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Employee Factors and Operational Performance: Evidence from PLN Indonesia Power

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ABSTRACT

This study presents empirical evidence regarding the contribution of workforce adequacy, organizational culture, and employee competency to company operational performance. To test the causal relationship between the variables, this study employed a quantitative approach with an explanatory design. Primary data were obtained from 50 operational employees of PT PLN Indonesia Power UBP Kamojang Unit PLTP Lahendong using proportionate stratified random sampling. The data were then analyzed using multiple linear regression with the aid of SPSS software. The results indicate that workforce adequacy has a positive and significant effect on operational performance. Furthermore, organizational culture and employee competency were also shown to contribute significantly to operational performance. Simultaneously, these three variables demonstrated a strong influence on company operational performance. The research model explained 58.09% of the variation in operational performance, while the remaining 41.91% was influenced by factors outside the model's scope. These findings indicate that improving operational performance requires an integrated human resource management approach. This includes workforce planning aligned with operational needs, strengthening the internalization of organizational cultural values, and continuously developing employee competencies as a strategy to achieve optimal operational performance.

ABSTRAK

Penelitian ini menyajikan bukti empiris mengenai kontribusi kecukupan tenaga kerja, budaya organisasi, dan kompetensi pegawai terhadap kinerja operasional perusahaan. Untuk menguji hubungan kausal antar variabel, studi ini menerapkan pendekatan kuantitatif dengan desain explanatory. Data primer diperoleh dari 50 karyawan operasional PT PLN Indonesia Power UBP Kamojang Unit PLTP Lahendong melalui teknik proportionate stratified random sampling, kemudian dianalisis menggunakan regresi linier berganda dengan bantuan perangkat lunak SPSS. Hasil penelitian menunjukkan bahwa kecukupan tenaga kerja berpengaruh positif dan signifikan terhadap kinerja operasional. Selain itu, budaya organisasi dan kompetensi pegawai juga terbukti memberikan kontribusi positif dan signifikan dalam meningkatkan kinerja operasional. Secara simultan, ketiga variabel tersebut menunjukkan pengaruh yang kuat terhadap kinerja

operasional perusahaan. Model penelitian mampu menjelaskan sebesar 58,09% variasi kinerja operasional, sementara sisanya sebesar 41,91% dipengaruhi oleh faktor lain di luar cakupan model. Temuan ini mengindikasikan bahwa peningkatan kinerja operasional memerlukan pendekatan pengelolaan sumber daya manusia yang terintegrasi. Hal tersebut mencakup perencanaan tenaga kerja yang selaras dengan kebutuhan operasional, penguatan internalisasi nilai-nilai budaya organisasi, serta pengembangan kompetensi pegawai secara berkelanjutan sebagai strategi untuk mencapai kinerja operasional yang optimal.

INTRODUCTION

The procedures and practices of international commerce and industrial production have changed as a result of globalization, which has also made global marketplaces more integrated. From the design phase to manufacture, distribution, and marketing, the production process has evolved into an international one. Governments have shifted their priorities away from import substitution policies in favor of policies that aim to increase global market competitiveness and increase regional and international agreements that aim to achieve the greatest degree of economic integration. This is because globalization has also changed the impact of traditional policy tools and diminished their significance as a means of influencing the volume and direction of international trade flows.

The global shift toward sustainable energy systems is no longer limited to expanding electricity generation capacity but increasingly demands improvements in operational effectiveness, reliability, and long-term sustainability. In this context, renewable energy particularly geothermal power has emerged as a strategic pillar for ensuring energy security while reducing environmental impact. Unlike intermittent renewable sources, geothermal energy offers a stable and continuous supply, positioning it as a critical component in supporting the transition toward low-carbon energy systems (International Energy Agency, 2022).

In Indonesia, geothermal power plants play a pivotal role in maintaining electricity stability, especially in regions beyond the Java grid, where energy infrastructure disparities remain significant. One of the key contributors is the Lahendong Geothermal Power Plant in Tomohon, operated under PT PLN Indonesia Power's Kamojang Generation Business Unit. This facility not only supports regional electricity demand but also strengthens the utilization of renewable energy in eastern Indonesia (Kementerian Energi dan Sumber Daya Mineral Republik Indonesia, 2023). However, sustaining the performance of such facilities requires more than technological reliability; it demands a balanced integration of technical systems and organizational capabilities.

Operational performance in geothermal power plants is commonly evaluated through indicators such as production efficiency, system reliability, and the consistency of energy output. These indicators reflect the organization's ability to manage resources

effectively while maintaining uninterrupted operations (Slack & Brandon Jones, 2019). Nevertheless, recent operational reports from the Lahendong unit during the 2023–2025 period reveal discrepancies between planned targets and actual performance outcomes. Specifically, electricity generation and sales have not consistently met projected levels, while reliability indicators such as the Equivalent Availability Factor (EAF) remain below expected standards and the Equivalent Forced Outage Rate (EFOR) exceeds acceptable thresholds. Such conditions indicate that operational stability has yet to be fully achieved, with unplanned disruptions still occurring at a notable frequency.

While these performance gaps are often attributed to technical factors, such an explanation may be overly simplistic. In practice, operational reliability is also shaped by non-technical dimensions, including workforce readiness, employee competence, and the prevailing organizational culture. In this study, workforce adequacy is conceptualized as the alignment between workforce capacity and operational workload rather than merely increasing the number of employees. Appropriate workforce allocation based on workload requirements enables organizations to optimize resource utilization while maintaining operational efficiency and reliability. Adequate staffing levels, relevant technical expertise, and a work culture oriented toward reliability and continuous improvement are essential in minimizing operational disturbances and enhancing system stability (Armstrong & Taylor, 2020). Conversely, limitations in human resource capacity or misalignment between organizational practices and operational demands may exacerbate inefficiencies and increase the likelihood of system failures.

Existing literature has widely acknowledged the role of human resource management and organizational culture in influencing organizational performance (Jitmau et al., 2024; Reza & Silalahi, 2021). However, much of this research remains concentrated on general performance metrics, with limited attention given to operational performance in highly technical environments. Studies within the power generation sector, particularly those focusing on renewable energy, tend to prioritize engineering and maintenance aspects when explaining performance indicators such as availability and outage rates. As a result, the contribution of organizational factors—such as workforce adequacy, employee competence, and cultural alignment—remains insufficiently explored (Dessler, 2020).

Furthermore, previous empirical studies have generally examined workforce adequacy, organizational culture, and employee competence as independent determinants of organizational or employee performance. Only limited studies have investigated the integrated influence of these three human resource dimensions on operational performance in geothermal power plants, where operational reliability depends on the interaction between technical systems and organizational capabilities. Consequently, the mechanism through which human resource factors contribute to operational reliability remains insufficiently explained in the existing literature.

This gap becomes more evident in the context of geothermal power generation, where empirical investigations integrating human resource dimensions with technical performance indicators are still scarce. Specifically, there is limited evidence explaining how workforce-related variables influence key reliability measures such as EAF and EFOR. This lack of integration restricts a comprehensive understanding of performance determinants, particularly in operational settings such as the Lahendong geothermal facility in North Sulawesi.

Based on these research gaps, this study offers two primary contributions. First, it develops an integrated framework that simultaneously examines the effects of workforce adequacy, organizational culture, and employee competence on operational performance within the geothermal power generation industry. Second, it extends the human resource management literature by positioning workforce adequacy as a strategic concept emphasizing the proportional alignment between workforce capacity and operational workload, rather than simply the quantity of employees. This perspective is expected to provide a more comprehensive explanation of operational performance in high-reliability organizations.

Addressing this limitation, the present study proposes an integrated analytical framework to examine the influence of workforce adequacy, organizational culture, and employee competence on operational performance. By evaluating both the individual and combined effects of these factors, this research seeks to provide a more holistic perspective on performance improvement within geothermal power plant operations.

From a theoretical standpoint, this study contributes to the development of human resource and operations management literature by bridging the gap between organizational factors and technical performance outcomes. It extends prior research by demonstrating that operational performance cannot be fully understood without incorporating human resource dimensions. Unlike previous studies that primarily emphasize technical or engineering aspects, this research highlights the strategic role of organizational factors in supporting operational reliability within geothermal power plants. Practically, the findings offer strategic insights for PT PLN Indonesia Power in optimizing workforce planning, strengthening organizational culture, and enhancing employee competencies to improve operational reliability. Furthermore, the study provides relevant implications for policymakers and energy sector stakeholders in formulating strategies to enhance the effectiveness and sustainability of geothermal power generation in Indonesia (Robbins & Judge, 2018; Hafidulloh & Mochklas, 2024).

LITERATURE REVIEW

Resource Based View (RBV)

This study is grounded in the Resource Based View (RBV), which posits that organizational performance is largely determined by the organization's ability to acquire, develop, and effectively utilize valuable, rare, inimitable, and well organized resources (Barney, 1991). Within this perspective, human resources constitute strategic assets that create sustainable competitive advantages when they are properly managed and aligned with organizational objectives.

In operationally intensive industries such as geothermal power generation, workforce adequacy, organizational culture, and employee competence represent complementary organizational resources. Workforce adequacy ensures that human resource capacity is proportionate to operational workload, organizational culture provides behavioral norms that encourage coordination and operational discipline, while employee competence enables individuals to perform complex technical tasks effectively. Accordingly, RBV provides an appropriate theoretical foundation for explaining how these organizational resources collectively contribute to operational performance.

Operational Performance

Operational performance can be better understood as the outcome of how effectively an organization orchestrates its resources, processes, and capabilities to sustain reliable and efficient operations. Rather than being limited to output metrics, performance reflects the organization’s ability to align internal capacities with operational demands in a dynamic environment. In this regard, the contribution of human resources becomes inseparable from technical systems, as both jointly determine the consistency and quality of operational outcomes.

Scholarly discussions increasingly suggest that operational effectiveness emerges from the interaction between organizational structures and human resource practices. Workforce planning, competence development, and cultural alignment collectively shape how tasks are executed, coordinated, and continuously improved. This perspective challenges the traditional view that places technical efficiency as the primary determinant of performance, emphasizing instead that organizational readiness plays an equally critical role.

Within the power generation sector, performance indicators such as outage rates and production levels are commonly used to evaluate system reliability. However, these indicators do not operate in isolation from organizational dynamics. The ability to maintain stable production is closely linked to how well human resources are managed, particularly in environments characterized by high operational complexity such as geothermal power plants. In this context, organizational readiness reflected in workforce

availability, capability alignment, and adaptive work practices becomes a crucial determinant of system stability.

From the perspective of the Resource-Based View, operational performance represents the organizational outcome generated through the effective deployment of strategic resources. Therefore, sustainable operational reliability depends not only on technological assets but also on the organization's capability to align human resources, organizational processes, and operational requirements.

Workforce Adequacy and Operational Performance

The relationship between workforce adequacy and operational performance can be interpreted through the lens of resource alignment. Workforce adequacy refers to the proportional alignment between workforce capacity and operational workload rather than simply the numerical sufficiency of employees. The concept emphasizes that organizations achieve higher operational effectiveness when the number, distribution, and capability of employees correspond to the actual workload and operational complexity. Consequently, workforce adequacy should not be interpreted as continuously increasing the number of employees but as optimizing workforce allocation according to organizational needs.

When this alignment is achieved, organizations are better positioned to maintain efficiency and prevent operational bottlenecks. Conversely, imbalances between workforce capacity and job demands often generate cascading effects, including increased work pressure, reduced accuracy, and delays in operational processes. Such conditions may ultimately compromise production continuity and system reliability. In operational settings that rely heavily on timely interventions such as power generation insufficient staffing can hinder preventive maintenance and delay corrective actions, thereby increasing the likelihood of system disruptions.

From a productivity standpoint, effective workforce allocation enables smoother task distribution and enhances coordination among employees. This not only improves operational responsiveness but also reduces the risk of unplanned downtime.

According to the Resource-Based View, an appropriately allocated workforce represents a valuable organizational resource because it allows organizations to utilize human capital efficiently while minimizing operational inefficiencies. Therefore, workforce adequacy serves as a strategic mechanism for improving operational stability rather than merely reflecting workforce quantity.

H1: Workforce adequacy has a significant effect on the company’s operational performance.

Organizational Culture and Operational Performance

Organizational culture plays a subtle yet powerful role in shaping how operational activities are carried out. Rather than functioning as a formal mechanism, culture operates

through shared understandings that influence decision making patterns, behavioral norms, and collective attitudes toward work. Its impact becomes particularly evident in environments where consistency, precision, and reliability are essential.

A strong cultural foundation can enhance coordination across functional units by fostering shared priorities and mutual understanding. In high reliability industries, such as geothermal power generation, cultural attributes related to discipline, safety awareness, and continuous improvement are especially critical. These values not only guide employee behavior but also reinforce adherence to operational procedures, thereby reducing the likelihood of errors and disruptions.

Moreover, organizational culture contributes to shaping employee commitment and accountability. When individuals internalize organizational values, they are more likely to perform their roles with greater responsibility and consistency. This alignment between individual behavior and organizational expectations strengthens operational coherence and supports sustained performance outcomes.

From the Resource-Based View, organizational culture represents an intangible organizational resource that is difficult for competitors to imitate. A culture emphasizing safety, collaboration, discipline, and continuous improvement strengthens organizational capability by encouraging employees to work cohesively toward shared operational objectives. Consequently, organizational culture contributes not only to employee behavior but also to the long-term sustainability of operational performance.

H2: Organizational culture has a significant effect on the company's operational performance.

Employee Competence and Operational Performance

Employee competence represents a key capability through which organizations translate resources into operational results. It encompasses not only technical expertise but also the cognitive and behavioral capacity required to address complex and dynamic work situations. In operationally intensive industries, competence determines how effectively employees can manage processes, anticipate potential issues, and respond to unexpected conditions.

The relevance of competence becomes more pronounced in geothermal power generation, where operational systems are highly complex and sensitive to disruptions. Employees with well developed competencies are better equipped to interpret system conditions, execute tasks accurately, and implement both preventive and corrective measures. This ability significantly contributes to minimizing operational downtime and maintaining system reliability.

From a strategic perspective, investments in competence development can enhance both efficiency and adaptability. Organizations that prioritize skill enhancement and continuous learning are more capable of sustaining high performance levels,

particularly in environments that require rapid problem solving and technical precision. Thus, competence can be viewed as a critical driver that enables consistent and reliable operational execution.

Employee competence also represents a strategic organizational resource because it enhances the organization's capability to solve operational problems, adapt to technological changes, and maintain production reliability. From the RBV perspective, competence becomes a source of competitive advantage when employees possess valuable technical expertise that is continuously developed through learning and organizational experience. Therefore, organizations with highly competent employees are more likely to sustain superior operational performance than organizations relying solely on technological resources.

H3: Employee competence has a significant effect on the company's operational performance.

Integrated Influence on Operational Performance

Operational performance is rarely shaped by a single factor; rather, it emerges from the interaction of multiple organizational dimensions. Workforce adequacy ensures that operational demands are supported by sufficient human resources, while organizational culture provides the behavioral framework that guides how work is performed. At the same time, employee competence determines the quality and accuracy of task execution.

The interplay among these factors creates a reinforcing mechanism that supports operational effectiveness. Adequate staffing reduces workload imbalances, a supportive culture enhances coordination and compliance, and strong competencies ensure precise and efficient task completion. When these elements are aligned, organizations are more capable of maintaining stable operations, minimizing disruptions, and achieving consistent performance outcomes.

From the Resource Based View, these three variables should not be viewed as independent organizational resources operating in isolation. Instead, workforce adequacy, organizational culture, and employee competence complement one another in strengthening organizational capability. Their integration enables organizations to optimize resource utilization, improve operational flexibility, and sustain reliable operational performance within high-reliability environments such as geothermal power generation facilities.

This integrated perspective highlights the importance of viewing operational performance as a multidimensional construct, where human resource factors and organizational dynamics collectively influence system reliability and productivity.

H4: Workforce adequacy, organizational culture, and employee competence simultaneously have a significant effect on the company's operational performance.

METHOD

This study employed a quantitative approach with an explanatory design to examine the effects of workforce adequacy, organizational culture, and employee competence on employees' perceived operational performance. The research was conducted at PT PLN Indonesia Power UBP Kamojang Unit PLTP Lahendong, Tomohon, North Sulawesi, Indonesia.

The population comprised all 50 operational employees directly involved in geothermal power plant operations. Since the entire population was accessible, a total sampling (census) technique was applied, resulting in 50 respondents. Eligible respondents were operational employees with at least one year of work experience who voluntarily participated in the survey.

Primary data were collected using a structured questionnaire with a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The study included three independent variables workforce adequacy (X_1), organizational culture (X_2), and employee competence (X_3) and one dependent variable, employees' perceived operational performance (Y). The operational definitions and measurement indicators for all variables are presented in Table 1.

Table 1. Operational Definition and Measurement Indicators of Research Variables

Variable	Indicators	Scale	Source
Workforce Adequacy	Staffing sufficiency, workload suitability, workforce allocation, task distribution	Likert (1–5)	Salsabila et al. (2026); Jitmau et al. (2024)
Organizational Culture	Shared values, teamwork, work discipline, communication, organizational commitment	Likert (1–5)	Robbins & Judge (2018)
Employee Competence	Knowledge, technical skills, problem-solving ability, work experience, professional attitude	Likert (1–5)	Armstrong & Taylor (2020); Alqudah et al. (2022)
Employees' Perceived Operational Performance	Perceived operational effectiveness, perceived achievement of production targets, perceived operational reliability, perceived ability to minimize operational disruptions	Likert (1–5)	Slack & Brandon-Jones (2019)

Source: Processed Primary Data, 2025

The dependent variable represents employees' perceptions of operational performance rather than objective engineering performance. Therefore, operational indicators such as electricity production achievement, Equivalent Availability Factor (EAF), and Equivalent Forced Outage Rate (EFOR) were measured as respondents'

perceptions of the organization's ability to achieve production targets, maintain operational reliability, and minimize operational disruptions, rather than through actual operational records.

RESULT AND DISCUSSION

Result

The study results were generated through a comprehensive analytical workflow utilizing SPSS version 25. The process commenced with testing the validity and reliability of the measurement instruments to ensure data integrity, followed by descriptive statistical analysis to summarize the distributional characteristics of the dataset.

To investigate the relationships among variables, multiple linear regression was subsequently employed. Hypothesis testing was conducted using the t-test to evaluate the significance of individual predictors and the F-test to assess their collective impact. Furthermore, the model's explanatory capability was examined using the coefficient of determination (R^2), which reflects the proportion of variance in the dependent variable explained by the independent variables.

Respondent Profile

The study sample consisted of operational personnel employed at the Kamojang Generation Business Unit, PLTP Lahendong, located in Tomohon, North Sulawesi. To provide a structured overview of respondent characteristics, demographic attributes were classified based on gender, educational background, and tenure, as detailed in Table 2.

Table 2. Profile of Research Respondents

Characteristics	Category	Number of people	Percentage (%)
Gender	Man	46	92%
	Woman	4	8%
Last education	High School	12	24%
	Diploma III	9	18%
	Diploma IV/S1	23	46%
	Strata-2	6	12%
Length of work	< 10 Years	20	40%
	10 – 20 Years	16	32%
	> 20 Years	14	28%

Source: Processed Primary Data, 2025

Referring to Table 2, the majority of respondents were male, accounting for 46 individuals (92%), while female respondents totaled 4 individuals (8%), indicating that the operational workforce within the power generation unit is predominantly male. In

terms of educational background, most respondents held a Diploma IV or bachelor's degree (23 individuals or 46%), followed by senior high school or equivalent (12 individuals or 24%), Diploma III (9 individuals or 18%), and master's degree qualifications (6 individuals or 12%). This distribution suggests that most employees possess adequate academic qualifications to support operational responsibilities. Based on tenure, respondents with less than 10 years of service accounted for 20 individuals (40%), those with 10–20 years of experience totaled 16 individuals (32%), and employees with more than 20 years of service comprised 14 individuals (28%). These findings imply that the majority of employees have accumulated sufficient work experience in performing operational activities. Overall, the respondent characteristics are considered representative of the human resource conditions within the company's operational unit.

Descriptive Statistical Analysis

Descriptive statistical techniques were employed to systematically examine the distributional patterns of each research variable, thereby providing an initial empirical characterization of the dataset, as presented in Table 3.

Table 3. Descriptive Statistics of Research Variables

Variables	Mean	Standard Deviation	Minimum	Maximum
Adequate Number of Employees	3.16	0.19	2.74	3.5
Organizational culture	4.09	0.09	3.86	4.22
Employee Competence	4.00	0.07	3.88	4.16
Company Operational Performance	4.01	0.12	3.72	4.18

Source: Processed Primary Data, 2025

The descriptive findings reveal distinct patterns in respondents' perceptions across the examined variables. Workforce adequacy exhibits a mean score of 3.16 (SD = 0.19), indicating a moderate level of perceived staffing sufficiency. In contrast, organizational culture attains the highest mean value of 4.09 with a low standard deviation (SD = 0.09), suggesting a strong and consistently shared perception regarding the implementation of organizational values. Similarly, employee competence records a high mean score of 4.00 (SD = 0.07), while operational performance shows a comparable mean of 4.01 (SD = 0.12), both reflecting generally positive evaluations among respondents.

The relatively high mean scores for these variables suggest that employee competence and operational performance are perceived positively by respondents. Additionally, all variables exhibit standard deviation values below 0.20, indicating minimal data dispersion and relatively homogeneous responses, thereby suggesting no substantial perceptual differences among respondents regarding the measured indicators.

Research Instrument Validity Test

A validity assessment was performed to determine the extent to which each questionnaire item accurately represents the underlying research constructs, thereby ensuring the precision and adequacy of the data for subsequent analysis and hypothesis testing. The results are presented in Table 4.

Table 4. Results of the Validity Test of the Research Instrument

Variables	Number of Items	r count (Min–Max)	r table	Information
Sufficient Number of Employees (X_1)	10	0.688 – 0.894	0.30	Valid
Organizational Culture (X_2)	10	0.777 – 0.875	0.30	Valid
Employee Competence (X_3)	10	0.720 – 0.916	0.30	Valid
Company Operational Performance (Y)	10	0.677 – 0.949	0.30	Valid

Source: Processed Primary Data (2025)

As presented in Table 4, all measurement items across the variables exhibit correlation coefficients exceeding the critical threshold ($r > 0.30$), indicating satisfactory construct validity. Accordingly, the entire set of instrument items is deemed appropriate for use in the data collection process.

Reliability Test of Research Instruments

Reliability testing was performed to assess the consistency and stability of the measurement items in representing the research constructs. Ensuring a satisfactory level of reliability is crucial to confirm that the collected data are robust and appropriate for further statistical analysis and hypothesis testing. The results of this assessment are presented in Table 5.

Table 5. Results of the Reliability Test of the Research Instrument

Variables	Cronbach's Alpha	Information
Sufficient Number of Employees (X_1)	0.768	Reliable
Organizational Culture (X_2)	0.828	Reliable
Employee Competence (X_3)	0.807	Reliable
Company Operational Performance (Y)	0.849	Reliable

Source: Processed Primary Data (2025)

As presented in Table 5, all variables exhibit Cronbach's alpha values above the acceptable threshold of 0.60, reflecting an adequate level of internal consistency. This outcome indicates that the measurement instruments produce stable and consistent results, thereby confirming their reliability and suitability for subsequent statistical analysis.

Multiple Linear Regression Analysis

Multiple linear regression was applied to examine the influence of workforce adequacy (X_1), organizational culture (X_2), and employee competence (X_3) on operational performance (Y). This method enables an assessment of both the direction and the

magnitude of each predictor's contribution to the outcome variable. The results of the estimation are reported in Table 6.

Table 6. Results of Multiple Linear Regression Analysis

Variables	Coefficient (β)	Std . Error	Tcount	Sig .	VIF
Constant	0.849	0.173	4.91	0,000	–
Sufficient Number of Employees (X_1)	0.768	0.162	4.74	0,000	1.42
Organizational Culture (X_2)	0.828	0.158	5.24	0,000	1.36
Employee Competence (X_3)	0.807	0.165	4.89	0,000	1.48

Source: Processed Primary Data, 2025

As presented in Table 6, the multiple linear regression analysis yields the following estimated model:

$$Y = 0.849 + 0.768X_1 + 0.828X_2 + 0.807X_3 + \varepsilon$$

The regression estimates reveal that all independent variables are associated with positive coefficients, indicating a direct relationship with operational performance. Workforce adequacy (β = 0.768) implies that an incremental increase in staffing sufficiency corresponds to a 0.768-unit rise in performance, assuming other variables remain constant. Among the predictors, organizational culture exhibits the highest coefficient (β = 0.828), suggesting a relatively stronger influence, while employee competence (β = 0.807) also contributes substantially to performance improvement.

In addition, all variables are statistically significant, as indicated by p-values below the 0.05 threshold, confirming their relevance in explaining operational performance. The Variance Inflation Factor (VIF) values for each predictor are below 10, indicating the absence of multicollinearity and supporting the stability and reliability of the regression model.

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t-Test

Partial hypothesis testing was performed using the t-test to examine the individual contribution of each independent variable to operational performance. Statistical significance was determined by comparing the p-values with the 0.05 threshold ($\alpha = 5\%$), where values below this level indicate meaningful effects.

Based on the regression output reported in Table 5, workforce adequacy (X_1) produces a t-value of 4.74 with a p-value of 0.000, indicating a positive and statistically significant effect, thus supporting the first hypothesis (H_1). Organizational culture (X_2) records a t-statistic of 5.24 and a p-value of 0.000, confirming its significant positive contribution and supporting the second hypothesis (H_2). Similarly, employee competence (X_3) yields a t-value of 4.89 with a p-value of 0.000, demonstrating a significant positive influence and leading to the acceptance of the third hypothesis (H_3).

Overall, these results indicate that each independent variable contributes significantly, at a partial level, to explaining variations in operational performance, reinforcing their respective roles within the proposed analytical model.

Determination Coefficient Test

The coefficient of determination (R^2) is employed to evaluate the explanatory power of the regression model, reflecting the extent to which the independent variables account for variations in the dependent variable. In this study, it captures the combined contribution of workforce adequacy, organizational culture, and employee competence to operational performance. The results are presented in Table 7.

Table 7. Coefficient of Determination Test Results (R^2)

S	R^2	Adjusted R^2	Predicted R^2
0.26866	58.09%	55.36%	45.94%

Source: Processed Primary Data, 2025

As shown in Table 7, the coefficient of determination (R^2) of 58.09% indicates that workforce adequacy, organizational culture, and employee competence collectively account for a considerable share of the variation in operational performance. The adjusted R^2 value of 55.36% suggests that the model maintains a moderate explanatory capability after controlling for the number of predictors included.

From a predictive standpoint, the Predicted R^2 value of 45.94% reflects a satisfactory level of generalizability to new data. In addition, the standard error of estimate (S = 0.26866) indicates a relatively small estimation error, implying that the model achieves an acceptable level of accuracy in predicting operational performance.

F-Test

The F-test was applied to evaluate the combined impact of the independent variables on operational performance within the regression model. In this context, the analysis determines whether workforce adequacy (X_1), organizational culture (X_2), and

employee competence (X_3) simultaneously influence the dependent variable (Y). The F-statistic was calculated using the coefficient of determination (R^2) based on the following equationThe F-test was applied to evaluate the combined impact of the independent variables on operational performance within the regression model. In this context, the analysis determines whether workforce adequacy (X_1), organizational culture (X_2), and employee competence (X_3) simultaneously influence the dependent variable (Y). The F-statistic was calculated using the coefficient of determination (R^2) based on the following equation:

$$F = \frac{(R^2/k)}{((1-R^2)/(n-k-1))}$$

Using an R^2 value of 0.5809, with three independent variables (k = 3) and a sample size of 50 (n = 50), the computed F-statistic is 21.25. The corresponding significance level of 0.000 falls well below the 0.05 threshold, indicating that workforce adequacy, organizational culture, and employee competence jointly have a positive and statistically significant effect on operational performance.

Accordingly, the fourth hypothesis (H_4) is supported, and the regression model is deemed suitable for explaining the relationship between the independent variables and operational performance.

Discussion

Workforce Adequacy and Operational Performance

The findings indicate that workforce adequacy has a positive and significant effect on employees' perceived operational performance. This result suggests that operational effectiveness is influenced not merely by the number of employees available but by the extent to which workforce capacity is appropriately aligned with operational workload and job complexity. Therefore, workforce adequacy should be interpreted as the proportional allocation of human resources based on workload requirements, rather than as an effort to continuously increase the number of employees.

From the perspective of the Resource-Based View (RBV), workforce adequacy represents a strategic organizational resource because it enables the efficient utilization of human capital to support operational objectives. Organizations achieve superior operational performance when available human resources are allocated according to operational priorities and technical requirements. In geothermal power generation, where operational activities involve continuous monitoring, preventive maintenance, and rapid response to equipment abnormalities, an imbalance between workload and workforce capacity may reduce operational responsiveness and increase the risk of service interruptions.

The findings also demonstrate that workforce adequacy contributes to operational reliability by ensuring that maintenance schedules, equipment inspections, and corrective

actions can be performed in a timely manner. This result extends previous studies (e.g., Mochklas, 2024) by showing that workforce adequacy contributes not only to productivity but also to maintaining operational continuity in high-reliability organizations. Consequently, organizational policies should prioritize workforce planning based on workload analysis and competency requirements rather than focusing solely on workforce expansion.

Organizational Culture and Operational Performance

Among the three independent variables, organizational culture exhibited the strongest influence on employees' perceived operational performance. This finding is particularly noteworthy because geothermal power plants operate in highly technical environments where employee competence is often assumed to be the primary determinant of operational success. However, the present study demonstrates that organizational culture exerts an even greater influence on operational effectiveness.

One possible explanation is that operational activities in geothermal power plants depend heavily on collective discipline, effective communication, and strict compliance with standardized operating procedures. Employees rarely work independently; instead, operational success relies on coordinated teamwork across different functional units. Consequently, shared organizational values emphasizing safety, discipline, accountability, and collaboration become fundamental in ensuring operational reliability.

From the perspective of the Resource-Based View, organizational culture constitutes an intangible organizational resource that is difficult for competitors to imitate. Unlike technical knowledge, which can be acquired through training, a strong organizational culture develops gradually through shared experiences, organizational learning, and leadership practices. As a result, culture functions as an informal governance mechanism that reinforces operational discipline beyond formal regulations.

This finding also provides an explanation for the dominance of organizational culture over technical competence. In high-reliability organizations such as PT PLN Indonesia Power UBP Kamojang Unit PLTP Lahendong, technical competence is generally standardized through recruitment, certification, and continuous training. Consequently, differences in operational performance are more likely to be explained by differences in how employees coordinate, communicate, and consistently implement organizational values during daily operations. This interpretation complements previous studies (Hafidulloh & Ratnaningtyas, 2024; Panggayudi & Mochklas, 2025) by suggesting that organizational culture functions not merely as a supporting factor but as a strategic capability that enhances operational reliability.

Employee Competence and Operational Performance

Employee competence also demonstrated a positive and significant influence on employees' perceived operational performance. This finding confirms that knowledge,

technical expertise, problem-solving ability, and professional attitudes remain essential for ensuring effective operational execution within geothermal power plants.

From the RBV perspective, employee competence represents valuable human capital that enables organizations to transform organizational resources into operational outcomes. Competent employees are better equipped to identify potential equipment failures, perform preventive maintenance accurately, and implement corrective actions efficiently. These capabilities improve operational reliability by minimizing downtime and reducing the likelihood of operational disruptions.

Although competence significantly contributes to operational performance, its influence was lower than that of organizational culture. This finding suggests that technical expertise alone may not be sufficient to ensure superior operational outcomes unless supported by a collaborative organizational environment that encourages knowledge sharing, coordination, and compliance with operational procedures. Therefore, investments in employee competency development should be complemented by initiatives that strengthen organizational culture and teamwork. Compared with previous studies (Alqudah et al., 2022; Ndruru et al., 2025), the present study demonstrates that competence contributes to operational performance through its interaction with broader organizational capabilities rather than functioning as an isolated determinant.

Integrated Effect on Employees' Perceived Operational Performance

The simultaneous influence of workforce adequacy, organizational culture, and employee competence indicates that operational performance is generated through the interaction of complementary organizational resources rather than by individual factors operating independently. This finding supports the Resource-Based View, which argues that sustainable organizational performance is achieved when multiple strategic resources are effectively integrated and managed.

In the operational context of geothermal power generation, workforce adequacy ensures that operational demands are matched by appropriate human resource capacity, organizational culture establishes behavioral norms that promote coordination and operational discipline, and employee competence enables accurate and reliable task execution. The interaction among these three dimensions creates organizational capability that strengthens operational effectiveness, minimizes disruptions, and supports the continuity of electricity generation.

Unlike previous studies that examined workforce adequacy, organizational culture, or employee competence separately, this study demonstrates that operational performance is more comprehensively explained through the combined influence of these organizational factors. The findings therefore contribute to the human resource management and operations management literature by highlighting that improving

operational reliability requires an integrated strategy encompassing workload-based workforce planning, the development of a strong organizational culture, and continuous competency enhancement. Such an integrated approach is particularly important for high-reliability organizations, where sustainable operational performance depends not only on technological excellence but also on the effective management of strategic human resources.

CONCLUSSION

Drawing on the empirical findings and subsequent analysis, this study concludes that workforce adequacy, organizational culture, and employee competence each exert positive and statistically significant effects on operational performance. These results underscore the importance of aligning workforce capacity with job demands, fostering the effective internalization of organizational values, and strengthening employees' job-relevant capabilities in enhancing task execution and achieving operational objectives. Furthermore, the simultaneous influence of these variables highlights that improvements in operational performance at PT PLN Indonesia Power are driven by the synergistic interaction of adequate staffing levels, a well-established organizational culture, and competencies aligned with job requirements.

In light of these findings, several managerial implications can be proposed. First, organizations should enhance workforce planning practices to ensure optimal alignment between staffing levels and operational workload, thereby minimizing inefficiencies associated with workforce imbalances. Second, reinforcing organizational culture through the systematic dissemination of corporate values, strengthening internal communication, and fostering a collaborative and innovation-oriented work environment is essential to sustain performance improvements. Third, continuous investment in employee competence development through structured training initiatives and human resource development programs is critical to enable adaptability to technological advancements and increasingly complex operational demands. Future research is recommended to integrate additional determinants of operational performance, including leadership, work motivation, and the work environment, to develop a more comprehensive and nuanced understanding of the factors shaping organizational performance. Future research is recommended to integrate additional determinants of operational performance, including leadership, work motivation, and the work environment, to develop a more comprehensive and nuanced understanding of the factors shaping organizational performance.

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