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Workplace Environment and Its Effect on Employee Productivity: Insights from the Boyolali Garment Industry

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ABSTRACT

This study aims to analyze the influence of physical and non-physical work environments on employee performance in the garment industry. Both physical and non-physical work environments are crucial factors that affect employee productivity and well-being. The research method employed is a survey with a Structural Equation Modelling (SEM) approach to evaluate the relationships between latent variables, namely physical work environment, non-physical work environment, and employee performance. Data were collected through questionnaires distributed to 39 respondents working in a garment company in Boyolali, Central Java. The analysis results show that the physical work environment has a significant influence on employee performance, with aspects such as temperature, ventilation, noise, and workspace layout contributing positively. On the other hand, the non-physical work environment, such as communication with superiors, self-development, and responsibility, does not show a direct significant effect on employee performance. These findings indicate that improvements in physical aspects are more urgently needed to directly enhance employee performance. However, non-physical factors may require a more strategic and in-depth approach to yield optimal impact.

Keywords: *physical work environment, non-physical work environment, employee performance, garment industry, SEM*

I. INTRODUCTION

The productivity of a company is crucial to remain competitive in an increasingly challenging market, and it is closely tied to the performance of its resources, particularly human resources. In ergonomics, human performance is influenced by physical and non-physical work environments [1], [2], [3]. Physical factors include lighting, noise levels, workspace layout, and ventilation [1]. While non-physical factors involve psychological aspects like interpersonal relationships and management dynamics [4]. Balancing these elements is vital for optimal employee performance [5].

The garment industry is a vital pillar of Indonesia's economy, significantly contributing to GDP, employment, and non-oil exports [6], [7]. As a labor-intensive sector, it provides livelihoods to millions, strengthening economic resilience and industrial growth. However, persistent challenges, including demanding work conditions, non-ergonomic setups, and intense production pressures, pose risks to worker well-being and overall efficiency. These factors not only affect individual performance but also have broader implications for productivity, quality output, and industry competitiveness [8]. Addressing these concerns through workplace improvements is crucial for ensuring long-term sustainability [9], enhancing employee welfare, and maintaining the sector's global standing.

Previous studies reveal a strong link between work environment and employee performance, though most focus on non-garment industries [10], [11], [12], [13]. However, garment workers face unique stressors, such as high production demands and intensive teamwork, underscoring the need for sector-specific research [9]. Additionally, prior studies often generalize the physical work environment without examining its distinct effects. Hence,

the specific research investigating weather working environment influencing employee's performance in garment industry needs to be conducted.

This research employs Structural Equation Modeling (SEM) to analyze complex relationships among latent variables that are not directly measurable [14], [15]. SEM's ability to simultaneously test multiple variables and uncover reasoning behind data makes it ideal for exploring factors affecting employee performance across various contexts [14], [15], [16].

The study examines how work environments impact employee performance in the garment industry, offering practical recommendations to improve working conditions and productivity. It includes a literature review, methodology, results, and recommendations tailored to the garment sector.

II. LITERATURE REVIEW

A. Work Environment

The work environment is defined as all physical and psychological factors that directly or indirectly influence employees [17]. Ferawati (2017) further describes it as everything surrounding workers that affects their ability to complete assigned tasks [18]. Additionally, it can be seen as a collection of processes that drive employee behavior toward achieving company goals, encompassing aspects related to the workplace itself [19]. In summary, the work environment refers to all physical and non-physical elements surrounding workers that impact their behavior and task performance. Generally, it is divided into two categories: physical and non-physical work environments. The next section explains the differences between these two types.

Physical Work Environment

Tangible elements like equipment, tools, office buildings, furniture, and workspace layout fall under the physical work environment. These factors directly impact employee performance by influencing comfort and efficiency [20]. Physical aspects such as lighting, temperature, humidity, and air circulation also play a role. Studies show that proper lighting and comfortable temperatures positively affect job satisfaction and performance [19]. Poor physical work conditions can lead to fatigue, reduced focus, and lower productivity. In production lines, inadequate physical environments are linked to higher costs and decreased worker effectiveness [21].

H1*: *A good physical work environment has a positive and significant impact on employee performance.

Non-Physical Work Environment

The non-physical work environment refers to intangible aspects of a workplace that influence employee performance and satisfaction. It includes interpersonal relationships and organizational culture. Effective communication and positive relationships with supervisors and colleagues contribute to employee performance [20]. Organizational culture and leadership that promote teamwork and transparency are crucial for enhancing motivation and performance [22]. Psychological and social conditions affecting how employees complete their tasks are also part of the non-physical work environment [23].

H2:* *A positive and conducive non-physical work environment has a significant and positive effect on employee performance.

B. Employee's Performance

Employee performance is defined as a measure of how effectively an employee can complete their tasks and responsibilities. It encompasses various aspects, including work outcomes, efficiency, work quality, initiative, and work attitude [24]. Other references suggest

that employee performance is influenced by factors such as employee competence, motivation, job satisfaction, and organizational effectiveness[24], [25], [26]. Furthermore, several indicators of employee performance are summarized as follows [27]:

a) Work effectiveness and efficiency;
b) Quality of work measured by key performance indicators (KPI);
c) Productivity, assessed by output within a specific time frame;
d) Job satisfaction with the work environment, facilities, and colleague relationships;
e) Commitment and loyalty, reflecting employee engagement in achieving organizational goals;
f) Problem-solving skills, including innovative solutions;
g) Individual competence, highlighting technical skills;
h) Workplace safety and health, measured by accident rates and prevention efforts;
i) Initiative and creativity, contributing to innovation and organizational development.

C. *Structural Equation Modelling* (SEM)

SEM is a statistical method used to build and test causal models consisting of two components: structural and measurement models [27]. It involves developing theoretical models, testing them with data, and evaluating the results [28]. SEM analyzes complex relationships between multiple variables, including latent constructs that cannot be directly observed [29]. Compared to traditional methods like path analysis and multiple regression, SEM provides deeper insights into the multifactorial nature of phenomena [28]. The SEM model used in this study is as follows:

$$\boldsymbol{\eta}_{(mx1)} = \boldsymbol{\beta}_{(m\times m)}\boldsymbol{\eta} + \boldsymbol{\gamma}_{(m\times n)}\boldsymbol{\xi}_{(n\times 1)} + \boldsymbol{\zeta}_{(m\times 1)} \quad (1)$$

Where:

$\boldsymbol{\eta}$: Dependent latent variable
$\boldsymbol{\beta}$: Path coefficient for endogenous latent variable & path coefficient for relationship between endogenous and exogenous latent variable
$\boldsymbol{\xi}$: Independent latent variable
$\boldsymbol{\zeta}$: Measurement error in structural model
m : Number of independent latent variable
n : Number of dependent latent variable

Meanwhile the equation for measurement model are as follows.
Dependent latent variable (y)

$$\boldsymbol{y}_{(qx1)} = \boldsymbol{\lambda}_{y(q\times m)} + \boldsymbol{\eta}_{(m\times 1)} + \boldsymbol{\varepsilon}_{(q\times 1)} \quad (2)$$

Independent latent variable (x)

$$\boldsymbol{x}_{(px1)} = \boldsymbol{\lambda}_{x(p\times n)} + \boldsymbol{\xi}_{(n\times 1)} + \boldsymbol{\delta}_{(p\times 1)} \quad (3)$$

Where:

$\boldsymbol{y}$: Indicators for dependent latent variable
$\boldsymbol{x}$: Indicators for independent latent variable
$\boldsymbol{\lambda}$: Outer loading
$\boldsymbol{\eta}$: Latent dependent variable
$\boldsymbol{\xi}$: Latent independent variable
$\boldsymbol{q}$: Number of dependent latent variable
$\boldsymbol{p}$: Number of independent latent variable
$\boldsymbol{\varepsilon}$: Error measurement of dependent latent variable
$\boldsymbol{\delta}$: Error measurement of independent latent variable

III. MODEL EVALUATION

A. Data

This study uses primary data collected through a survey of 39 employees working in the garment industry, conducted in November 2024. The survey employed a Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

B. Research Variable

This study employs latent variables, including dependent and independent variables, along with their influencing indicators.

1. Independent variable: Physical Working Environment Variable (ξ_1)

This study uses 10 indicators to assess employee satisfaction with physical work environment conditions. These indicators are adapted from the study conducted by Sazly and Permana (2020) [30]. The indicators related to the physical work environment are presented in Table 1.

Table 1. The indicators of physical working variables (ξ_1)

No	Dimension	Indicators
$x_{1.1}$	Lighting	I feel that the intensity of sunlight in my workspace is sufficient to support work activities.
$x_{1.2}$		I feel that the lighting from the lamps in my workspace is adequate.
$x_{1.3}$	Temperature	I feel that the temperature in my workspace is comfortable while working.
$x_{1.4}$	Air circulation	I feel that the ventilation in my workspace functions well to maintain air circulation.
$x_{1.5}$	Noise	I feel that the layout of my workspace is already comfortable and enhance my work
$x_{1.6}$		I feel that the air purifier in my workplace has been working good
$x_{1.7}$	Colour	I feel that the colour of my workplace surrounding has enhance my productivity when working
$x_{1.8}$	Workplace layout	I feel that the layout of my workplace facility is efficient and easy to be accessed
$x_{1.9}$		I feel that the workspace area provides sufficient room for me to carry out activities without any obstacles.
$x_{1.10}$	Safety	I feel that my workspace is safe and meets the necessary safety standards to protect me while working.

2. Independent variable: Non-Physical Working Environment (ξ_2)

The indicators used to measure employee satisfaction with the non-physical work environment were developed based on the questionnaire indicators previously utilized by Sazly and Permana (2020) [30]. Table 2 presents the questionnaire items for the non-physical work environment variable.

Table 2. The indicators of nonphysical working variables (ξ_2)

No	Dimension	Indicators
$x_{2.1}$	Work responsibility	I feel that my tasks at the factory are aligned with my abilities or specialization
$x_{2.2}$		I feel that my job responsibilities have been clearly explained.
$x_{2.3}$	Work instruction	I feel that my supervisor provides clear guidance to complete tasks
$x_{2.4}$	Self development	The company supports me in pursuing further education

$x_{2.5}$	Comfortable	I feel comfortable collaborating with my colleagues
$x_{2.6}$	Communication	My relationship with my supervisor is good and supports my performance

3. Dependent variable: Work performance (η_1)

Table 3 presents the indicators used to measure employee performance.

Table 3. Latent variable of employee performance (η_1)

No	Dimension	Indicators
$y_{1.1}$	Effectiveness	The workload assigned to me is appropriate for my abilities
$y_{1.2}$		I successfully complete tasks within the specified time frame
$y_{1.3}$	Quality	My abilities align with the duties and responsibilities assigned to me
$y_{1.4}$		I believe that the quality of my work meets the established standards
$y_{1.5}$	Timeliness	I always complete tasks within the timeframe set by the organization.
$y_{1.6}$		I am always present at the workplace during the designated working hours
$y_{1.7}$	Productivity	I actively participate in various activities or tasks assigned at work
$y_{1.8}$	Efficiency	I plan my work independently to complete tasks effectively and efficiently

4. Demographic Variable

The demographic variables analyzed in this study include employee age, tenure, gender, and the division where employees are assigned.

C. Research Method

This study was conducted through three main steps. First, an exploration of respondent characteristics was carried out to understand the demographic profile and gather information on research variables. Second, Structural Equation Modeling (SEM) analysis was performed, starting with the development of a conceptual model and path diagram, followed by evaluating the measurement model for validity and reliability, and assessing the structural model to test relationships between latent variables. The conceptual model used in this study is shown in Figure 1. Third, hypothesis testing was conducted to determine the significance of the relationships between variables formulated in the conceptual model.

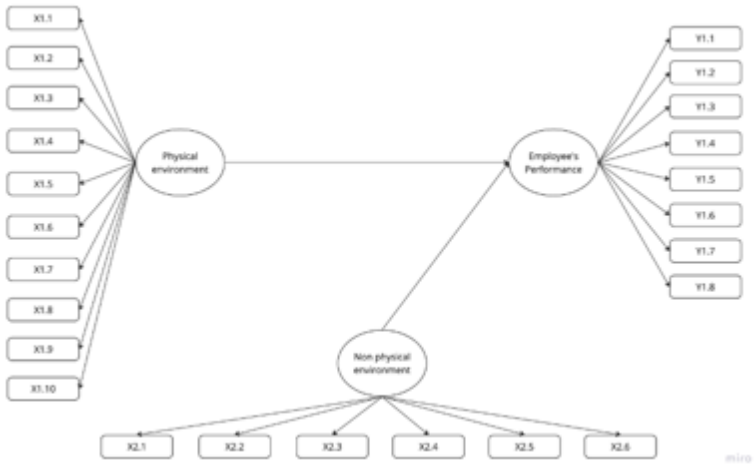

Figure 1. Construct diagram of this research

IV. RESULT AND DISCUSSION

A. Demographic Profile

Most respondents in this study were female (59.0%), predominantly aged 41–60 years (51.3%), with most having worked for over five years (74.4%). Table 4 highlights employee perceptions of the physical work environment, focusing on light intensity and temperature indicators. Overall, satisfaction levels (satisfied and very satisfied) dominated, particularly for temperature, ventilation, and safety, with the highest satisfaction reported in the lab/QC, engineering, and spinning divisions. Neutral perceptions were minimal, except for specific indicators like noise and color schemes in certain divisions. Overall, employees were largely satisfied with the physical work environment, though aspects like noise require further attention.

Table 4. Employee Perceptions of the Physical Work Environment

Latent Variable	Indicator	Perception	Administration	*Drawing*	*Engineering*	*Laboran/QC*	*Mechanic*	*Other*	*Production*	*Spinning*	*Utility*
Physical working environ-ment (ξ_1)	$x_{1.3}$	Not satisfy	0%	0%	0%	0%	0%	0%	0%	13%	0%
		Neutral	0%	32%	0%	0%	0%	8%	69%	0%	27%
		Satisfy	0%	14%	0%	14%	100%	53%	31%	25%	73%
		Very satisfy	100%	54%	100%	86%	0%	39%	0%	63%	0%
	$x_{1.6}$	Not satisfy	0%	7%	12%	0%	0%	0%	0%	12%	0%
		Neutral	0%	11%	0%	11%	0%	25%	20%	0%	25%
		Satisfy	0%	29%	0%	15%	100%	33%	80%	0%	33%
		Very satisfy	100%	54%	88%	74%	0%	42%	0%	88%	42%

Table 5 presents employee satisfaction perceptions based on indicators such as workload suitability, task completion, skills alignment, work quality, productivity, and efficiency, categorized by division. Most employees in divisions like Engineering, Laboratory/QC, and Spinning expressed high

satisfaction with efficiency (71%-79%). However, divisions such as Drawing and Utility recorded neutral perceptions for specific indicators, such as workload suitability (21%) and efficiency (10%).

Table 5. Employee Perceptions of Employee's Performance

Latent Variable	Indicator	Perception	Administration	*Drawing*	*Engineering*	*Laboran/ QC*	*Mechanic*	*Other*	*Production*	*Spinning*	*Utility*
Employee's performance (η_1)	$y_{2.1}$	Neutral	0%	21%	18%	0%	0%	8%	20%	0%	0%
		Satisfy	0%	28%	24%	44%	100%	41%	80%	21%	62%
		Very satisfy	100%	52%	59%	56%	0%	51%	0%	79%	38%
	$x_{2.7}$	Neutral	0%	10%	0%	0%	0%	0%	0%	0%	0%
		Satisfy	0%	55%	21%	29%	100%	50%	100%	21%	62%
		Very satisfy	100%	34%	79%	71%	0%	50%	0%	79%	38%

B. *Structural Equation Modelling (SEM)*

The analysis employs the SEM approach, including model evaluation and hypothesis testing. Model evaluation assesses the proposed model's ability to explain employee performance comprehensively, while hypothesis testing identifies the impact of independent variables, namely physical and non-physical environments, on employee performance.

1. Model Evaluation

a) Construct model evaluation

The validity of each indicator in forming latent variables is assessed using outer loading and Average Variance Extracted (AVE). Reliability is evaluated through composite reliability and Cronbach's alpha. Table 6 presents the composite and Cronbach's alpha values.

Table 6. Validity Values Based on Composite Reliability & Cronbach's Alpha

Indicator	*Cronbach's alpha*	*Composite reliability*
Physical working environment (ξ_1)	0,881	0,887
Nonphysical working environment (ξ_2)	0,944	0,949
Employee's performance (η_1)	0,931	0,933

A latent variable is considered reliable if Cronbach's alpha exceeds 0.6 and composite reliability is above 0.7. As shown in Table 6, all variables meet these thresholds, indicating that physical and non-physical work environments, as well as employee performance, demonstrate good reliability as measurement instruments.

Table 7. Validity indicator based on outer loading & AVE

Latent variable	Indicator	*Outer loading*	AVE
Nonphysical working environment (ξ_2)	$x_{2.1}$	0,82	0,68
	$x_{2.2}$	0,88	
	$x_{2.3}$	0,72	
	$x_{2.4}$	0,83	
	$x_{2.5}$	0,85	
Physical working environment (ξ_1)	$x_{1.1}$	0,65	0,64
	$x_{1.2}$	0,85	
	$x_{1.3}$	0,74	
	$x_{1.4}$	0,75	
	$x_{1.5}$	0,84	
	$x_{1.6}$	0,83	
	$x_{1.7}$	0,88	

Latent variable	Indicator	*Outer loading*	AVE
	$x_{1.8}$	0,84	
	$x_{1.9}$	0,83	
Employee's performance (η_1)	$y_{1.1}$	0,87	0,71
	$y_{1.2}$	0,84	
	$y_{1.3}$	0,85	
	$y_{1.4}$	0,80	
	$y_{1.5}$	0,87	
	$y_{1.6}$	0,81	
	$y_{1.7}$	0,84	

For the validity of indicators in constructing latent variables (Table 7), all indicators except sunlight intensity ($x_{1.1}$) have outer loading values >0.7, indicating they are valid in measuring the latent variables (physical work environment, non-physical work environment, and employee performance). Additionally, AVE values for all variables exceed 0.5, meaning the indicators explain over 50% of the variance for the latent variables.

Discriminant validity was assessed through cross-loading to evaluate whether each indicator correlates more strongly with its latent variable than with others. An indicator is deemed valid if its cross-loading value is higher for its latent variable than for others. Table 8 presents the cross-loading values for each indicator. Based on Table 8, all indicators show higher cross-loading values for their respective latent variables compared to others, confirming their validity in measuring each latent variable.

Table 8. Cross loading value

	Indicator	Physical working environment (ξ_1)	Nonphysical working environment (ξ_2)	Employee's performance (η_1)
Physical working environment (ξ_1)	$x_{1.1}$	0,62	**0,65**	0,60
	$x_{1.2}$	0,69	**0,85**	0,84
	$x_{1.3}$	0,65	**0,73**	0,61
	$x_{1.4}$	0,60	**0,74**	0,72
	$x_{1.5}$	0,73	**0,84**	0,77
	$x_{1.6}$	0,67	**0,83**	0,75
	$x_{1.7}$	0,76	**0,88**	0,87
	$x_{1.8}$	0,68	**0,84**	0,77
	$x_{1.9}$	0,58	**0,83**	0,76
	$x_{1.10}$	0,62	**0,85**	0,78
	$x_{1.11}$	0,70	**0,74**	0,66
Nonphysical working environment (ξ_2)	$x_{2.1}$	**0,82**	0,75	0,76
	$x_{2.2}$	**0,88**	0,70	0,63
	$x_{2.3}$	**0,72**	0,65	0,60
	$x_{2.4}$	**0,83**	0,66	0,63
	$x_{2.5}$	**0,85**	0,63	0,56
Employee's	$y_{1.1}$	0,73	0,74	**0,87**

	Indicator	Physical working environment (ξ_1)	Nonphysical working environment (ξ_2)	Employee's performance (η_1)
performance (η_1)	$y_{1.2}$	0,65	0,84	**0,84**
	$y_{1.3}$	0,63	0,75	**0,85**
	$y_{1.4}$	0,46	0,69	**0,80**
	$y_{1.5}$	0,65	0,81	**0,87**
	$y_{1.6}$	0,70	0,80	**0,81**
	$y_{1.7}$	0,76	0,82	**0,84**

b) Structural Model Evaluation

The inner model evaluation measures model accuracy using R^2 and Q^2 values. In this model, R^2 is 0.86, indicating that 86% of employee performance in garment companies in Boyolali, Central Java, is explained by physical and non-physical work environments, with the remaining 14% influenced by other variables outside the model. The Q^2 value of 0.8 (above 0) confirms the model's strong predictive ability, demonstrating its effectiveness in explaining factors influencing employee performance.

2. Hypothesis Testing

Table 9 presents the significance test values for hypothesis testing.

Table 9. Statistics test result

Hypothesis	Parameter coefficients	T-value	P-value
Physical working environment (ξ_1) → Employee's performance (η_1)	0,90	0,21	0,83
Nonphysical working environment (ξ_2) → Employee's performance (η_1)	0,03	7,08	0.00

The results in Table 9 show that the T-value for the physical work environment variable (t(α=5%) = 1.96) indicates a significant impact on garment employees' performance in Boyolali, Central Java (Physical Work Environment → Employee Performance). In contrast, the non-physical work environment does not have a significant effect. Positive coefficients for the independent variables suggest they contribute positively to improving employee performance.

C. Discussion

The study reveals that garment employees generally have a positive perception of their physical and non-physical work environments, with most expressing satisfaction (<80%). However, two physical environment indicators temperature and noise received lower ratings. High temperatures and humidity, necessary to maintain fabric quality in garment factories, and noise from production machines and cooling systems were identified as key issues. Prolonged exposure to noise can negatively impact employee performance, as noted by prior studies [31], [32].

Additionally, the sunlight intensity indicator ($x_{1.1}$) was found irrelevant for assessing employee perceptions, as garment operations avoid direct sunlight to preserve fabric quality. Overall, satisfaction with the physical environment significantly improves employee

performance, aligning with previous findings by Kavitha & Akash (2012) and Raphael (2024) [33], [34].

Conversely, non-physical factors like communication, self-development, and responsibilities did not significantly affect performance. This contrasts with earlier studies suggesting their significant impact but aligns with findings from Subagio et al. (2024), which indicate that non-physical environments have indirect rather than direct effects on performance [35]. This highlights the contextual nature of non-physical environment impacts, influenced by other factors.

V. SUMMARY

This study reveals that the physical work environment significantly impacts employee performance in the garment industry, while the non-physical environment does not have a direct significant effect. Physical elements such as temperature, ventilation, noise, and workspace layout positively contribute to performance when well-managed. In contrast, non-physical factors like communication, personal development, and interpersonal relationships are more relevant to employee well-being, with an indirect and contextual influence on performance.

The findings also highlight that aspects such as noise levels and workspace temperature require improvement. This study provides opportunities for further research to explore the complex relationship between the non-physical work environment and performance, including mediating factors. Future research could examine non-physical variables like organizational policies and workplace culture using a longitudinal approach to evaluate their long-term impact on the work environment.

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