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The Impact of Physical and Non-Physical Work Environment on Work Productivity in the Production Division
(Case Study: PT Rubber)

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ABSTRACT

This study aims to analyze the effect of physical and non-physical work environments on employee productivity in the Production Division of PT Rubber. The physical work environment includes lighting, ventilation, temperature, and noise, while the non-physical environment covers coworker relationships, communication, work atmosphere, and workload. The research population consisted of 171 employees, with a sample of 120 respondents determined using the Slovin formula (5% margin of error). Data were collected through a 5-point Likert scale questionnaire comprising 30 items (10 physical, 10 non-physical, 10 productivity), all tested for validity and reliability (Cronbach's Alpha physical = 0.932; non-physical = 0.937; productivity = 0.959). Data analysis was performed using multiple linear regression with SPSS. The t-test results show that the physical work environment significantly affects productivity (t-value = 6.411; sig. 0.000), while the non-physical work environment has a more dominant effect (t-value = 9.384; sig. 0.000). The F-test obtained an F-value of 1073.772 > F-table = 3.07 (sig. 0.000), indicating a significant simultaneous effect. The resulting regression equation is $Y = -0.530 + 0.427X_1 + 0.594X_2$. These findings highlight the importance of optimizing physical work conditions and fostering a positive psychological work climate, with priority given to non-physical factors, to support sustainable productivity

Keywords: *Physical work environment, non-physical work environment, work productivity, SPSS.*

Introduction

The level of work effectiveness is to assess the extent to which an individual worker can complete the tasks that are their responsibility, based on the quality and quantity standards set by the company. An individual worker is considered to have efficient performance if they can meet the established work targets, both in terms of the quantity and quality of their output. For example, in the case study of the company CV. LPS, it was found that there has been a decline in employee work performance over the past five years, from 2011 to 2015. The decline was fundamentally triggered by suboptimal working conditions [1]. To create a conducive work atmosphere for employees in carrying out their tasks, the organization must pay attention to the working conditions of employees at the job site as a way to encourage the improvement of their effectiveness and work results [2].

The working conditions are one of the significant elements that have an impact on activities within the company. What is meant by working conditions are all the things in the employees' work area that have the potential to influence their behavior or condition while carrying out the work obligations that need to be completed. The supportive work environment, both in terms of tangible facilities and psychological aspects, indicates the emergence of a conducive and productive work atmosphere, which ultimately fosters comfort and satisfaction for all employees [3]. A supportive and comfortable work environment can create a sense of security and open opportunities for all employees to perform their tasks to the best of their abilities. Additionally, the condition of the workplace also affects psychological feelings and motivation in carrying out tasks, resulting in efficient use of working hours with positive confidence, thereby improving employee performance [4]. An unsupportive work environment can make employees more susceptible to health issues, more vulnerable to mental stress, and more likely to have difficulty concentrating [5]. Unsupportive working conditions hurt every worker. However, behind these conditions, feelings of discomfort often arise [6].

The working conditions are classified into two types, namely tangible work aspects and intangible work aspects [7]. The tangible aspects of the workplace are all the elements surrounding all employees that can affect their conditions or behavior while performing their jobs. Examples include a workspace with minimal distractions, a pleasant work atmosphere, stable room temperature, and adequate lighting, as part of the overall work environment [8]. The intangible aspects of the work environment are the overall situations that are formed and

related to professional interactions, including the relationships between employees and supervisors, the relationships between superiors and subordinates, as well as communication among colleagues [9]. A supportive and pleasant work environment can enhance comfort while working, which ultimately influences the improvement of work results and effectiveness.

The level of employee performance effectiveness fundamentally involves the utilization of human resources and work facilities frugally and optimally, leading to the achievement of goals in line with work output and the time required to create results through employee contributions [10]. The level of work effectiveness is a crucial element in determining the success of an organization. If employees' work results continue to show significant and sustained improvement, the organization can more easily achieve its previously set targets [11]. On the other hand, performance levels will decline if an employee is unable to maintain competitiveness compared to their colleagues. If the decline continues without any efforts to improve, there is a high possibility that the company will face the risk of ceasing operations [12].

PT Rubber is a manufacturing company that produces rubber parts for the automotive industry. In order to respond to the growth potential of the rubber industry, assess opportunities in the national rubber sector, and face competition with other rubber companies domestically. In 2024, PT Rubber estimated its production target to be Rp 240,847,929,645, but the actual figure was Rp 214,259,289,615, indicating a decline in the productivity of PT Rubber's employees. The decline in production achievement can be caused by various factors, one of which is the working environment. The work environment is an important factor that should be a serious concern for companies because it has a direct impact on employee productivity levels. If not managed properly, this factor can harm all parties involved, both workers and employers themselves, and has the potential to cause a decline in overall performance.

Therefore, in order to achieve an optimal level of productivity, the company needs to focus on managing the working environment conditions. Creating a conducive work atmosphere can meet the employees' needs, which will ultimately contribute significantly to the development of work outcomes [5]. If the company is able to provide adequate attention to the needs and well-being of its employees, it will have a positive impact on their performance improvement. Conversely, if employees cannot show optimal attention or responsibility in carrying out their tasks, this has the potential to cause a decline in work productivity [13].

Based on the observations at PT Rubber, employees in the production division have complained about the state of the work environment, both in physical and non-physical aspects, which affects their work comfort level. Physical environmental factors, such as lighting, ventilation, noise, and work facilities that support comfort, need to be improved to better support their work productivity. Meanwhile, non-physical environmental factors, such as relationships among employees. In addition, the workload or work pressure must also be a concern, with the aim of creating a more supportive and comfortable work environment for employees.

Based on the description above, PT. Rubber is experiencing a decline in work productivity, which is suspected to be caused by the lack of surrounding conditions in the work environment that encompass both material and non-material aspects in the production area. This research aims to analyze the impact of working environment conditions, both physical and non-physical, on employee effectiveness. Practically, this study aims to present data or insights regarding the influence of the working environment, encompassing both physical and non-physical aspects, on employee productivity. The goal is to improve work productivity and create a management of surrounding conditions that supports employee efficiency.

Research methodology

This research uses a quantitative method to identify the influence of working environment conditions, both physical and non-physical, on employee productivity levels at PT Rubber. Referring to the relationship between the variables established in the hypothesis, the research model design is structured with the following stages.

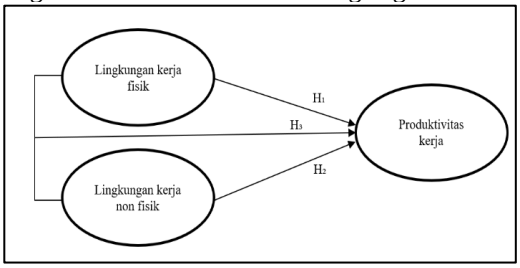

Figure 1. Frame of mind

This study proposes several hypotheses based on the relationships between the variables being examined.
H1: The physical work environment has a significant impact on employee productivity levels.
H2: Non-physical work environment aspects have a significant impact on employee productivity levels.

H3: Both aspects of the work environment, both physical and non-physical, significantly contribute to achieving work productivity.
The following process flow system is the research stages conducted by the author at PT Rubber.

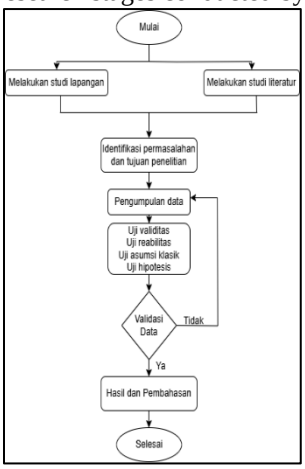

Figure 2. Research flowchart

The image shows the research flow, which begins with a literature review and direct data collection in the field, followed by problem identification and the determination of research objectives. After data collection, a series of analysis tests such as validity, reliability, classical assumptions, and hypothesis testing are conducted. If the data does not meet the criteria, re-collection is carried out. The valid data is then analyzed to produce the discussion and conclusion of the research.

Research Sample

The population in this study includes all employees currently performing tasks in the production division at PT Rubber, totaling 171 employees. The production division was chosen because it is the core part of the company directly related to work processes and production results, making it highly relevant for research in relation to the work environment and work productivity. The researcher determined the sample size based on calculations. The sample quantity was calculated using Slovin's formula with a margin of error of 5%, resulting in a total of 120 samples. This number is considered adequate to represent the population while providing valid and reliable results in testing the research hypothesis regarding the impact of working conditions on employee effectiveness and work output.

Questionnaire

Data collection in this study was conducted by distributing questionnaires to respondents to evaluate how workplace conditions, which include material and non-material elements, affect work efficiency in the production division at PT Rubber. The questionnaire was meticulously designed, considering aspects of validity and reliability, to ensure that the research variables can be measured accurately. The questionnaire contains questions to gather information about employees' views on the comfort of the conditions around the work area, the comfort of the work atmosphere, and the impact of these two factors on their productivity. It consists of several sections, each focused on the main variables, namely the physical and non-physical aspects of the work environment and work productivity.

The questionnaire study was distributed through an online Google Form. Data were collected through interviews and the distribution of questionnaires structured using a five-point Likert Scale, where each question is accompanied by five answer choices representing the level of perception or assessment of the respondents. There are 30 questions asked in this study, including 10 physical questions, 10 non-physical questions, and 10 work productivity questions. All these questions will be tested for validity and reliability by distributing the questionnaire to 120 respondents. The questionnaire was given anonymously without asking for personal information. Respondents were given clear instructions about the purpose of the research and the importance of honest answers. Each questionnaire is coded to maintain confidentiality.

Data Analysis

In this study, the data were processed and analyzed using SPSS through various stages of analysis. The initial step includes testing for validity and reliability to ensure that the measurement tools used in the research can accurately and consistently measure the data. The data analysis process also involves classical assumption tests to

ensure that the obtained data meet the model's guideline assumptions. Using linear regression analysis, resulting in analysis results that are recognized for their validity and can be trusted [14].

Validity Test

Validity testing is intended to determine the ability of the questionnaire to obtain data that truly represents the research variables. A statement, item, or indicator can be considered valid if the calculated r value exceeds the table r value and has a positive value [15].

Reliability Test

Reliability testing is a measurement process aimed at assessing the limits of an instrument's ability to provide consistent findings free from bias or error. This test is conducted to ensure that respondents' answers to the questionnaire have stability in measuring certain phenomena or variables. The decision-making indicator in this test is based on the Cronbach's Alpha value for each aspect, where the instrument is considered reliable if the Cronbach's Alpha coefficient exceeds 0.6 [16].

Classic Assumption Test

Normality testing aims to ensure that data on an ordinal, interval, or ratio scale have a data distribution that approaches a normal distribution. The normality test is to show that the variables in the study have a normal data distribution [17]. The use of t and F tests depends on the assumption that the residuals are normally distributed [18]. Whereas according to [19] The basis for determining whether the normality assumption is met or not is as follows: (a) if the data distribution is around the diagonal line and in line with that line or the histogram diagram forms a distribution pattern that approaches normal, then the regression model is considered to meet the normality requirement; (b) conversely, if the data distribution moves away from the diagonal line or does not align with the direction of the diagonal line or the histogram appearance does not reflect a normal distribution pattern, then the regression model is stated to not meet the normality assumption.

Multicollinearity testing is conducted to detect any violations of the classical assumption regarding the linear relationship between explanatory factors in the regression model. The indication of the presence or absence of multicollinearity can be determined through the Variance Inflation Factor (VIF) value. If the VIF is recorded as less than 10 and Tolerance has a value greater than 0.1, then the regression model can be said to be free from multicollinearity [17].

Heteroscedasticity testing is conducted to ensure that multiple linear regression does not contain heteroscedasticity, which is a condition where the variance of the residuals is not constant at every level of the independent variable. The purpose of this test is to determine whether there is inconsistency in the distribution of residuals between observations in the regression design [17]. The basis for determining heteroskedasticity analysis can be seen from the pattern of point distribution on the scatterplot graph. If a certain pattern appears that is regularly patterned, for example, forming waves or a spread that widens and then narrows, this condition indicates the presence of heteroskedasticity. On the other hand, if no specific pattern is visible and the residual points are randomly scattered above or below the zero line on the Y-axis, it can be stated that the regression model does not exhibit heteroskedasticity [20].

Hypothesis Testing

In this study, the multiple linear regression method is applied to measure the extent to which several independent variables simultaneously affect one dependent variable [21]. The study of estimating the linear relationship with multiple variables is a regression method that has many independent variables and has the advantage of predicting future situations by assessing several independent factors (X) along with the dependent factor (Y) [22].

The multiple linear regression approach with SPSS was chosen because of its ability to facilitate data processing and provide the necessary statistical tools. The impact of real and non-physical work on productivity is measured by applying the multiple linear regression analysis approach. In the analysis, the equation used refers to the method that has been explained in [23], that is:

$$Y = a + \beta 1X1 + \beta 2X2 + e \quad \text{.....(1)}$$

Y: Work productivity
X1: Physical work environment
X2: Lingkungan kerja non fisik
a: Constant or fixed value, which is the average value of Y when the values of X1 and X2 are zero.
b1: The impact value of the relationship of component X1 (Physical Work Environment)
b2: The impact value of the relationship of component X2 (Non-physical work environment)
e: mistake / nuisance

The hypothesis testing methods applied in this research are the t-test and the F-test. The t-test (partial) essentially shows the extent to which the impact of an explanatory factor or independent variable individually explains the differences in the dependent variable [18]. Basis for taking according to [24] to prove the hypothesis in this research, a t-test is used, which involves comparing the significance level test by comparing the t-calculated value based on the t-table. If the t-calculated value exceeds the t-table, the alternative hypothesis (Ha) is accepted. Conversely, if the t-calculated value does not exceed the t-table, the alternative hypothesis (Ha) is rejected.

The simultaneous F test essentially shows whether the independent factors collectively affect the dependent factor in the model design. Basis for taking according to [18] to test the hypothesis in the research process by applying the F-test, which involves comparing the significance of the calculated F-value with the F-table value simultaneously. If the calculated F-value is greater than the F-table value and the significance level is below 5%, then the null hypothesis (H_0) is not accepted, indicating a significant effect. Conversely, if the calculated F-value is greater than the F-table value but the significance level is more than 0.05, then the null hypothesis (H_0) is not rejected, indicating no significant effect is found.

Result and Discussion

Validity Test

Table 1. Results of the validity test of the physical work

Indicator	r-table	r-hitung	Keterangan
X1.1	0,177	0,774	Valid
X1.2	0,177	0,814	Valid
X1.3	0,177	0,801	Valid
X1.4	0,177	0,829	Valid
X1.5	0,177	0,786	Valid
X1.6	0,177	0,745	Valid
X1.7	0,177	0,803	Valid
X1.8	0,177	0,763	Valid
X1.9	0,177	0,793	Valid
X1.10	0,177	0,792	Valid

Based on the information presented in Table 1, the results of the variable validity test, all question items are considered valid because they have correlation values that exceed the r-table value, thus all indicators are suitable for further analysis, indicating that the calculated r value exceeds 0.177, which means the test results show that the empirical correlation index score exceeds the established r-table value. This indicates that each questionnaire item related to the physical variable has met the expected validity standards, thus the obtained data can be considered valid. If an item is declared invalid in the validity test, the statement in the item will be corrected, then the validity test will be carried out again until it meets the predetermined criteria.

Table 2. Results of the validity test of the non-physical work

Indicator	r-table	r-hitung	Keterangan
X2.1	0,177	0,796	Valid
X2.2	0,177	0,829	Valid
X2.3	0,177	0,820	Valid
X.24	0,177	0,780	Valid
X2.5	0,177	0,845	Valid
X2.6	0,177	0,775	Valid
X2.7	0,177	0,814	Valid
X2.8	0,177	0,757	Valid
X2.9	0,177	0,820	Valid
X2.10	0,177	0,792	Valid

Referring to Table 2, the validity test data indicates that all items in the non-physical work environment variable have calculated r-values exceeding the table r-value, which is above 0.177. This means that the empirical correlation coefficient values of each question item meet the minimum validity requirements of the instrument.

Table 3. Productivity validity test results

Indicator	r-table	r-hitung	Keterangan
Y1.1	0,177	0,828	Valid

Y1.2	0,177	0,843	Valid
Y1.3	0,177	0,837	Valid
Y1.4	0,177	0,840	Valid
Y1.5	0,177	0,855	Valid
Y1.6	0,177	0,838	Valid
Y1.7	0,177	0,875	Valid
Y1.8	0,177	0,882	Valid
Y1.9	0,177	0,874	Valid
Y1.10	0,177	0,879	Valid

Referring to the mentioned chart, the test results prove that the assessment instrument is valid and can be used in the aspect of productivity, with a correlation coefficient calculated above 0.177 or the calculated r being greater than the table r, thus all items in this part of the variable instrument are declared valid based on the test results.

Reliability Test

Table 4. Each question item

Variabel	Cronbach's Alpha	Keterangan
Lingkungan Kerja Fisik	0,932	Reliabel
Lingkungan Kerja Non-Fisik	0,937	Reliabel
Produktivitas	0,959	Reliabel

Table 4 shows that in the Reliability Statistics, the Cronbach's Alpha coefficient for the physical work environment statement items is 0.932, for the intangible work atmosphere statement items is 0.937, and for the productivity question items is 0.959. Thus, it can be stated that the questionnaire is reliable. In accordance with the research [16] The basis for decision-making in reliability testing is to review the magnitude of the Cronbach's Alpha coefficient for each factor. An instrument can be considered reliable if the Cronbach's Alpha value is greater than 0,6.

Normality Test

Table 5. Normality test results

	One-	Sample Kolmogorov-Smirnov Test	Unstandardized Residual
N			120
Normal Parameters[ab]	Mean		,0000000
	Std. Deviation		1,82359452
Most Extream Differences	Absolute		,047
	Positive		,047
	Negative		-,045
Test Statistic			,047
Asymp Sig (2-tailed)			,200c, d

Table 5 indicates that the significance value of the Unstandardized Residual Kolmogorov Smirnov is 0.200, with a significance value exceeding 0.05. These findings indicate that the data distribution is normally distributed according to the test assumptions.

Heteroscedasticity Test

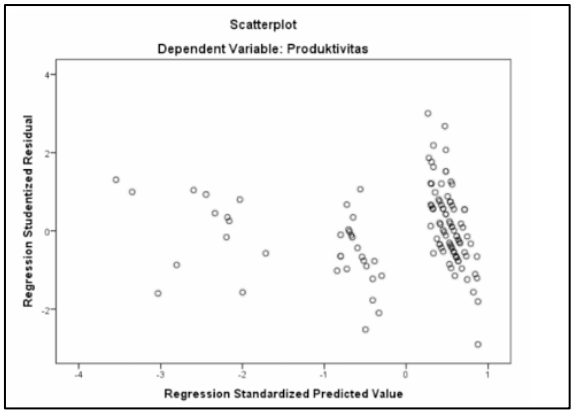

Figure 3. Heteroscedasticity test results

Referring to the obtained data results, it can be stated that no heteroscedasticity pattern was detected in this study, as indicated by the scattered data points evenly distributed along the Y-axis around the zero mark, with no clear pattern present.

Multicollinearity Test

Table 6. Multicollinearity test results

Coefficients[a]			
Model		Collinearity Tolerance	Statistics VIF
1	Lingkungan Kerja Fisik	,113	8,857
	Lingkungan Kerja Non Fisik	,113	8,857

Figure 5 shows the overall VIF value for the physical work environment aspect and the non-physical work environment aspect recorded at 8.857, less than 10, and the tolerance value of 0.113 > 0.100, indicating that multicollinearity symptoms are not present in this research finding.

Multiple Linear Regression Test

Table 7. Multiple linear regression test results

Model		Coefficients[a] Unstandardized B	Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	-,530	,917		-,578	,564
	Lingkungan Kerja Fisik	,427	,067	,401	6,411	,000
	Lingkungan Kerja Non Fisik	,594	,063	,587	9,384	,000

Based on the results of the regression coefficient calculations, the constant shows a value of -0.530, while the coefficient b1 is 0.427 and the coefficient b2 is 0.594, thus obtaining the equation as stated. The equation Y=a+b1X1+b2X2+e, Y= -0.53 + 0.427X1 + 0.594X2 + e

t-test

Table 8. t test result

Model		Coefficients[a] Unstandardized B	Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	-,530	,917		-,578	,564
	Lingkungan Kerja Fisik	,427	,067	,401	6,411	,000
	Lingkungan Kerja Non Fisik	,594	,063	,587	9,384	,000

The physical work environment instrument in influencing productivity obtained a significance of 0.000 < 0.05. Then, based on the test, the t-value exceeded the t-table (6.411 > 1.980). This finding confirms that independently, the aspect of the physical work environment is related to the productivity variable. The significance

value obtained from the influence of non-physical aspects on productivity is 0.000 < 0.05. Furthermore, in the t-test, it was found that the t-value exceeded the t-table (9.384 > 1.980). This finding indicates that the aspect of the non-physical work environment impacts the level of productivity.

F test

Table 9. F test result

Model		Sum of squares	df	Mean square	F	Sig
1	Regresi	7263,733	2	3631,866	1073,772	,000
	Residual	395,734	117	3,382		
	Total	7659,467	119			

Based on the results, it is known that the calculated F value is 1073.772 at a significance level of 0.000 < 0.005. The calculated F value is greater than the F table value (1073.772 > 3.07), thus it can be concluded that there is a significant impact of physical work and non-physical work on productivity.

Conclusion

According to research data completed in the Production Division of PT Rubber, it can be established that working conditions, both physical and non-physical, have been proven to make a significant contribution to worker productivity. From statistical testing, physical conditions, which include factors such as lighting, air circulation, room temperature, and noise level, have a significant positive contribution, although the magnitude of the influence is below that of non-physical aspects. Meanwhile, non-physical elements, which encompass employee interactions, workload, and work atmosphere, show a more dominant role in enhancing employee performance. The results of the partial tests confirm that both elements, individually, have a significant impact, while the simultaneous testing shows that together they enhance work productivity. These findings provide evidence that a psychologically conducive work environment must be a priority for the company to support optimal physical working conditions, thereby enabling the company to achieve its production targets sustainably. Furthermore, the variables in this study only cover the physical and non-physical work environment, without including other factors such as work motivation, leadership, or compensation, which could potentially impact productivity. Therefore, future research is recommended to expand the study to other divisions or different companies to increase the generalizability of the findings, as well as add relevant independent variables, such as leadership style, training programs, or reward systems, to make the research model more comprehensive.

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