



DOI: <https://doi.org/10.38035/gijtm.v4i2>
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Testing the SEM-PLS Analysis Workflow on a Model of Employee Performance Determinants in the Forestry Sector: Employee Resilience as an Intervening Variable A Methodological Article Based on Simulation Data, Prepared for a Survey of Industrial Forest Plantation (HTI) Company Employees in Jambi Province

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Abstract: The forestry sector is a strategic sector in Indonesia characterized by high-risk work, remote locations, dependence on natural conditions, and demands for both physical and psychological resilience from employees. These conditions create an opportunity for employee resilience to serve as an intervening variable between organizational determinants—specifically transformational leadership, organizational support, and workload—and employee performance. This article aims to comprehensively demonstrate the model testing process using component-based Structural Equation Modeling (specifically, standardized regression as an approximation of PLS Path Modeling), while also presenting a methodologically developed research instrument and a field survey plan ready for implementation. As actual field data was unavailable during the article's preparation, all numerical results ($n = 220$) are derived from mathematically generated simulation data; the data structure is consistent with the hypothesized relationships (H1–H7) and reflects a demographic profile typical of the forestry sector based on secondary literature. The simulation results demonstrate that the analysis workflow—ranging from validity and reliability testing and path coefficient analysis to the Sobel test and Variance Accounted For (VAF) calculation—can be executed consistently, yielding relationship patterns that align with theoretical expectations: transformational leadership ($\beta = 0.261$) and organizational support ($\beta = 0.284$) positively influence employee resilience, whereas workload has a negative influence ($\beta = -0.321$); furthermore, employee resilience positively influences employee performance ($\beta = 0.357$) and mediates the effects of the three aforementioned determinants (VAF 36.9%–52.9%). As these figures are based on simulation, they do not represent the actual conditions of Industrial Forest Plantation (HTI) employees and cannot serve as a basis for policy decisions or empirical claims. The article's primary contribution lies in the validated, consistent analysis pipeline, alongside the research instrument and

survey plan detailed in the supplementary documentation, which are ready for use in primary data collection for future research.

Keyword: *Research Methodology, Simulation Data, SEM-PLS, Employee Resilience, Employee Performance, Forestry Sector, Instrument Design.*

INTRODUCTION

The forestry sector plays a vital role in Indonesia's national economy, serving as a source of foreign exchange earnings—through Industrial Forest Plantations (HTI) and Forest Concession Rights (HPH)—and as a major employer in regions with limited economic access. Jambi Province, which possesses a significant area of production forest, hosts the operations of numerous large-scale forestry companies; these firms employ thousands of workers across various functions, ranging from field operations (such as planting, harvesting, and forest protection) to administration and management. The nature of work in this sector differs significantly from that of the service or conventional manufacturing industries: employees are required to work in remote locations and unpredictable weather conditions, while facing relatively high risks of workplace accidents, long working hours, and intense pressure to meet strict production targets (Kartodihardjo et al., 2021).

These working conditions impose high job demands, meaning that employee performance cannot be explained solely through conventional approaches such as competence, training, or compensation systems. Employees in the forestry sector require additional psychological capacity to continue functioning optimally under pressure—specifically, employee resilience. Employee resilience is defined as an individual's capacity to adapt positively, endure, and recover from adversity, pressure, or changes within the work environment (Luthans, 2002; Fletcher & Sarkar, 2013).

Resilient individuals tend to maintain stable work performance even under high-pressure conditions, whereas individuals with low resilience are more prone to performance decline, burnout, and turnover (Kuntz et al., 2016).

Various prior studies have confirmed that employee performance is influenced by organizational factors such as leadership style, organizational support, and workload (Bakker & Demerouti, 2017; Robbins & Judge, 2022). Transformational leadership is considered capable of providing the direction, inspiration, and emotional support that help employees cope with work-related pressure (Bass & Riggio, 2006).

Perceived organizational support contributes to psychological safety and work commitment (Eisenberger et al., 1986). Conversely, excessive workload has the potential to be a source of work stress that depletes employees' psychological resources (Bakker & Demerouti, 2007).

Several studies have demonstrated that employee resilience acts as a mediator between organizational factors and individual work outcomes (Kuntz et al., 2016; Youssef & Luthans, 2007); however, research specifically integrating transformational leadership, organizational support, and workload as determinants of employee resilience within the context of Indonesia's forestry sector remains limited. Most research on workplace resilience has been conducted in the service, healthcare, and education sectors (Hartmann et al., 2020), whereas natural resource-based sectors characterized by high-risk, physically demanding work—such as forestry—have received relatively little attention. This gap serves as a crucial basis for the model developed in this article.

Employee performance refers to the level of an individual's work results achieved in relation to standards, targets, or criteria established by the organization—encompassing

aspects such as quantity, quality, timeliness, and the effectiveness of resource utilization (Robbins & Judge, 2022).

Employee performance is generally distinguished into task performance—work behaviors that directly contribute to the production of an organization's core goods or services—and contextual performance—behaviors that support the social and psychological environment in which task performance takes place (Borman & Motowidlo, 1997).

Employee resilience is an individual's dynamic capacity to adapt positively to adversity, pressure, failure, or significant change within a work context, as well as the ability to "bounce back" and even "bounce forward" after facing such challenging situations (Fletcher & Sarkar, 2013; Luthans, 2002). In contrast to early views that regarded resilience as an innate trait, contemporary literature views it as a capacity that can be built and developed—a "state-like capacity"—through experience, social support, and organizational interventions (Kuntz et al., 2016; Youssef & Luthans, 2007).

Transformational leadership is a leadership style that emphasizes inspiration, intellectual stimulation, individualized consideration, and the leader's idealized influence on subordinates, with the aim of encouraging them to achieve performance that exceeds standard expectations (Bass & Riggio, 2006). Transformational leaders provide emotional support, build subordinates' self-confidence, and create a greater sense of meaning in work, thereby potentially equipping employees with additional psychological resources to cope with work-related pressure (Tafvelin et al., 2019).

METHOD

This study employs an explanatory quantitative approach using Structural Equation Modeling (SEM) analysis. Hypotheses H1–H7 were deductively derived from established key theories: Job Demands-Resources Theory (Bakker & Demerouti, 2007, 2017), Conservation of Resources Theory (Hobfoll, 1989), Social Exchange Theory (Blau, 1964), and Psychological Capital Theory (Luthans, 2002; Luthans et al., 2007).

The target population for this study consists of permanent employees of Industrial Forest Plantation (HTI) companies in Jambi Province—specifically in the Batanghari, Tebo, and Muaro Jambi regencies—at both operational and supervisory levels. These employees are involved in either field activities (planting, harvesting, nursery operations, forest security, and occupational safety) or operational support functions (administration, finance, HR, and planning). The instruments and sampling plan for this population have been fully designed and are presented in the accompanying document, "Primary Data Collection Plan: HTI Employee Survey in Jambi Province"; however, at the time of writing this article, access for field data collection was not yet available.

Were analyzed using a component-based Structural Equation Modeling (SEM) approach—specifically, multiple regression on the standardized mean scores of each construct—as an approximation of PLS Path Modeling Mode A (Hair et al., 2019). The measurement model (outer model) was evaluated using outer loadings (item-construct score correlations), Average Variance Extracted (AVE), Composite Reliability (CR), and Cronbach's Alpha, while discriminant validity was assessed using the Fornell-Larcker criterion. The structural model (inner model) was evaluated using standardized path coefficients, t-tests, and the coefficient of determination (R^2). The mediating role of employee resilience was examined using the Sobel test (Sobel, 1982) to assess the significance of the indirect effect, alongside the calculation of Variance Accounted For (VAF) to determine the mediation category: $VAF \geq 80\%$ indicates full mediation, $20\%–80\%$ indicates partial mediation, and $< 20\%$ indicates no mediation (Hair et al., 2019). When the direct effect is non-significant while the indirect effect is significant, the pattern is classified as "indirect-

only mediation" or full mediation, in accordance with the contemporary criteria established by Zhao, Lynch, and Chen (2010).

RESULT AND DISCUSSION

Convergent validity was assessed based on the outer loading values of each item on its respective construct using the simulated data (Table 1). All items exhibited loadings above 0.6—with the majority exceeding 0.7, consistent with recommended thresholds (Hair et al., 2019)—indicating that the measurement structure embedded in the simulation procedure (3.1) was successfully reconstructed by the analysis workflow.

Table 1. Outer Loadings for Simulated Data

Construct	Item	Outer Loading
X1	X1.1	0,733
X1	X1.2	0,660
X1	X1.3	0,698
X1	X1.4	0,745
X1	X1.5	0,685
X1	X1.6	0,692
X2	X2.1	0,745
X2	X2.2	0,786
X2	X2.3	0,723
X2	X2.4	0,784
X2	X2.5	0,736
X2	X2.6	0,744
X3	X3.1	0,711
X3	X3.2	0,749
X3	X3.3	0,760
X3	X3.4	0,782
X3	X3.5	0,733
Z	Z.1	0,734
Z	Z.2	0,730
Z	Z.3	0,726
Z	Z.4	0,665
Z	Z.5	0,779
Z	Z.6	0,722
Y	Y.1	0,684
Y	Y.2	0,636
Y	Y.3	0,687
Y	Y.4	0,637
Y	Y.5	0,708
Y	Y.6	0,769

The convergent validity (AVE) and reliability (Composite Reliability and Cronbach's Alpha) for each construct in the simulated data are presented in Table 3. The Cronbach's Alpha and Composite Reliability values for all constructs exceed the 0.70 threshold. The AVE values for constructs X2, X3, and Z are above the 0.50 threshold, whereas the AVE values for constructs X1 (0.494) and Y (0.474) fall slightly below this threshold; however, their composite reliability values remain high (0.854 and 0.843), consistent with the argument that AVE is a relatively conservative criterion (Fornell & Larcker, 1981; Hair et al., 2019).

Table 2. Average Variance Extracted (AVE) and Construct Reliability for Simulated Data

Construct	Construct Name	AVE	Composite Reliability	Cronbach's Alpha
X1	Transformational Leadership	0,494	0,854	0,795
X2	Organizational	0,568	0,887	0,847
X3	Support Workload	0,559	0,864	0,802
Z	Employee Resilience	0,529	0,870	0,821
Y	Employee Performance	0,474	0,843	0,777

Discriminant validity was tested using the Fornell-Larcker criterion on the simulated data by comparing the square root of the AVE (diagonal values) with the inter-construct correlations (off-diagonal values). Table 3 shows that the square root of the AVE for each construct (in bold) is greater than its correlation with other constructs; thus, discriminant validity is established for all constructs in this simulated dataset.

Table 3. Fornell-Larcker Matrix for Simulated Data

	X1	X2	X3	Z	Y
X1	0,703	0,054	-0,053	0,294	0,205
X2	0,054	0,754	0,130	0,257	0,250
X3	-0,053	0,130	0,748	-0,298	-0,239
Z	0,294	0,257	-0,298	0,727	0,471
Y	0,205	0,250	-0,239	0,471	0,688

The structural model yields two regression equations: (1) Employee Resilience (Z) as a function of Transformational Leadership (X1), Organizational Support (X2), and Workload (X3); and (2) Employee Performance (Y) as a function of Employee Resilience (Z) along with those three determinants. The coefficient of determination (R^2) value.

Table 4. Coefficient of Determination (R^2) for Simulated Data

Endogenous Variable	Predictor	R^2	Adjusted R^2	Category
Employee Resilience (Z)	X1, X2, X3	0,246	0,235	Mild-Moderate
Employee Performance (Y)	Z, X1, X2, X3	0,265	0,251	Mild-Moderate

Table 5. Path Coefficients for Simulated Data

Hypothesis	Fath	β	SE	t-value	p-value	Information
H1	$X1 \rightarrow Z$	0,261	0,059	4,407	< 0,001	Significant (+)
H2	$X2 \rightarrow Z$	0,284	0,060	4,763	< 0,001	Significant (+)
H3	$X3 \rightarrow Z$	-0,321	0,060	-5,384	< 0,001	Significant (+)
H4	$Z \rightarrow Y$	0,357	0,067	5,303	< 0,001	Significant (+)
-	$X1 \rightarrow Y$ (direct)	0,083	0,061	1,357	0,175	Significant (+)
-	$X2 \rightarrow Y$ (direct)	0,174	0,062	2,799	0,005	Significant (+)
-	$X3 \rightarrow Y$ (direct)	-0,151	0,063	-2,399	0,016	Significant (+)

The results based on the simulation data indicate that transformational leadership ($\beta = 0.261$; $p < 0.001$) and organizational support ($\beta = 0.284$; $p < 0.001$) have a significant positive effect on employee resilience, while workload has a significant negative effect ($\beta = -0.321$; $p < 0.001$). This pattern was intentionally embedded during the simulation design phase (3.1); consequently, the results demonstrate that the path coefficient estimation pipeline accurately reconstructs the embedded structure. The direct effect of X1 on Y is not significant ($p = 0.175$), whereas the direct effects of X2 and X3 on Y remain significant after accounting for Z; this pattern serves as the basis for the mediation analysis in the subsequent section.

The examination of the role of employee resilience as an intervening variable using simulated data was conducted via the Sobel test for the indirect effect (indirect effect = $a \times b$) and the calculation of the Variance Accounted For (VAF).

Table 6. Effects of Employee Resilience Mediation on Simulation Data

Hypothesis	Mediation Line	Direct	Indirect	Total	z (Sobel)	p	VAF	Type of Mediation
H5	$X1 \rightarrow Z \rightarrow Y$	0,083 (ns)	0,093	0,176	3,389	<0,001	52,9%	Full mediation
H6	$X2 \rightarrow Z \rightarrow Y$	0,174*	0,102	0,275	3,544	<0,001	36,9%	Partial Mediation
H7	$X3 \rightarrow Z \rightarrow Y$	-0,151*	-0,115	-0,266	-3,778	<0,001	43,2%	Partial Mediation

Discussion

The pattern of the relationship in the simulation data is consistent with the theoretical proposition in Part 2 as it is designed in the simulation procedure (3.1). This consistency shows that the analysis pipeline, ranging from instrument drafting, outer model testing, inner model testing, to Sobel and VAF mediation tests, functions as appropriate and is ready to be applied to primary data. This section discusses what this kind of pattern will indicate if it will be found in actual field data, and is not intended as a claim for the real conditions of HTI employees at this time.

If the positive influence of transformational leadership on employee resilience (H1) will be confirmed on primary data, the findings will be in line with the view that leaders who provide inspiration, individual attention, and intellectual stimulation contribute to strengthening the adaptive capacity of his subordinates (Bardoel et al., 2014; Tafvelin et al., 2019). In the context of the forestry sector, effective field leadership can be expected to have a big role given the nature of work that demands rapid decision-making in emergencies, such

as wildfires, extreme weather, or regional security disturbances but this suspicion needs to be tested directly on HTI employees through primary surveys.

Similarly, if the positive influence of the organization's support on employee resilience (H2) is confirmed, this will be consistent with the principle of reciprocity in Social Exchange Theory (Blau, 1964; Eisenberger et al., 1986): support in the form of occupational safety facilities, health assurance, and recognition of the contribution of field employees allegedly reinforces the perception that organizations care about their well-being. Similarly, if the negative influence of workload on employee resilience (H3) is confirmed, this will be in line with the Conservation of Resources Theory (Hobfoll, 1989), which states that prolonged work demands without offsetting adequate resource recovery can lead to the depletion of individual psychological resources.

If the positive influence of employee resilience on employee performance (H4) is confirmed, the findings will reinforce the view that the psychological capacity of the individual is an important prerequisite for the achievement of optimal performance in a stressful work environment (Luthans et al., 2007; Youssef & Luthans, 2007). The mediation pattern (H5–H7) on simulation data illustrates how the influence of transformational leadership, organizational support, and workload on employee performance can work largely through the formation or degradation of resilience capacity first, rather than directly the indirect-only pattern on the transformational leadership path (H5) illustrates the scenario in which the impact of leadership on channeled performance is almost entirely through the strengthening of resilience, while organizational support and workload (H6, H7) on this simulation remain. Whether this pattern also applies to real HTI employees can only be ascertained after the primary data is analyzed.

The R² value of 24.6% for employee resilience and 26.5% for employee performance in simulation data is classified as a weak-moderate category (Chin, 1998) a reasonable consequence because this simulation model only involves three determinants, while in actual field data, resilience and performance are likely also influenced by many other factors outside the model (e.g. individual competence, occupational safety climate, and personality characteristics). It should be reaffirmed that all numbers in this section are derived from data that are deliberately designed so that the structure is in accordance with the direction of the hypothesis; the magnitude of the coefficient, the level of significance, and the value of R² cannot be generalized as the real condition of HTI employees in Jambi Province.

Direction of Advanced Research

Methodologically, this article provides an end-to-end SEM-PLS pipeline that has been tested end-to-end (instrument, outer model, inner model, Sobel mediation and VAF instruments and survey plans (companion documents), so the next step for researchers is to directly carry out primary surveys without the need to reconstitute the instrument design and analysis flow from the beginning.

Theoretically, the tested framework integrates Job Demands-Resources Theory, the Conservation of Resources Theory, and Psychological Capital Theory into a specific model for the forestry sector context of a natural resource-based sector that is relatively rarely studied in the work-resilience literature over the service, health, or education sectors. This framework is a theoretical proposition that has been formulated in a sequence and is ready to be tested empirically, not a proven finding.

The following practical implications are conditional and new to the management of forestry companies when confirmed with primary data: first, companies may consider transformational leadership programs for supervisors and field managers, given its allegedly great role in forming employee resilience in work locations away from the head office. Second, strengthening the organization's support in the form of occupational safety facilities,

health insurance, and recognition of the contribution of field employees can be considered policy. Third, companies can consider the management of more measurable workloads, for example through work rotation, timetime settings, and production target planning that considers employee psychological capacity. Fourth, companies can consider resilience development programs directly, such as stress management training, mindfulness, and psychological capital strengthening. All these implications must be verified through primary surveys before being adopted as policy basis.

CONCLUSION

This article demonstrates the complete flow of testing the SEM-PLS model for the determinant employee performance of the forestry sector with employee resilience as an intervening variable, using simulation data ($n = 220$) which is designed consistent with the direction of the H1–H7 hypothesis. The results of the simulation show that the pipeline analysis goes as it should and produces a pattern of relationships that correspond to the theoretical direction in all seven hypotheses. The main contribution of this article is not to substantive empirical findings because the data analyzed is not field data, but on: (1) research instruments that have been compiled and validated methodologically; (2) the SEM-PLS analysis flow that has been tested can be carried out consistently from raw data to mediation tests; and (3) primary survey plans (sampling techniques and field data collection procedures) that are ready to be implemented, as detailed in the accompanying document "Prim Data Collection Plan". The next step is the implementation of the survey in the HTI employee population in Jambi Province, so that this model can be tested empirically and the results can be used as a basis for scientific claims and policy recommendations.

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