

THE EFFECT OF WORK ENVIRONMENT ON TURNOVER INTENTION WITH JOB SATISFACTION AS AN INTERVENING VARIABLE (A Study on Manufacturing Operators in Batam City)

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Received: 01/04/2026 | Revised : 05/04/2026 | Accepted: 20/04/2026 | Published : 13/05/2026

Abstract

The high turnover rate in Batam's manufacturing industry presents a serious challenge for human resource management, particularly at the production operator level, which forms the operational backbone of factories. This study aims to analyze the effect of work environment on turnover intention with job satisfaction as an intervening variable among manufacturing operators in Batam. The research employs a quantitative approach using a survey technique with a five-point Likert-scale questionnaire. The respondents comprised 100 manufacturing operators in Batam, selected through purposive sampling. Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 4 software. The results show that work environment has a positive and significant effect on job satisfaction ($\beta = 0.612$; $p < 0.001$), work environment has a negative and significant effect on turnover intention ($\beta = -0.241$; $p = 0.012$), job satisfaction has a negative and significant effect on turnover intention ($\beta = -0.468$; $p < 0.001$), and job satisfaction partially mediates the effect of work environment on turnover intention ($\beta = -0.286$; $p < 0.001$). These findings indicate that improvements in both physical and non-physical work environments can reduce operators' turnover intention through enhanced job satisfaction.

Keywords: *Work Environment, Job Satisfaction, Turnover Intention, Manufacturing Operator, PLS-SEM.*

1. INTRODUCTION

Batam City is one of the largest manufacturing industrial centers in Indonesia, designated as a Free Trade Zone and Free Port (KPBBP). The manufacturing sector absorbs approximately 44.07% of Batam's total workforce and serves as a key contributor to regional economic growth (BP Batam, 2024). The rapid growth of electronics, machinery, and shipbuilding industries in Batam is accompanied by high demand for production operators as the core workforce on the factory floor. However, behind this large labor absorption, the employee turnover rate in the manufacturing industry remains relatively high, averaging around 18% per year globally (MyRobin, 2024) — a figure that imposes considerable financial and operational burdens on companies.

Turnover intention, defined as an employee's voluntary willingness to leave the organization, is the primary predictor of actual turnover (Moblely, 1977; Stojanović-Aleksić et al., 2022). Among manufacturing operators, the intention to leave is influenced by various factors, ranging from heavy physical workload and monotonous working conditions to perceptions of an unsupportive work environment. Chen et al. (2001), in an empirical study using a national sample of workers, found that the work environment is an important antecedent that shapes job satisfaction and ultimately influences turnover intention. Arnoux-Nicolas et al. (2016) also confirmed that adverse working conditions are positively correlated with turnover intention.

The work environment in Batam's manufacturing plants has distinct characteristics, such as machine noise, mild chemical exposure, shift work systems, and high physical demands. These conditions make the work environment — both physical and non-physical — a critical variable affecting operators' work attitudes. Sedarmayanti (2017) classifies the work environment into physical dimensions (lighting, temperature, noise, layout) and non-physical dimensions (relationships with coworkers and supervisors, communication, and work atmosphere). When the work environment is perceived positively by employees, it tends to enhance job satisfaction and reduce turnover intention (Ahmad Saufi et al., 2023). Job satisfaction is positioned as a mediating variable linking the work environment to turnover intention. Robbins and Judge (2019) define job satisfaction as a positive feeling about one's job resulting from an evaluation of its characteristics. Wang and Duffy (2022) found that job satisfaction significantly

mediates the relationship between decent work and turnover intention among new generation employees. A similar study in the banking sector by Saputra and Wibowo (2024) also confirmed the mediating role of job satisfaction between the work environment and turnover intention. However, studies that specifically target manufacturing operators in Batam using this mediation model remain limited, even though the characteristics of the industry and workforce in Batam differ from those of the service or banking sectors. Based on this background, this study aims to: (1) examine the effect of work environment on job satisfaction; (2) examine the effect of work environment on turnover intention; (3) examine the effect of job satisfaction on turnover intention; and (4) examine the mediating role of job satisfaction in the relationship between work environment and turnover intention among manufacturing operators in Batam. The contribution of this study is twofold: theoretically, it enriches the human resource management literature, particularly in the context of Indonesia's manufacturing industrial zones; and practically, it provides input for the management of manufacturing companies in designing operator retention strategies.

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

2.1 Work Environment

The work environment refers to everything surrounding employees that may influence their performance of assigned tasks (Sedarmayanti, 2017). Nitisemito, as cited in Sunyoto (2019), states that the work environment encompasses all tools and materials encountered, the surroundings in which a person works, the work methods, and the work arrangements both as individuals and as groups. The work environment is divided into two main dimensions: physical (such as lighting, air circulation, noise, equipment layout, and work safety) and non-physical (relationships with supervisors, coworker relationships, and work atmosphere) (Sedarmayanti, 2017). In the context of manufacturing operators, the physical work environment is critical because it directly relates to occupational health and safety. Meanwhile, the non-physical work environment plays a role in shaping the psychological climate that supports productivity (Chen et al., 2001). Ahmad Saufi et al. (2023) emphasized that positive perceptions of the work environment are a key driver of employee engagement and a deterrent to turnover intention.

2.2 Job Satisfaction

Job satisfaction is defined as a positive feeling toward a job that results from an evaluation of its characteristics (Robbins & Judge, 2019). Luthans (2011) identifies five widely cited dimensions of job satisfaction: the work itself, pay, promotion, supervision, and coworkers. Job satisfaction is an affective construct that describes the extent to which employees like or dislike their work, and it consistently influences various work behaviors, including turnover intention (Mobley, 1977). According to social exchange theory, employees who experience high job satisfaction reciprocate with positive attitudes and behaviors toward the organization, including a commitment to remain (Stojanović-Aleksić et al., 2022). Conversely, when job satisfaction is low, employees tend to initiate a psychological withdrawal process that culminates in the intention to leave the organization.

2.3 Turnover Intention

Turnover intention refers to an employee's conscious tendency or willingness to seek alternative employment and leave the current organization (Mobley, 1977). In Mobley's classic model, turnover intention represents the final cognitive stage before actual turnover occurs. Commonly used indicators of turnover intention include thoughts of quitting, intention to search for another job, and intention to actually leave the company in the near future (Wang & Duffy, 2022). High turnover intention is detrimental to companies as it generates recruitment and retraining costs, loss of organizational knowledge, and disruption of production continuity (MyRobin, 2024). In labor-intensive manufacturing industries such as those in Batam, the loss of trained operators means a decline in production line efficiency, making efforts to reduce turnover intention a managerial priority.

2.4 Hypothesis Development

Effect of Work Environment on Job Satisfaction. Chen et al. (2001) demonstrated that the work environment is the strongest antecedent of job satisfaction, more influential than employees' demographic characteristics. Saputra and Wibowo (2024), in the context of Bank Lampung employees, found that the work environment had a positive and significant effect on job satisfaction. When physical and non-physical environments are adequate, employees feel more comfortable and enjoy their work.

H1: *Work environment has a positive and significant effect on the job satisfaction of manufacturing operators in Batam.*

Effect of Work Environment on Turnover Intention. Arnoux-Nicolas et al. (2016) found that adverse working conditions were positively and significantly associated with turnover intention. Stojanović-Aleksić et al. (2022) also documented a negative relationship between a supportive work environment and the intention to leave. In the context of Batam's manufacturing operators, the physical condition of the plant and interpersonal relationships at work are expected to suppress the desire to quit.

H2: *Work environment has a negative and significant effect on the turnover intention of manufacturing operators in Batam.*

Effect of Job Satisfaction on Turnover Intention. Mobley (1977) positioned job satisfaction as the principal cognitive antecedent of turnover intention. Wang and Duffy (2022) and Ahmad Saufi et al. (2023) provide consistent empirical evidence that job satisfaction is negatively related to turnover intention across various worker populations.

H3: *Job satisfaction has a negative and significant effect on the turnover intention of manufacturing operators in Batam.*

The Mediating Role of Job Satisfaction. Chen et al. (2001) explicitly positioned job satisfaction as a key mediator between work environment and turnover intention. Similar mediation patterns have been replicated by Stojanović-Aleksić et al. (2022) and Saputra and Wibowo (2024). Therefore, work environment is presumed to influence turnover intention both directly and indirectly through job satisfaction.

H4: *Job satisfaction mediates the effect of work environment on the turnover intention of manufacturing operators in Batam.*

2.5 Conceptual Framework

Based on the literature review and hypotheses developed, the conceptual framework of this study is depicted as follows: Work Environment (X) → Job Satisfaction (Z) → Turnover Intention (Y), with a direct path from Work Environment to Turnover Intention. This model is consistent with Mobley's (1977) causal turnover framework and the structural model of Chen et al. (2001).

Figure 1. Research Conceptual Framework

Work Environment (X) (Sedarmayanti, 2017)	Job Satisfaction (Z) (Robbins & Judge, 2019)	Turnover Intention (Y) (Mobley, 1977)
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H1 (+) → H3 (-)

H2 (-) : direct path X → Y

H4 : indirect path X → Z → Y (mediation)

Source: developed by the authors, 2025

3. RESEARCH METHOD

3.1 Research Design

This study employs a quantitative approach using a survey method. The research design is explanatory, aiming to test causal relationships among variables based on a previously constructed theoretical framework (Hair et al., 2022). Primary data were collected through closed-ended questionnaires distributed both directly and through digital forms.

3.2 Population and Sample

The study population consists of production operators in manufacturing companies located in Batam City. According to Sitorus (2023), as cited in studies on Batam's manufacturing sector, there are approximately 604 large and medium-sized industries operating in Batam, with manufacturing absorbing 44.07% of the total workforce (BP Batam, 2024). Given the very large and indeterminate population, the sample was determined using purposive sampling with the following criteria: (1) currently working as a production operator; (2) located in Batam City; and (3) having a minimum tenure of one year at the current company.

The sample size was set at 100 respondents. This sample size meets the PLS-SEM rule of thumb of ten times the number of structural paths leading to the largest endogenous construct (Hair et al., 2019). With the model containing a maximum of two paths leading to the endogenous variable (Turnover Intention), the minimum required sample is 20 respondents; therefore, 100 respondents are more than adequate. Kock and Hadaya (2018) also recommend a minimum sample size of approximately 100 for structural models with three latent constructs.

3.3 Operational Definitions and Measurement

All variables were measured using a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). The variable indicators were developed from well-established literature. The details of the indicators are presented in Table 1.

Table 1. Variable Operationalization

Variable	Dimensions	Indicators	Source
Work Environment (X)	Physical & Non-Physical	WE1. Lighting WE2. Air circulation WE3. Noise level WE4. Work safety WE5. Coworker relationships WE6. Supervisor relationships WE7. Work atmosphere	Sedarmayanti (2017)
Job Satisfaction (Z)	Work, pay, promotion, supervision, coworkers	JS1. Satisfaction with the work itself JS2. Satisfaction with pay JS3. Satisfaction with promotion opportunities JS4. Satisfaction with supervision JS5. Satisfaction with coworkers	Luthans (2011); Robbins & Judge (2019)
Turnover Intention (Y)	Cognitive withdrawal	TI1. Thoughts of quitting TI2. Intention to search for another job TI3. Intention to leave in the near future TI4. Comparing current job with alternatives	Mobley (1977); Wang & Duffy (2022)

Source: compiled by the authors from various references, 2025

3.4 Data Analysis Technique

Data were analyzed using the Partial Least Squares Structural Equation Modeling (PLS-SEM) approach with SmartPLS 4 software. PLS-SEM was chosen because it is suitable for exploratory research aimed at prediction and explanation, does not require assumptions of multivariate normality, and performs well with relatively small to medium sample sizes (Hair et al., 2019).

First, the evaluation of the measurement model (outer model) included convergent validity (outer loading > 0.70 and Average Variance Extracted/AVE > 0.50), internal consistency reliability (Cronbach's Alpha and Composite Reliability > 0.70), and discriminant validity using the Fornell-Larcker criterion and Heterotrait-Monotrait Ratio (HTMT < 0.90). Second, the structural model (inner model) was evaluated using the coefficient of determination (R²), predictive relevance (Q²), path coefficients, and significance testing through a bootstrapping procedure with 5,000 subsamples (Hair et al., 2022). Mediation analysis was conducted by examining the significance of the indirect effect and using the Variance Accounted For (VAF) approach to determine the type of mediation.

4. RESULTS AND DISCUSSION

4.1 Respondent Characteristics

Of the 100 questionnaires distributed, all were returned and deemed valid for analysis (response rate of 100%). The characteristics of the respondents are presented in Table 2.

Table 2. Respondent Demographic Characteristics (n = 100)

Characteristic	Category	Frequency	%
Gender	Male	58	58.0
	Female	42	42.0
Age	≤ 25 years	31	31.0
	26–35 years	47	47.0
	> 35 years	22	22.0
Education	Senior High / Vocational	76	76.0
	Diploma	18	18.0
	Bachelor	6	6.0
Tenure	1–3 years	44	44.0
	4–6 years	34	34.0
	> 6 years	22	22.0
Industry Sector	Electronics	51	51.0
	Machinery/Metal	27	27.0
	Plastics & Others	22	22.0

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The majority of respondents are male (58%), aged between 26–35 years (47%), with a senior high or vocational school education (76%), tenure of 1–3 years (44%), and predominantly working in the electronics sector (51%). This composition reflects the general characteristics of Batam's manufacturing operator workforce, dominated by senior high or vocational school graduates and the electronics sector as a major player (Ariastuty Sirait, as cited in BP Batam, 2024).

4.2 Measurement Model Evaluation (Outer Model)

The convergent validity evaluation results show that all indicator outer loadings exceed 0.70, the AVE of each construct is above 0.50, and both composite reliability and Cronbach's Alpha exceed the 0.70 threshold. Detailed outer model results are presented in Table 3.

Table 3. Outer Model Results (Convergent Validity & Reliability)

Construct	Indicator	Outer Loading	Cronbach's Alpha	Composite Reliability	AVE
Work Environment (X)	WE1	0.782	0.881	0.908	0.585
	WE2	0.753			
	WE3	0.724			
	WE4	0.811			
	WE5	0.769			
	WE6	0.763			
	WE7	0.778			
Job Satisfaction (Z)	JS1	0.841	0.862	0.901	0.646
	JS2	0.791			
	JS3	0.762			
	JS4	0.815			
	JS5	0.806			
Turnover Intention (Y)	TI1	0.867	0.854	0.902	0.696
	TI2	0.842			
	TI3	0.811			
	TI4	0.821			

Source: SmartPLS 4 data processing, 2025

Discriminant validity was assessed using the Fornell-Larcker criterion and HTMT. According to Fornell-Larcker, the square root of AVE for each construct is greater than its correlation with other constructs, and all HTMT values are below 0.90 as recommended by Hair et al. (2019). The discriminant validity results are presented in Table 4.

Table 4. Discriminant Validity (Fornell-Larcker)

Construct	JS	WE	TI
Job Satisfaction (JS)	0.804		
Work Environment (WE)	0.612	0.765	
Turnover Intention (TI)	-0.616	-0.528	0.834

Note: diagonal values represent the square root of AVE (shown in bold in the SmartPLS output).

Source: SmartPLS 4 data processing, 2025

4.3 Structural Model Evaluation (Inner Model)

Structural model evaluation began with examining collinearity among predictor constructs. All Variance Inflation Factor (VIF) values are below the critical threshold of 5 (highest VIF = 1.598), indicating no multicollinearity issues. The R² value for Job Satisfaction is 0.375 (moderate), and for Turnover Intention is 0.456 (moderate), indicating that the model has adequate explanatory power (Hair et al., 2019). The Q² values (cross-validated redundancy) of 0.231 and 0.299 — both above zero — indicate good predictive relevance.

Table 5. R-square and Q-square

Endogenous Construct	R-square	Q-square	Description
Job Satisfaction (JS)	0.375	0.231	Moderate
Turnover Intention (TI)	0.456	0.299	Moderate

Source: SmartPLS 4 data processing, 2025

4.4 Hypothesis Testing

Hypothesis testing was performed using a bootstrapping procedure with 5,000 subsamples and a two-tailed test at a 5% significance level. The results of direct and indirect effect testing are presented in Table 6.

Table 6. Hypothesis Testing Results (Direct & Indirect Effects)

H	Path	Coefficient (β)	t-statistic	p-value	Conclusion
H1	WE \rightarrow JS	0.612	8.974	0.000	Supported
H2	WE \rightarrow TI	-0.241	2.506	0.012	Supported
H3	JS \rightarrow TI	-0.468	5.192	0.000	Supported
H4	WE \rightarrow JS \rightarrow TI (mediation)	-0.286	4.381	0.000	Supported

Source: SmartPLS 4 data processing, 2025

The Variance Accounted For (VAF) is calculated as the ratio of the indirect effect to the total effect: $VAF = (-0.286) / (-0.286 + (-0.241)) = 0.543$, or 54.3%. According to Hair et al. (2022), a VAF between 20% and 80% indicates partial mediation. Therefore, job satisfaction is shown to partially mediate the effect of work environment on turnover intention.

4.5 Discussion

Work Environment and Job Satisfaction. The H1 finding confirms that the work environment has a positive and significant effect on the job satisfaction of manufacturing operators in Batam ($\beta = 0.612$; $p < 0.001$). This result is consistent with Chen et al. (2001), who positioned the work environment as the strongest antecedent of job satisfaction, and aligns with the findings of Saputra and Wibowo (2024) in the Bank Lampung context. For Batam's manufacturing operators, physical conditions such as lighting, air circulation, and work safety, as well as non-physical conditions such as relationships with supervisors and coworkers, contribute significantly to a sense of satisfaction with the job.

Work Environment and Turnover Intention. The H2 results show a significant negative effect of work environment on turnover intention ($\beta = -0.241$; $p = 0.012$). Although significant, the magnitude of this direct effect is smaller than the path through job satisfaction. This finding is consistent with Arnoux-Nicolas et al. (2016) and Stojanović-Aleksić et al. (2022), who noted that supportive working conditions suppress employees' intention to leave. In the context of Batam operators, a safe and supportive plant environment serves as a direct deterrent to turnover intention, particularly amid the high mobility of labor across industrial zones.

Job Satisfaction and Turnover Intention. H3 received empirical support ($\beta = -0.468$; $p < 0.001$), with job satisfaction emerging as the strongest negative predictor of turnover intention. This result reinforces Mobley's (1977) classic model and aligns with Wang and Duffy (2022) and Ahmad Saufi et al. (2023), who consistently found that satisfied employees have lower intentions to leave. For manufacturing operators, satisfaction with pay, promotion opportunities, supervision, and coworker relationships serves as the primary deterrent to leaving the company.

The Mediating Role of Job Satisfaction. H4 indicates that job satisfaction partially mediates the effect of work environment on turnover intention (β indirect = -0.286 ; $p < 0.001$; $VAF = 54.3\%$). This means that most of the effect of the work environment on turnover intention operates through the psychological mechanism of job satisfaction. This result reinforces the causal framework of Chen et al. (2001) and Stojanović-Aleksić et al. (2022) and supports the thesis that improvements in the work environment have not only a direct impact on turnover intention but also operate through enhanced job satisfaction. The implication is that operator retention strategies in Batam should be directed toward work environment interventions designed to improve job satisfaction — for instance, ergonomic improvements at workstations, supervisor training to build supportive relationships, and improving the quality of work atmosphere across shifts.

5. CONCLUSION AND IMPLICATIONS

This study concludes that the work environment has a positive and significant effect on job satisfaction, has a negative and significant effect on turnover intention, and that job satisfaction has a negative and significant effect on turnover intention. Job satisfaction is shown to partially mediate the effect of work environment on the turnover intention of manufacturing operators in Batam, with a VAF value of 54.3%. These findings indicate that the management of manufacturing companies in Batam should treat improvements in the work environment — both physical and non-physical — as a key pillar of their operator retention strategy, as these effects operate both directly and through enhanced job satisfaction.

The practical implications of these findings include: (1) improving plant ergonomics and physical conditions (lighting, air circulation, noise control); (2) developing supervisors' capacity to build supportive working relationships; (3) creating a cohesive cross-shift work atmosphere; and (4) regularly monitoring job satisfaction as an early indicator of turnover intention. The limitations of this study lie in the relatively small sample size (100 respondents) and the purposive sampling approach, which cannot be fully generalized to all manufacturing operators in Batam. Future research is recommended to expand the sample, test demographic control variables, and add moderating variables such as organizational support or affective commitment.

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