variables are developed based on the result provided in previous conducted research in this paper’s literature review. Fig. 4 is path model of this research. Evaluation of structural model of this research is carried out with criteria detailed in table 4. To make sure regression results is not biased, collinearity (VIF) is examined before assessing the structural relationship [26]. In-sample predictive power is referred by R^2 value [28]. Q^2 value is calculated to assess model’s predictive accuracy [29][30].

Table 4 – Structural Model Evaluation Criteria [26]

Indicator	Cut-Off Value
Collinearity (VIF)	$0.2 < VIF < 3$
SRMR	< 0.80
R^2	0.25; 0.50; 0.75
Q^2	$> 0; 0.25; 0.50$

If the structural model meets all criteria, path coefficient can be evaluated in structural model evaluation to see how strong the variables affecting others. Bootstrapping procedure in PLS-SEM conducted to assess significance of relationship between variables thus can be used to conclude hypotheses test.

4. Result and Discussion

PLS-SEM technique is carried out with path weighting scheme, 300 max iterations, and stop criterion ($10^{-2} - X$): 7. Fig. 4 shows the result of PLS-Algorithm.

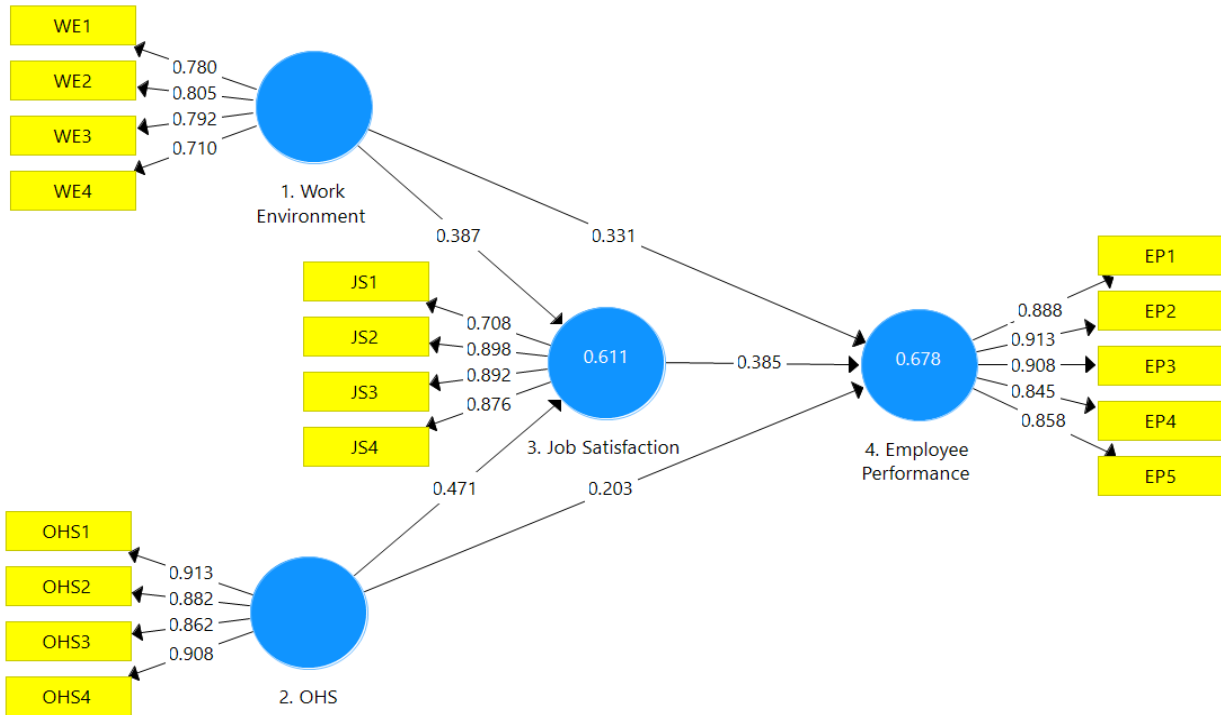


Fig. 4 - PLS Algorithm Result

4.1 Evaluation of Measurement Model

Evaluation of measurement model carried out based on criteria in Table 3. Table 5 show the reflective indicator loading, composite reliability (CR), Cronbach’s alpha, and rho alpha. From that table the indicator loading values meet the criteria with all the value equal or more than 0.708. With loadings equal or above 0.708, they indicate that construct at least explains fifty per cent variance of indicator, thus providing indicator reliability that can be accepted [26].

Table 5 – Construct Reliability Evaluation

Variable	Indicator	Loading	Cronbach’s A	Rho A	CR
Work Environment (WE)	Noise (WE1)	0.708	0.777	0.789	0.855
	Air Quality (WE2)	0.805			
	Employee Relationship (WE3)	0.792			
	Employee-Supervisor Relationship (WE4)	0.710			
OHS	Inspection (OHS1)	0.913	0.914	0.917	0.795
	Health and Safety Response (OHS2)	0.882			
	Equipment Availability (OHS3)	0.862			
	Health and Safety Insurance (OHS4)	0.908			
Job Satisfaction (JS)	Workload (JS1)	0.708	0.865	0.864	0.910
	Salary, Incentive, Appraisal (JS2)	0.898			
	Career Development (JS3)	0.892			
	Loyalty (JS4)	0.876			
Employee Performance (EP)	Discipline (EP1)	0.888	0.929	0.933	0.946
	Work Quality (EP2)	0.913			
	Work Quality (EP3)	0.908			
	Work Time (EP4)	0.845			
	Teamwork (EP5)	0.858			

Air quality has highest loading factor in work environment variable with loading factor value of 0.805. Health and safety inspection is indicator with highest loading factor in OHS variable. Salary, incentive and appraisal is the indicator in job satisfaction with highest loading value of 0.892. Highest indicator loading factor in employee performance is work quality.

The Cronbach’s alpha value of all constructs are more than 0.7 and less than 0.95, rho alpha value more than 0.7 and less than 0.95, and composite reliability more than 0.7 and less than 0.95 which mean all of the construct meet the requirement of construct reliability. Table 6 shows Average Variance Extracted (AVE). All AVE values meet the requirement (>0,5) which means all of the constructs is valid. HTMT shown in Table 6. The HTMT values meet the criteria (<0.85). The construct reliability, validity and discriminant validity are achieved, the measurement model is reliable and valid.

Table 6 – Construct Validity (AVE)

Construct	AVE
Work Environment	0.597
OHS	0.795
Job Satisfaction	0.718
Employee Performance	0.779

Table 7 – Discriminant Validity (HTMT)

	Work Environment	OHS	Job Satisfaction	Employee Performance
Work Environment				
OHS	0.765			
Job Satisfaction	0.838	0.812		
Employee Performance	0.839	0.753	0.845	

4.2 Evaluation of Structural Model

Evaluation of structural model assessed using criteria based in Table 4. The results show that all the values of VIF are less than 3 which indicates that there is no collinearity problem [25]. R square values are shown in Table 9. Model’s explanatory power is measured by R square value [26]. The R square value ranges from 0 to 1. Greater explanatory power indicated by higher R square value. R square values can be considered as 0.75 for substantial, 0.50 for moderate and 0.25 for weak [26]. The R square values in this research are in the range of 0.604 – 0.678 which indicates that this model has moderate explanatory power.

Table 8 – Collinearity Statistic (VIF)

	Work Environment	OHS	Job Satisfaction	Employee Performance
Work Environment			1.747	2.132
OHS			1.747	2.317
Job Satisfaction				2.568
Employee Performance				

Table 9 – R Square

	R Square	R Square Adjusted
Job Satisfaction	0.611	0.604
Employee Performance	0.678	0.669

Table 10 – Construct Cross-validated Redundancy

	Q Square
Work Environment	0.417
OHS	0.514

Another means is by calculating the Q square value to assess the predictive accuracy of path model [29][30]. It is based on the blindfolding procedure. Q square is not an out-of-sample prediction measurement, but incorporates elements of out-of-sample prediction and explanatory power in the sample. [26]. Q square value greater than 0.5, 0.25 and 0 indicates large, medium and small relevance of prediction. Blindfolding results from this research show that there is large predictive relevance on OHS, and medium predictive relevance on Work Environment.

4.3 Path Coefficient Analysis and Hypotheses Test by Bootstrapping

PLS Algorithm calculation and bootstrapping in PLS-Sem is used to determine path coefficient and its statistical significance [25]. For final result, bootstrapping with 5000 subsamples is recommended [25]. Fig 5 shows bootstrapping result of path model.

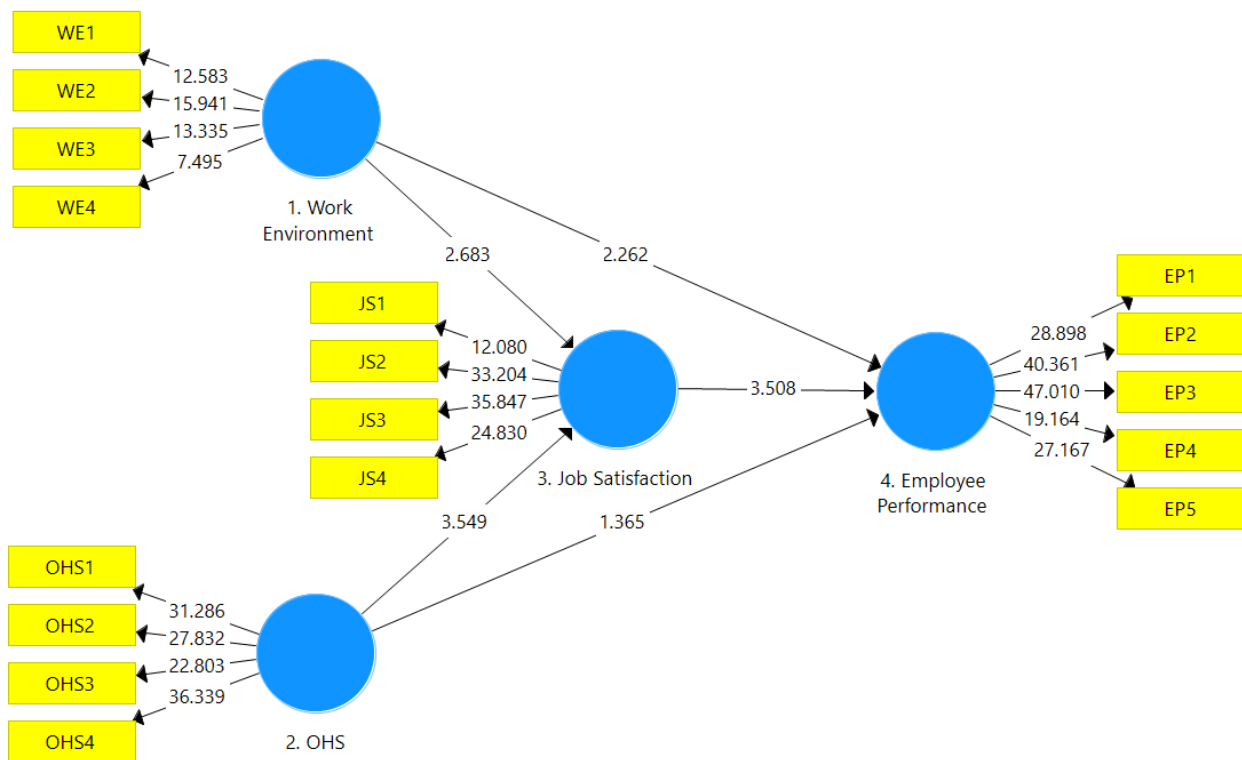


Fig. 5 - Bootstrapping result

Table 11 – Path Coefficient

	Original Sample Estimate	T Statistics	P Values
Work Environment (WE) ► Job Satisfaction (JS)	0.387	2.683	0.008
Work Environment (WE) ► Employee Performance (EP)	0.331	2.262	0.000
OHS ► Job Satisfaction (JS)	0.471	3.549	0.024
OHS ► Employee Performance (EP)	0.203	1.365	0.120
Job Satisfaction (JS) ► Employee Performance (EP)	0.385	3.508	0.000

The results in table 11 show relationship between Work Environment (WE), Occupational Health and Safety (OHS), Job Satisfaction (JS) and Employee Performance (EP). From five relationship, there are three significant relationship, and two non-significant relationship. WE positive and significantly affect EP with path coefficient

0.331 and T statistic 2.683, thus H₁ is accepted. WE also have positive and significant effect on JS with path coefficient 0.387 and T statistic 2.683 and lead to the acceptance of H₂. OHS have positive but not significant effect on EP with path coefficient 0.203 and T statistic 1.365, H₃ is rejected. OHS have positive and significant effect on JS with path coefficient 0.471 and T statistic 0.024, thus H₄ is accepted. JS have positive and significant effect on EP with path coefficient 0.385 and T statistic 3.508, H₅ is accepted.

Table 12 – Indirect Path Coefficient

	Original Sample Estimate	T Statistics	P Values
Work Environment (WE) ► Job Satisfaction (JS) ► Employee Performance (EP)	0.179	1.820	0.069
OHS ► Job Satisfaction (JS) ► Employee Performance (EP)	0.182	3.048	0.002

Table 12 show the indirect path coefficient result. The result show that there is positive but non significant effect of WE on EP through JS with path coefficient 0.179 and T statistic 1.820. This mean there is no mediation role of JS and H₆ is rejected. On the other hand, there is positive and significant effect of OHS on EP through JS with path coefficient 0.182 and T statistic 3.048. It means that there is mediation role of JS. Since OHS doesn't affect EP directly (non significant) and mediation JS on OHS and EP relationship is significant, then JS play full mediation role. H₇ is accepted.

5. Conclusion

Result shows that work environment has positive and significant effect on employee performance in PT. Z. The result is in-line with findings from Massoudi and Hamdi [7], Dharmanegara et al. [8] and Ramli [9]. Work environment also has positive and significant effect on employee satisfaction, in line with Antara et al. [14], Raziq and Maulabakshs [20] and Atmaja et al. [21]. Air quality is the main indicator that reflects work environment. Air quality includes temperature, pollution, and circulation. In research, development and manufacturing company like PT. Z, there are activities and processes that may impact the air quality such as welding, soldering, cutting, grinding, painting, resin curing and other chemical process by emitting pollutant such as solid particulate matter, volatile organic compound, chemical pollution, and metal dust. These emitted pollutants may reduce air quality thus affecting employee's performance and satisfaction. The temperature also need to be maintained. The ideal working temperature is between 21 – 25 degrees Celsius and when temperature is more than 25 degrees Celsius, every 1 degrees Celsius increment reports a 2 per cent productivity drop [31][32]. PT. Z need to rearrange the placement of air-pollutant activities or processes, install air filters and good circulation [33] and maintain ideal working temperature [31][32] to get better air quality, thus will improve employee's satisfaction and performance.

Table 13 – Conclusion

Hypotheses	Estimates	P values	Sig.	Conclusion
H1 Work Environment (WE) ► Job Satisfaction (JS)	0.387	0.008	Yes	H1 Accepted
H2 Work Environment (WE) ► Employee Performance (EP)	0.331	0.000	Yes	H2 Accepted
H3 OHS ► Job Satisfaction (JS)	0.471	0.024	Yes	H3 Accepted
H4 OHS ► Employee Performance (EP)	0.203	0.120	No	H4 Rejected
H5 Job Satisfaction (JS) ► Employee Performance (EP)	0.385	0.000	Yes	H5 Accepted
H6 Work Environment (WE) ► Job Satisfaction (JS) ► Employee Performance (EP)	0.179	0.069	No	H6 Rejected
H7 OHS ► Job Satisfaction (JS) ► Employee Performance (EP)	0.182	0.002	Yes	H7 Accepted

Occupational Health and Safety in this research does not have significant effect on employee performance, it differs with majority of findings in literature but have the same result with Ekowati [24]. On the other hands, OHS has positive and significance effect on job satisfaction, in line with Barphanda and Unnithan [11] and Perera [10]. Health and safety insurance indicator mainly reflects OHS. OHS doesn't affect performance in this research may be caused by the employee see work environment as more important factor, also despite the presence of OHS, they tend to do their job as comfortable as they want and inclined to go for the easiest and quickest option rather than the safest [34]. Some employees may still think that implementing health and safety may costly, in both time and resources [34], it may be the reason why implementation of OHS doesn't have direct effect on their performance. In terms of job satisfaction, the presence of OHS increases job satisfaction since workers experience good health and safety [35].

Job satisfaction has positive and significant effect on employee performance. It is in line with all the finding results shown in literature. Salary, incentive, and appraisal is main indicator that reflects job satisfaction. Employee will be motivated when they get better salary, incentive, and appraisal, thus tend to increase their performance [36]. It also applies otherwise, when the firm doesn't give enough salary, incentive and appraisal, it may demotivate the employee and result in decreased performance. PT. Z need to pay more attention to employee's salary, incentive, and appraisal to ensure that it meets employee's expectation. Result from this research show that job satisfaction can't mediate the effect of working environment on employee performance. It is in line with Atmaja et al.'s result [21]. On the other hand, the effect of OHS on performance of employee can be mediated by job satisfaction and in line with the result from Perera [10] and Barpanda and Unnithan [11]. Since there is no direct effect of OHS on employee performance, job satisfaction play as a full mediator role.

Final words, this research shows that in private research, development, and manufacture company, there are positive and significant effect of work environment on employee performance, work environment on job satisfaction, OHS on job satisfaction, and job satisfaction on employee performance. Job satisfaction also mediates the effect of OHS on employee performance. On the other hand, OHS does not have a direct effect on employee performance and job satisfaction cannot mediate the effect of work environment on employee performance.

Disclaimer

The authors whose names are written certify that they have no conflict of interest.

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