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THE INFLUENCE OF WORK ENVIRONMENT, ORGANIZATIONAL CULTURE, AND INVOLVEMENT ON PERFORMANCE WITH LEAN MANUFACTURING AS A MEDIATING VARIABLE IN TJIWI KIMIA TBK PAPER MILL EMPLOYEES

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Abstract

This study aims to analyze the influence of the work environment, organizational culture, and employee engagement on employee performance with Lean Manufacturing as a mediating variable. The research population amounted to 255 employees, consisting of various levels of positions, with a sample of 154 respondents selected using proportional sampling techniques in 4 sections/divisions. Data collection was carried out through a questionnaire with a Likert scale and analyzed using the Structural Equation Modeling-Partial Least Square (SEM-PLS) method. The results of the study show that the work environment, organizational culture, and employee involvement have a positive and significant effect on the implementation of Lean Manufacturing. Lean Manufacturing, work environment, and organizational culture have a positive and significant effect on employee performance; employee involvement does not have a significant effect directly on employee performance. Meanwhile, the indirect influence of the work environment, organizational culture, and employee involvement has a positive and significant effect on employee performance through the mediation of Lean Manufacturing implementation. An important finding of this study is that Lean Manufacturing acts as a full mediator between employee engagement and employee performance. This research provides a theoretical contribution in integrating Socio-Technical Systems Theory (STS) and Social Exchange Theory (SET) in the context of the manufacturing industry in Indonesia, as well as providing practical implications for companies to integrate human factor management with Lean systems synergistically to improve organizational performance sustainably.

Keywords: ***Organizational Culture, Employee Engagement, Employee Performance, Lean Manufacturing, Work Environment.***

1. INTRODUCTION

Employee performance is a fundamental aspect that determines the success and sustainability of an organization in an increasingly competitive business environment. Optimal performance is reflected in the consistent efficiency, productivity, and quality of work results, as well as being the driving force for the creation of added value for the organization. In the context of a process-intensive and high-efficiency-oriented manufacturing industry, employee performance management is a strategic issue that cannot be ignored. The achievement of high performance not only helps organizations reduce waste but also maintains process consistency and encourages continuous improvement (Devi M. & Selvan, 2024).

Employee performance levels are influenced by various factors, both internal and external. External factors that have a significant influence include the work environment, organizational culture, and the work system implemented by the company. The work environment—both physical and non-physical—plays an important role in shaping employee comfort, safety, and motivation at work. An ergonomic physical environment, such as optimal lighting, temperature, and noise levels have been shown to increase labor productivity (Capistrano & Norona, 2020), while a conducive non-physical environment, such as harmonious relationships between colleagues and support from employers, also strengthens a healthy work climate (Kusuma, 2021; Pratiwi et al., 2026). Such environmental conditions are an important prerequisite for the successful implementation of sustainable improvement practices because the success of the process is highly dependent on teamwork and effective communication.

On the other hand, organizational culture plays a strategic role in shaping shared values, norms, and goals that influence the way employees think and act. A culture that emphasizes quality, collaboration, and transparency has been proven to encourage employees to be more proactive, productive, and able to make continuous improvements (Paredes-Saavedra et al., 2024; Pham et al., 2024). Correspondingly, employee engagement reflects the extent to which employees feel a sense of belonging, are passionate about, and actively participate in their work. A high level of engagement encourages initiative, creativity, and commitment to achieve organizational goals (Cesário & Chambel, 2017; Naqshbandi et al., 2024).

In an effort to systematically improve performance, many manufacturing companies are adopting *Lean Manufacturing* (LM) as a strategic approach to reduce waste and increase competitiveness. The success of the implementation of *Lean Manufacturing* ultimately depends heavily on the readiness of the organization's social factors, namely a supportive work environment, a solid organizational culture, and the active involvement of employees in internalizing the principles of efficiency and continuous improvement (Darmayanti et al., 2023. This is in line with the Socio-Technical Systems Theory (STS), which emphasizes that performance optimization can only be achieved through synchronization between technical

and social subsystems simultaneously (Lima et al., 2023; S. Sahoo, 2020). Meanwhile, Social Exchange Theory (SET) explains that when an organization provides a positive environment and culture, employees will respond by increasing their engagement, which in turn drives improved performance (Špoljarić & Verčič, 2023).

Although the relationship between the work environment, organizational culture, and employee engagement on performance has been extensively researched, previous research results have shown significant inconsistencies. Regarding the work environment, several studies prove that there is a positive and significant influence on employee performance (Sukmara & Sukmayadi, 2025; Arbyan & Riyanto, 2023; Devi M. & Selvan, 2024), but other studies have found the opposite result, that the work environment does not have a significant effect on performance (Esthi, 2020; Nurlina, 2021). Similarly, in organizational culture variables, some researchers found positive and significant influences (Paredes-Saavedra et al., 2024; Gandung, 2024; Putri et al., 2021), while other researchers found no significant effect (Shahidi et al., 2024; Wahjoedi, 2021; Zufri et al., 2024). On the employee engagement variable, similar inconsistencies were also found: some studies proved a significant influence on performance (Cesário & Chambel, 2017; Naqshbandi et al., 2024), but other studies conclude otherwise (Kinanti & Hermiati, 2023; Wardiansyah et al., 2024). This gap in findings indicates the possibility of other variables acting as bridges in the relationship between these three factors and employee performance, which have not been adequately explored in the existing literature.

The novelty of this research lies in the use of *Lean Manufacturing* implementation as a mediating variable in explaining the relationship between the work environment, organizational culture, and employee involvement on employee performance. In contrast to previous studies that generally placed *Lean Manufacturing* as an independent variable or object of independent study, this study positions *Lean Manufacturing* as a connecting mechanism that bridges organizational social factors with performance improvement. This approach theoretically integrates Socio-Technical Systems Theory (STS) and Social Exchange Theory (SET) in one comprehensive and empirically verified research model in the large-scale paper manufacturing industry environment in Indonesia. Thus, this study not only contributes to filling the gaps of previous research findings but also offers a new mediation model that can be a reference for the development of human resource management and operations management science, especially in the context of the implementation of *Lean Manufacturing* in the manufacturing industry of developing countries.

This research aims to: (1) analyze the influence of work environment, organizational culture, and employee involvement on the implementation of *Lean Manufacturing.* (2) Analyze the influence of the work environment, organizational culture, employee engagement, and *Lean Manufacturing* on employee performance. (3) Analyze the influence of the work environment on employee performance mediated by the implementation of

employee Lean Manufacturing. (4) Analyze the influence of organizational culture on employee performance mediated by the implementation of *employee Lean Manufacturing*. (5) Analyze the influence of employee engagement on employee performance mediated by the implementation of *employee Lean Manufacturing*.

2. RESEARCH METHOD

This study uses a quantitative approach with an explanatory survey method. Quantitative methods are used because data is collected in numerical form through questionnaires, such as the Likert scale, and then statistically analyzed using techniques such as SEM-PLS, regression, or path analysis to ensure that the hypothesis is objectively tested.

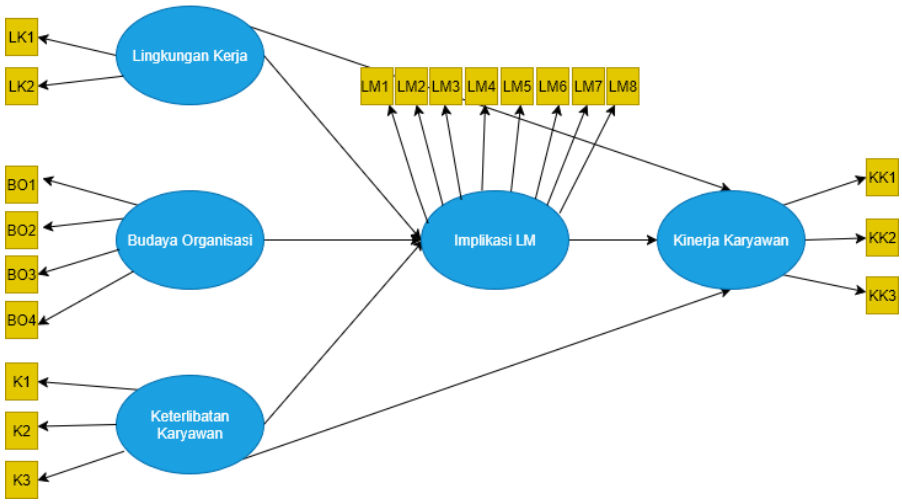

Figure 1. Conceptual Model

The population of this study is 255 employees of Tjiwi Kimia Paper Factory "X", structurally consisting of 1 Head of Division, 2 Production Experts, 6 Admins, 4 Managers, 30 Supervisors, and 212 Operators. This study uses proportional sampling techniques in 4 parts, with a total sample of at least 154 respondents.

All items in the questionnaire use a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). Testing of the instrument is carried out through validity and reliability tests. The validity test used Pearson's product-moment correlation with the r-value criterion calculated > r table (0.361). The reliability test used Cronbach's Alpha with a > value criterion of 0.70. The test results show that all items are valid and reliable.

The data analysis technique used was Partial Least Squares Structural Equation Modeling (PLS-SEM) with the help of SmartPLS 3.0 software. The analysis was carried out in two stages: (1) evaluation of the measurement model through a convergent validity test (loading factor > 0.70 and AVE > 0.50), discriminant validity. (2) evaluation of the structural model through path coefficient tests, R-square, and hypothesis testing using bootstrapping.

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3. RESULTS AND DISCUSSION

Respondent Characteristics

The results of the analysis of respondent characteristics showed that the majority of respondents in this study were employees of a production section consisting of men, namely 151 people (98.06%), while female respondents amounted to 3 people (1.94%). The age group of 25-30 years was the largest group, with 42 respondents (27.27%), followed by the age group of 31-35 years old with 38 respondents (24.68%). The age group of 36–40 years had as many as 32 respondents (20.78%), and the age group over 40 years old had as many as 24 respondents (15.58%) reflect the existence of employees with more mature work experience. Meanwhile, the age group under 25 years old was the group with the least number of respondents, namely 18 people (11.69%). The majority of respondents have a Bachelor's education background or higher, with a total of 96 respondents (62.34%). Meanwhile, 52 respondents (33.77%) had a Diploma education, and only 6 respondents (3.90%) had a high school education. There were no respondents with elementary/equivalent or junior high school/equivalent education. Most of the respondents had 8-13 years of work experience, as many as 128 respondents (83.12%). Meanwhile, respondents with 1-7 years of work experience amounted to 23 respondents (14.94%), and only 3 respondents (1.95%) had 14-20 years of work experience. There were no respondents with work experience of less than 1 year or more than 20 years.

Partial Least Squares (PLS) Analysis

Organizational Culture (X2) uses 12 reflective items, Employee Engagement (X3) uses 9 reflective items, Lean Manufacturing (Z) uses 24 reflective items, and Employee Performance (Y) uses 9 reflective items. All items are reflective indicators that have gone through a reverse coding process for negative statements before being analyzed using SmartPLS. The relationship between variables is stated to be significant if the p-value < 0.01, which indicates that the research hypothesis is statistically acceptable.

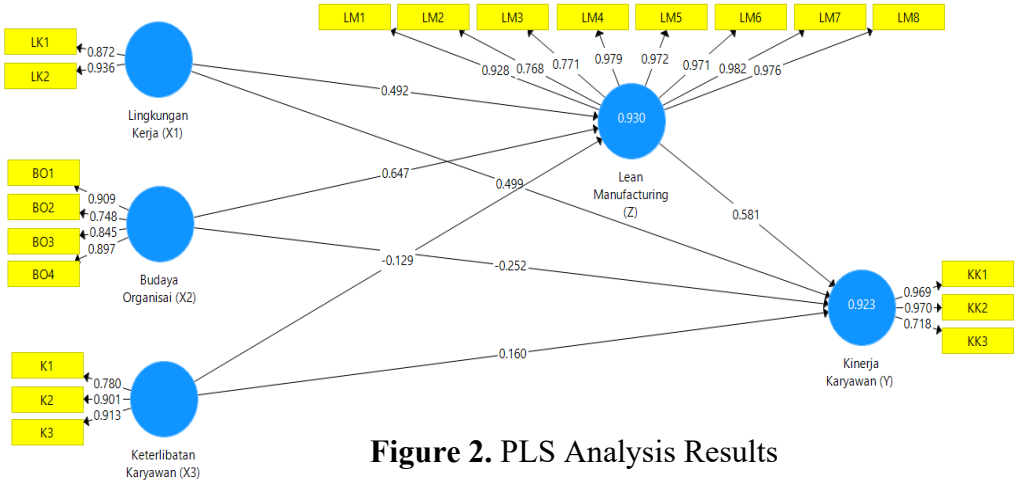

Figure 2. PLS Analysis Results

Table 1. Results of Outer Loading Research Variables

Indicator	Work Environment (X1)	Organizational Culture (X2)	Employee Engagement (X3)	*Lean Manufacturing* (Z)	Employee Performance (Y)
LK1	0,855				
LK2	0,900				
BO1		0,743			
BO2		0,800			
BO3		0,808			
BO4		0,758			
K1			0,806		
K2			0,752		
K3			0,781		
LM1				0,728	
LM2				0,729	
LM3				0,694	
LM4				0,742	
LM5				0,732	
LM6				0,740	
LM7				0,728	
LM8				0,777	
KK1					0,850
KK2					0,856
KK3					0,667

From the table above, it can be seen that there are 2 reflective items with a value of less than ≥ 0.70, but the outer loading ≥ 0.60 is declared feasible and acceptable, especially in exploratory research or early model development, as long as the Composite Reliability (CR) value ≥ 0.70 and AVE ≥ 0.50 are met (Hair et al., 2014; Ghozali & Latan, 2015). Thus, all indicators are declared to be valid in a convergent manner.

Table 2. Average Variance Extracted (AVE) Results

Construct	AVE	Criteria	Remarks
Work Environment (X1)	0,585	≥ 0.50	Valid
Organizational Culture (X2)	0,538	≥ 0.50	Valid
Employee Engagement (X3)	0,507	≥ 0.50	Valid
Lean Manufacturing (Z)	0,660	≥ 0.50	Valid
Employee Performance (Y)	0,548	≥ 0.50	Valid

The test results showed that the entire construct had an AVE value above 0.50. This indicates that each construct can explain more than half of the variance of its indicators. Therefore, it can be concluded that the measurement model has met the convergent validity criteria.

Table 3. Discriminant Validity Results

Construct	Work Environment (X1)	Organizational Culture (X2)	Employee Engagement (X3)	Lean Manufacturing (Z)	Employee Performance (Y)
Work Environment (X1)	0,878				
Organizational Culture (X2)	0,707	0,778			
Employee Engagement (X3)	0,674	0,770	0,780		
Lean Manufacturing (Z)	0,746	0,797	0,798	0,734	
Employee Performance (Y)	0,691	0,722	0,674	0,730	0,796

Based on the Fornell–Larcker criteria, the square root value of AVE in each construct (diagonal value) is greater than the correlation value between other constructs. This shows that each construct has adequate empirical differences and can explain its indicators better than the others. Thus, it can be concluded that the measurement model has met the discriminant validity and is suitable for future structural model analysis. Hair, 2019).

Table 4. Coefficient of Determination (R-Square)

Endogenous constructs	R Square	R Square Adjusted
Lean Manufacturing (Z)	0,753	0,748
Employee Performance (Y)	0,615	0,605

The R-Square value shows that the variables Work Environment, Organizational Culture, and Employee Engagement are able to explain 75.3% of Lean Manufacturing variations, while the remaining 24.7% are explained by other variables outside the model. Furthermore, the R-squared value of 0.615 shows that Lean Manufacturing, together with

exogenous variables, is able to explain 61.5% of the variation in Employee Performance. Based on the structural model evaluation criteria in PLS-SEM, the R Square value of 0.75 is categorized as strong, while the value of around 0.50–0.75 is categorized as moderate to strong. Thus, it can be concluded that the structural model has good, clear power and is feasible to proceed with hypothesis testing (Hair et al., 2019).

Table 5. Goodness of Fit Index (GoF Index) Results

Model Feasibility Index	Saturated Model	Estimated Model	Criteria
SRMR	0,069	0,069	≤ 0.08
d_ULS	0,991	0,991	—
d_G	0,514	0,514	—
Chi-Square	431,188	431,188	—
NFI	0,747	0,747	≥ 0.70

Based on the results of the fit model test, the SRMR value of 0.069 is below the maximum limit of 0.08, which indicates that the model has a good degree of compatibility between the empirical covariance matrix and the model covariance matrix. In addition, the Normed Fit Index (NFI) value of 0.747 has exceeded the minimum limit of 0.70, so it can be categorized as a fairly good model. Thus, overall, the structural model is declared feasible (fit) and can be continued in testing the influence between variables (Hair et al., 2019; Ghozali & Latan, 2020).

Table 6. F-Square Model Results

Variable Exogenous	Lean Manufacturing (Z)	Employee Performance (Y)	Categories Influence
Work Environment (X1)	0,062	0,136	Small – Medium
Organizational Culture (X2)	0,058	0,145	Small – Medium
Employee Engagement (X3)	0,008	0,203	Very small – Medium
Lean Manufacturing (Z)	—	0,041	Small

The results of the effect size (f^2) test showed that Work Environment, Organizational Culture, and Employee Engagement had a small to moderate influence on Lean Manufacturing and Employee Performance. The largest influence was shown by Employee Engagement on Employee Performance ($f^2 = 0.203$) which was in the medium category, while the influence of Lean Manufacturing on Employee Performance was in the small category. This suggests that although the influence of each variable is not large individually, its contribution is still meaningful in explaining the endogenous variable (Hair et al., 2019).

Hypothesis Testing

Table 7. Path Coefficients Analysis

Relationships Between Variables	Path Coefficient	T-Statistic	P-Value	Verdict
Work Environment (X1) → Employee Performance (Y)	0,243	2,616	0,009	Significant
Work Environment (X1) → *Lean Manufacturing* (Z)	0,270	4,449	0,000	Significant
Organizational Culture (X2) → Employee Performance (Y)	0,273	2,619	0,009	Significant
Organizational Culture (X2) → *Lean Manufacturing* (Z)	0,324	4,770	0,000	Significant
Employee Engagement (X3) → Employee Performance (Y)	0,098	1,028	0,305	Insignificant
Employee Engagement (X3) → *Lean Manufacturing* (Z)	0,367	5,705	0,000	Significant
Lean Manufacturing (Z) → Employee Performance (Y)	0,252	2,487	0,013	Significant

Based on the results of the path coefficient analysis shown in the table above, it can be concluded that the Work Environment and Organizational Culture have a positive and significant effect on both Lean Manufacturing and Employee Performance. On the other hand, employee engagement has been shown to have a positive and significant effect on Lean Manufacturing, but it does not directly affect employee performance. In addition, the Lean Manufacturing variable shows a positive and significant influence on Lean Manufacturing.

Table 8. Indirect Influence Analysis

Indirect Relationships	Coefficient (O)	T-Statistic	P-Value	Ket.	Types of Mediation
X1 → Z → Y	0,068	2,231	0,026	Significant	Partial Mediation
X→ Z → Y	0,082	2,056	0,040	Significant	Partial Mediation
X3 → Z → Y	0,092	2,310	0,021	Significant	Full Mediation

The results of the indirect influence analysis show that Lean Manufacturing (Z) plays a mediating variable in the relationship between Work Environment (X1), Organizational Culture (X2), and Employee Engagement (X3) on Employee Performance (Y). The indirect influence of the Work Environment on Employee Performance through Lean Manufacturing has a coefficient of 0.068 with a t-statistic of 2.231 and a p-value of 0.026, while the indirect influence of Organizational Culture shows a coefficient of 0.082, t-statistic of 2.056, and a p-value of 0.040, both of which indicate partial mediation as the direct influence remains significant.

Meanwhile, the indirect influence of Employee Engagement on Employee Performance through Lean Manufacturing has a coefficient of 0.092, t-statistic 2.310, and p-value 0.021, with a non-significant direct influence (p-value 0.305), so Lean Manufacturing plays a full mediating role in the relationship. The following is a table of conclusions from the hypothesis test.

Table 9. Indirect Influence Analysis

Hip.	Independent Variables	Variable Mediation	Dependent Variable	Path Coefficient	P-Value	T-Statistic	Ha
H1	Work Environment (X1)	–	*Lean Manufacturing* (Z)	0,270	0,000	4,449	Accepted
H2	Organizational Culture (X2)	–	*Lean Manufacturing* (Z)	0,324	0,000	4,770	Accepted
H3	Employee Engagement (X3)	–	*Lean Manufacturing* (Z)	0,367	0,000	5,705	Accepted
H4	*Lean Manufacturing* (Z)	–	Employee Performance (Y)	0,252	0,013	2,487	Accepted
H5	Work Environment (X1)	–	Employee Performance (Y)	0,243	0,009	2,616	Accepted
H6	Organizational Culture (X2)	–	Employee Performance (Y)	0,273	0,009	2,619	Accepted
H7	Employee Engagement (X3)	–	Employee Performance (Y)	0,098	0,305	1,028	Rejected
H8	Work Environment (X1)	*Lean Manufacturing* (Z)	Employee Performance (Y)	0,068	0,026	2,231	Accepted
H9	Organizational Culture (X2)	*Lean Manufacturing* (Z)	Employee Performance (Y)	0,082	0,040	2,056	Accepted
H10	Employee Engagement (X3)	*Lean Manufacturing* (Z)	Employee Performance (Y)	0,092	0,021	2,310	Accepted

DISCUSSION

Based on the results of hypothesis testing, this study shows that there is a direct and indirect influence between the work environment, organizational culture, and employee involvement on the implementation of Lean Manufacturing and employee performance. In addition, Lean Manufacturing has also proven to have an important role as a mediating variable in strengthening the relationship between these variables to improve employee performance.

1) H1: The test results showed that the work environment had a positive and significant effect on the implications of Lean Manufacturing at PT Pabrik Kertas Tjiwi Kimia Tbk. The road coefficient value was 0.270, with a t-statistic value of 4.449, and a p-value of 0.000, which was lower than 0.05. These results show that the more effective application of Lean Manufacturing principles can be achieved through a work environment that is comfortable, safe, and supportive of operational activities. Therefore, H1 is accepted. Empirically, these results are supported by research by Yadav et al. (2020), who found that a structured work environment improves the stability of lean processes, as well as Tiwari et al. (2020) and Colim et al. (2021), who affirm that an ergonomic and safe work environment contributes significantly to the successful implementation of Lean Manufacturing.

2) H2: Organizational culture has been proven to have a positive and significant effect on the implications of Lean Manufacturing with a path coefficient value of 0.324, a t-statistic value of 4.770, and a p-value of 0.000. These results show that the values, norms, and work habits embedded in the organization have an important role in supporting the successful implementation of Lean Manufacturing. H2 is therefore accepted. Research by Alkhoraif & McLaughlin (2018) shows that quality-oriented culture increases lean success, while Cadden et al. (2020) and Maware & Parsley (2022) affirm that Lean Manufacturing can only be sustainable if it is embedded in the organization's culture. With the implementation of Lean Manufacturing, the culture of Innovative Work Behavior (IWB) and Organizational Learning Capability (OLC) will emerge and increase company innovation (Sopiah et al., 2024) .

3) H3: Employee engagement showed a positive and significant influence on Lean Manufacturing with a path coefficient value of 0.367, a t-statistic value of 5.705, and a p-value of 0.000. This confirms that the active participation of employees in process improvement, decision-making, and problem-solving greatly contributes to the successful implementation of Lean Manufacturing. Thus, H3 is accepted. Empirically, Ramírez-Zavala et al. (2024) found that engagement increases the success of continuous improvement, while De Silva & Seneviratne (2022) and Nadirah Roslin et al. (2019) affirm that employee engagement strengthens compliance with lean standards.

4) H4: Lean Manufacturing has a positive and significant effect on employee performance, with a path coefficient value of 0.252, a t-statistic value of 2.487, and a p-value of 0.013. These findings show that the implementation of Lean Manufacturing is able to increase work efficiency, reduce waste, and improve workflows, which ultimately has an impact on improving employee performance. Therefore, H4 was accepted. These findings are consistent with the research of Memari et al. (2022), which showed improvements in operational performance through lean, as well as Trubetskaya et al. (2022) and Bento & Tontini (2024), who found that lean significantly improves employee productivity and quality of work.

5) H5: The work environment has a positive and significant effect on employee performance with a path coefficient value of 0.243, a t-statistical value of 2.616, and a p-value of 0.009. These results indicate that comfortable, safe, and supportive working conditions can improve employee productivity and work quality. Thus, H5 was accepted. Empirically, Fortuny-Santos et al. (2024) and Zhenjing et al. (2022) found that a good work environment improves performance, while Tortorella et al. (2021) affirmed that a lean-based work environment has a significant impact on employee productivity (Musa, 2024; Setiawan et al. (2024).

6) H6: Organizational culture has been proven to have a positive and significant effect on employee performance, with a path coefficient value of 0.273, a t-statistical value of 2.619, and a p-value of 0.009. These findings suggest that a strong organizational culture is able to encourage positive, disciplined, and performance-oriented work behavior. Therefore, H6 was accepted. These findings are supported by Kumari & Singh (2018), who find a strong link between culture and performance, as well as Azmy & Wiadi (2023) and Simakhajornboon et al. (2024), who assert that organizational culture improves the consistency and quality of employee performance Sunyoto et al. (2023).

7) H7: The test results show that employee engagement has no significant effect on employee performance directly. This is indicated by the path coefficient value of 0.098, the t-statistic value of 1.028, and the p-value of 0.305, which is greater than 0.05. Thus, employee involvement has not been able to directly improve employee performance without other factors mediating the relationship. Therefore, H7 was rejected. These findings are in line with Riyanto et al. (2021), who stated that engagement has more effect on satisfaction, as well as Vermeulen et al. (2020) and Zondo & Zondo (2020), who found that engagement does not always have a direct impact on performance without the support of the work system.

8) H8: The results of the indirect effects test show that the work environment has a positive and significant effect on employee performance through Lean Manufacturing. The path coefficient value of 0.068, with a t-statistic of 2.231 and a p-value of 0.026, shows that Lean Manufacturing plays a mediating variable in this relationship. Thus, H8 was accepted. These findings are supported by Kamble et al. (2020), who found the role of lean mediation, as well as Gaiardelli et al. (2019) and Cadden et al. (2020), who affirm that the work environment reinforces the effectiveness of lean in improving performance. With an environment that implements Lean, innovative behaviors emerge that affect the performance of the user (Prilatama et al., 2025).

9) H9: Organizational culture has a positive and significant effect on employee performance through Lean Manufacturing, with a path coefficient value of 0.082, a t-statistic value of 2.056, and a p-value of 0.040. These findings indicate that Lean Manufacturing is able to strengthen the influence of organizational culture on improving employee performance. Therefore, H9 is accepted. These findings are in line with Taherimashhadi & Ribas (2018), who stated lean as a cultural philosophy, as well as Maware & Parsley (2022) and Huang et al. (2023), who found that culture strengthens the relationship between lean and performance. This is also reinforced by the findings Mahmud et al. (2024; Yudiarsa et al., 2025). Organizational culture has a positive and significant influence on job satisfaction, organizational commitment, and employee performance.

10) H10: The test results show that employee involvement has a positive and significant effect on employee performance through Lean Manufacturing, with a path coefficient value of 0.092, t-statistical value of 2.310, and p-value of 0.021. This shows that although the direct influence of employee involvement on performance is not significant, through the implementation of Lean Manufacturing, the influence becomes significant. Thus, H10 was accepted, and Lean Manufacturing acted as a full mediator in this relationship. These findings are supported by Awan et al. (2020), who stated that engagement improves performance through work systems, as well as Bhardwaj & Kalia (2021) and Zahraei & Pitts (2020), who affirm that employee involvement will be optimal if supported by a structured operational system such as Lean Manufacturing. With a good work system, employee skills and abilities will increase, which affects employee performance Putri Audina et al., 2023;Winarno & Zulaikah, 2021) .

4. CONCLUSION

The conclusion of this study shows that the work environment, organizational culture, and employee involvement have an important role in supporting the implementation of Lean Manufacturing at PT Pabrik Kertas Tjiwi Kimia Tbk. A conducive work environment, both physically and non-physically, has proven to be the main foundation in the successful implementation of Lean principles. In addition, a strong organizational culture characterized by the value of continuous improvement, discipline, and collaboration also contributes significantly to the effectiveness of Lean Manufacturing implementation. High employee engagement, through active participation in work processes and continuous improvement, further strengthens the success of the implementation of Lean as an effort to eliminate waste.

Furthermore, the implementation of Lean Manufacturing has been proven to be able to significantly improve employee performance through increased efficiency, quality, and work effectiveness. The work environment and organizational culture also directly affect employee performance, showing that comfortable working conditions and strong organizational values can drive increased productivity. However, employee engagement does not show a significant direct impact on performance, indicating the need for an intermediary mechanism for such engagement to have a real impact.

In this case, Lean Manufacturing has been proven to act as a mediating variable that strengthens the relationship between the work environment, organizational culture, and employee engagement on employee performance. The work environment and organizational culture are not only directly affected, but also through the implementation of Lean, which optimizes work processes. Meanwhile, employee engagement shows a significant influence on performance only through Lean Manufacturing, which confirms its role as a full mediator in the relationship.

Theoretically, this research contributes to the development of human resource management and operations management science by integrating Socio-Technical Systems Theory (STS) and Social Exchange Theory (SET). The results of the study reinforce the view that the success of technical systems such as Lean Manufacturing is highly dependent on the readiness of social subsystems, as well as the reciprocal relationships between organizations and employees that are realized through a supportive work environment and culture.

However, this study has several limitations, including the limited scope of one company, the subjective use of questionnaire-based data, and the limitations of the variables studied. Therefore, further research is recommended to expand the object of research, use a more diverse methodological approach, and add other variables in order to obtain a more comprehensive understanding of the factors that affect employee performance.

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