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Cluster-Based Modeling of Internal Factors and FinTech Influence on Strategy: A Case Study of Bank BNI

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Abstract

The rapid development of financial technology (FinTech) and shifting organizational dynamics have compelled banking institutions to reassess their internal capabilities and strategic positioning. This study aims to examine the influence of internal factors namely the Core Values of State-Owned Enterprises (AKHLAK), innovation culture, gratitude, employee commitment, and employee performance on the competitive strategy of Bank BNI, while also investigating the moderating role of FinTech. A quantitative research design was employed using a survey method, involving 200 employees of Bank BNI. Data were analyzed using Cluster Analysis and Structural Equation Modeling–Partial Least Squares (SEM–PLS) through WarpPLS software. The results indicate that AKHLAK core values, innovation culture, and gratitude have significant positive effects on employee commitment and performance. Furthermore, both employee commitment and performance significantly enhance the bank's competitive strategy. FinTech was found to significantly moderate the relationship between employee-related factors and competitive strategy. In conclusion, this study presents an integrated model that highlights the strategic role of internal organizational values and behavior, enhanced by digital technology, in fostering competitive advantage within the banking sector.

Keywords: Core Values (AKHLAK), Competitive Strategy, Financial Technology, Cluster Analysis, SEM-PLS

1. INTRODUCTION

The banking industry has undergone accelerated transformation in the aftermath of the COVID-19 pandemic, which fundamentally reshaped consumer behavior and triggered a widespread shift toward digital financial services. In response to this paradigm shift, banks must not only adopt emerging technologies but also strengthen their internal organizational capabilities to maintain competitiveness in a rapidly evolving landscape.

Bank Negara Indonesia (BNI), one of the largest state-owned banks in Indonesia, has actively embraced digital transformation by enhancing its technological infrastructure and aligning strategic initiatives with its internal organizational values. These values are encapsulated in the AKHLAK framework—Amanah (Trustworthy), Kompeten (Competent), Harmonis (Harmonious), Loyal, Adaptif (Adaptive), and Kolaboratif (Collaborative)—as mandated by the Ministry of State-Owned Enterprises (SOEs) through Circular Letter No. SE-7/MBU/07/2020 [1].

While digital transformation is often viewed through a technological lens, BNI emphasizes the importance of aligning digital strategies with human capital development. Internal factors such as innovation culture, employee gratitude, organizational commitment, and performance are recognized as critical components influencing strategic success. Gratitude, a positive emotional state, enhances interpersonal relationships and fosters psychological well-being, contributing to a harmonious and productive work environment [2], [3]. Likewise, employee commitment and performance have long been associated with higher organizational productivity, reduced turnover

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intentions [4], [5], and sustained competitive advantage through improved service quality and customer satisfaction [6], [7].

Despite the growing body of research on human capital and digital adoption in the banking sector, there remains a significant gap in understanding how internal values, behavioral dynamics, and technological enablers interact to shape competitive strategies particularly in state-owned banks undergoing digital acceleration. Previous studies have examined elements such as innovation culture and employee behavior [8], [9], core organizational values [10], and the broader effects of digital transformation [11], [12]. However, few have explored these variables in an integrated framework or investigated the moderating role of financial technology (FinTech) in strengthening internal strategic alignment.

This study addresses that gap by proposing and testing an integrated model that connects internal organizational factors namely AKHLAK values, innovation culture, and gratitude to employee commitment and performance, and ultimately to the bank's competitive strategy. The moderating role of FinTech is also examined to assess how digital innovation influences these relationships. The novelty of this research lies in its multidisciplinary perspective, combining psychological, organizational, and technological dimensions through a dual analytical approach: Cluster Analysis and Structural Equation Modeling–Partial Least Squares (SEM–PLS).

The primary contribution of this study is the development of an integrated model that unites internal values, behavioral constructs, and digital enablers to explain and enhance competitive strategy in the banking sector. This model enriches theoretical understanding and offers practical guidance for state-owned enterprises seeking to harmonize human capital and digital innovation to improve strategic outcomes in a digital economy.

2. METHODS

2.1 Data Collection

This study employed a survey method to collect primary data using a structured, self-administered questionnaire. Due to COVID-19 restrictions, data collection was conducted online through Google Forms, enabling wide distribution and accessibility across various BNI branch locations without requiring physical interaction. The questionnaire covered items measuring internal organizational variables, behavioral responses, and strategic perceptions.

2.2 Population and Sample

The target population included all employees of Bank Negara Indonesia (BNI) across Indonesia, with the individual employee as the unit of analysis. A purposive sampling technique was applied, selecting 200 employees who were directly involved in areas relevant to digital transformation, human capital management, and competitive strategy. The sample size aligns with the minimum requirement for SEM analysis in models with up to 10 latent variables, as suggested by Jöreskog and Sörbom [13]. Participants were selected based on their roles and ability to provide reliable insights into the organizational processes and changes under investigation.

2.3 Research Instrument and Ethical Considerations

The questionnaire items were adapted from previously validated instruments from relevant studies in organizational behavior, innovation culture, and digital transformation domains. Content validity was assessed through expert judgment, while construct validity and reliability were tested empirically using:

- Cronbach's Alpha and Composite Reliability (CR) to assess internal consistency (threshold > 0.70),
- Average Variance Extracted (AVE) to assess convergent validity (threshold > 0.50),
- Discriminant validity via Fornell-Larcker criterion and cross-loadings.

To ensure ethical compliance, informed consent was obtained from all respondents prior to participation. Participants were assured of anonymity, data confidentiality, and voluntary participation.

2.4 Research Instrument and Ethical Considerations

This study adopted a dual analytical strategy, integrating Cluster Analysis and Structural Equation Modeling–Partial Least Squares (SEM–PLS) to gain deeper insights into the internal heterogeneity among respondents and to test the hypothesized structural relationships.

1) Cluster Analysis

Cluster Analysis was conducted using the K-Means algorithm to segment respondents based on patterns of similarity in their responses to internal organizational constructs (e.g., AKHLAK, innovation culture, gratitude, commitment, and performance). The steps followed:

- Determining the number of clusters (k) based on silhouette coefficient and elbow method.
- Random initialization of centroids.
- Allocation of data points based on Euclidean distance.
- Iterative reallocation until convergence was achieved.

The purpose was to identify subgroups of employees who shared common organizational perceptions, which can help tailor managerial strategies more effectively. Cluster validation was performed using silhouette analysis and intra/inter-cluster distance ratios.

2) Structural Equation Modeling–Partial Least Squares (SEM–PLS)

SEM-PLS analysis was performed using WarpPLS version 7.0, suitable for models with complex path structures, moderation, and smaller sample sizes. The following stages were carried out:

- Measurement model evaluation:
  - Reliability (Cronbach's Alpha, Composite Reliability),
  - Convergent validity (AVE),
  - Discriminant validity (Fornell-Larcker and cross-loading test).
- Structural model assessment:
  - Path coefficient significance (p-values),
  - Effect sizes (Cohen's f^2),
  - Predictive relevance (Q^2),
  - Coefficient of determination (R^2),
  - Moderation analysis using interaction terms.
- Model fit and quality metrics:
  - APC (Average Path Coefficient), ARS (Average R-squared), AARS (Average Adjusted R-squared),
  - AVIF (Average Variance Inflation Factor), AFVIF, and GoF (Goodness of Fit), following the criteria set by Solimun et al. [14].

The conceptual model is illustrated in Figure 1, which presents the hypothesized relationships among the core values of BUMN (AKHLAK), innovation culture, and gratitude, and their influence on employee commitment and performance. These internal factors are further linked to competitive strategy, while Financial Technology is examined as a moderating variable that influences the relationship between commitment, performance, and strategic outcomes.

2.5 Research Instrument and Ethical Considerations

Based on the literature, twelve hypotheses were developed to examine both direct and moderated relationships among the variables. Previous empirical studies support the roles of organizational values [10], [15], innovation and gratitude [8], [16], commitment [17], and FinTech adoption [11], [12] in influencing employee behavior and organizational strategy. The contribution of this method is its integration of behavioral and technological dimensions into a strategic framework using dual quantitative approaches to validate complex interaction effects.

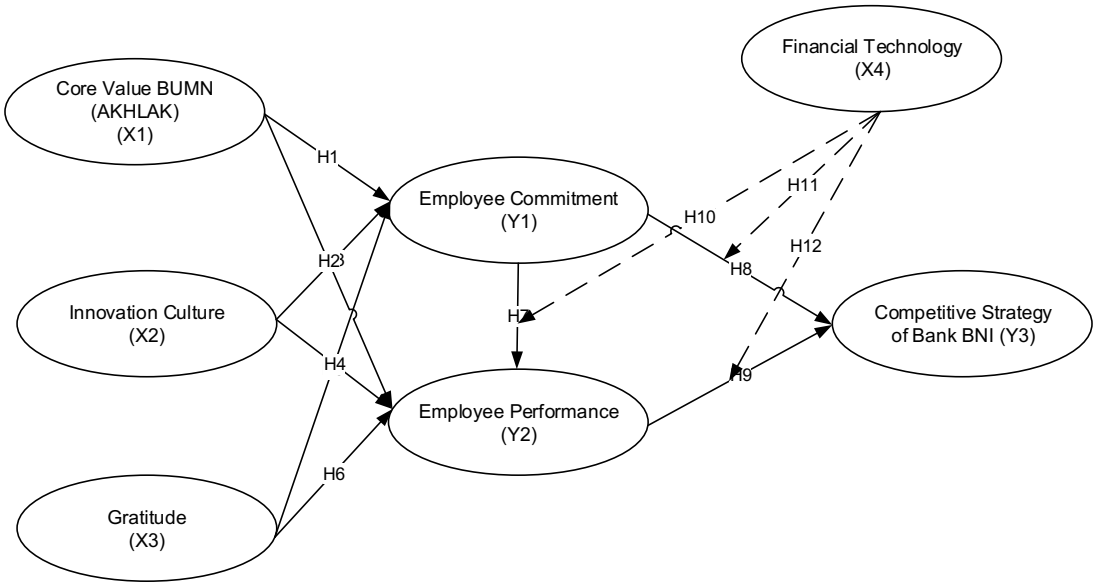

Figure 1. Conceptual Model

3. RESULT AND DISCUSSIONS

3.1 Validity and Reliability Testing

1) Validity Test

All questionnaire items demonstrated corrected item–total correlations above 0.30, satisfying minimum standards of convergent validity as recommended by psychometric literature [18], [19], [20]. Therefore, all indicators were deemed valid and retained for further analysis.

2) Reliability Test

Reliability analysis showed that all constructs had Cronbach's Alpha values above 0.60, confirming internal consistency [21], [22]. This supports that the instrument was both valid and reliable, and the dataset was appropriate for advanced statistical modeling.

3.2 Cluster Analysis

The purpose of the cluster analysis was to group respondents based on the key internal variables measured in the study. A non-hierarchical clustering method, specifically the K-Means Clustering algorithm, was employed. This method assigns data points to clusters based on their proximity to centroids and iteratively recalculates cluster centers until convergence is achieved, a technique commonly applied in multivariate research as noted by Everitt et al., Jain, and Hussain and Haris [23], [24], [25].

The optimal number of clusters was determined using Figure 2, which displays the results of the silhouette analysis. This analysis indicated that two clusters (k = 2) provided the most appropriate grouping of respondents based on the similarity of their responses.

Figure 3, which presents the cluster plot, visually depicts the distribution of respondents across the two identified clusters. Data points are color-coded to reflect their cluster membership, highlighting the clear separation between the two groups.

The distribution of respondents across clusters is shown in Table 1. Cluster 1 comprised 110 respondents, representing 61.80 percent of the sample, while Cluster 2 included 68 respondents, or 33.71 percent. This indicates that Cluster 1 contained the larger proportion of participants.

A comparative overview of the number of members in each cluster across the measured variables is provided in Figure 4, which demonstrates the internal differences between the clusters based on constructs such as AKHLAK values, innovation culture, gratitude, commitment, and performance.

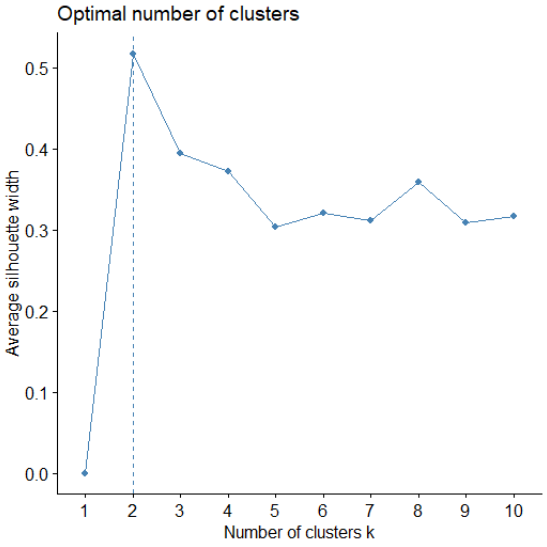

Figure 2. Silhouette Analysis

Figure 3. Cluster Plot

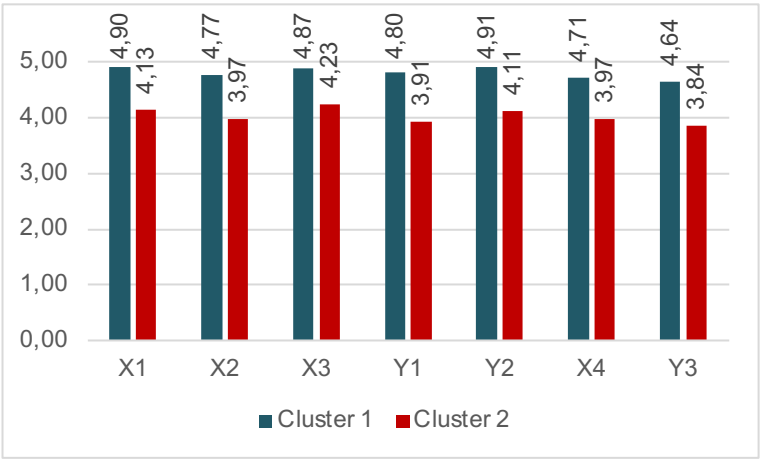

Figure 4. Comparison of Number of Members in Clusters Based on Variables

Table 1. Number of Members per Cluster

Cluster	Number of Members	
	Frequency (persons)	***Percentage (%)***
Cluster 1	110	61,80%
Cluster 2	68	33,71%
Total	178	100,00%

3.3 SEM-PLS Analysis with WarpPLS

1. Validity Test

Based on the analysis results presented in Table 2, all indicators for each latent variable BUMN Core Values (AKHLAK), Innovation Culture, Gratitude, Financial Technology, Employee Commitment, Employee Performance, and Competitive Strategy are found to be significant and positively weighted. There are no indicators with negative weights or insignificant values in any of the variables. Therefore, no indicators were removed from the model, as all met the criteria for measuring their respective constructs.

Subsequently, the model was evaluated for fit and quality indices using only valid indicators. This ensured the model's structural integrity prior to hypothesis testing.

Table 2. Indicator Exploration Results for Each Variable in the WarpPLS SEM Model

Variable	Indicator	Model Indicator	Weight	P-value	Conclusion
Core Value BUMN (AKHLAK) (X1)	Trustworthiness (X1.1)	Reflective	0,905	<0,001	Used in the model
	Competent (X1.2)	Reflective	0,888	<0,001	Used in the model
	Harmonious (X1.3)	Reflective	0,890	<0,001	Used in the model
	Loyal (X1.4)	Reflective	0,911	<0,001	Used in the model
	Adaptive (X1.5)	Reflective	0,905	<0,001	Used in the model
	Collaborative (X1.6)	Reflective	0,889	<0,001	Used in the model
Culture of Innovation (X2)	Courage (X2.1)	Reflective	0,922	<0,001	Used in the model
	Creativity (X2.2)	Reflective	0,919	<0,001	Used in the model
	Teamwork (X2.3)	Reflective	0,916	<0,001	Used in the model
Gratitude (X3)	Sense of Appreciation (X3.1)	Reflective	0,770	<0,001	Used in the model
	Positive Feelings (X3.2)	Reflective	0,754	<0,001	Used in the model
	Expression of Gratitude (X3.3)	Reflective	0,917	<0,001	Used in the model
Financial Technology (X4)	Character (X4.1)	Reflective	0,820	<0,001	Used in the model
	Benefits (X4.2)	Reflective	0,953	<0,001	Used in the model
	Benefits Induced (X4.3)	Reflective	0,926	<0,001	Used in the model
Employee Commitment (Y1)	Affective Commitment (Y1.1)	Reflective	0,813	<0,001	Used in the model
	Continuance Commitment (Y1.2)	Reflective	0,914	<0,001	Used in the model
	Normative Commitment (Y1.3)	Reflective	0,907	<0,001	Used in the model
Employee Performance (Y2)	Work Outcomes (Y2.1)	Reflective	0,933	<0,001	Used in the model
	Work Behavior (Y2.2)	Reflective	0,956	<0,001	Used in the model
	Personal Traits (Y2.3)	Reflective	0,949	<0,001	Used in the model
Competitive Strategy (Y3)	Costs (Y3.1)	Reflective	0,703	<0,001	Used in the model
	Quality (Y3.2)	Reflective	0,846	<0,001	Used in the model
	Flexibility (Y3.3)	Reflective	0,912	<0,001	Used in the model
	Reliability (Y3.4)	Reflective	0,915	<0,001	Used in the model

2. WarpPLS model Fit and Quality Indices model

Model fit assessment was conducted using the ten measures of Model Fit and Quality Indices as outlined by Solimun et al. (2017) in the WarpPLS approach. These results are summarized in Table 3. The Goodness of Fit index evaluates how well the structural model represents the

observed data and the underlying theoretical constructs. Based on the values shown in Table 3, all model fit and quality indices meet the required thresholds. Consequently, the model demonstrates good fit and can be reliably used for hypothesis testing and explanation of the studied phenomenon.

Table 3. Model Model Fit and Quality Indices

Model Fit	***Value***	***Fit Criteria***	***Result***
Average path coefficient	APC = 0,240 P < 0,001	P < 0,05	Significant
Average R-squared	ARS = 0,680 P < 0,001	P < 0,05	Significant
Average adjusted R-squared	AARS = 0,671 P < 0,001	P < 0,05	Significant
Average block VIF	AVIF = 4,245	*acceptable* if AVIF ≤ 5 ideal if AVIF ≤ 3,30	*Acceptable*
Average full collinearity VIF	AFVIF = 4,912	*acceptable if AFVIF ≤ 5* *ideal if AFVIF ≤ 3,30*	*Acceptable*
Tenenhaus GoF	GoF = 0,727	*small if GoF ≥ 0,10* *medium if GoF ≥ 0,25* *big if GoF ≥ 0,36*	Big
Sympson's paradox ratio	SPR = 0,846	*acceptable if SPR ≥ 0,70* *ideal if SPR = 1*	*Acceptable*
R-squared contribution ratio	RSCR = 0,941	*acceptable if RSCR ≥ 0,90* *ideal RSCR = 1*	*Acceptable*
Statistical suppression ratio	SSR = 1,000	*acceptable if SSR ≥ 0,70*	*Acceptable*
Nonlinear bivariate causality direction ratio	NLBCDR = 0,846	*acceptable* if NLBCDR ≥ 0,70	*Acceptable*

3.4 Hypothesis Testing Results

The results of the hypothesis testing are summarized in Table 4, which presents the twelve direct relationships between variables assessed in this study. Of these twelve hypothesized paths, eleven are found to be statistically significant and one is insignificant. Therefore, eleven hypotheses are accepted and one is rejected.

The results of the hypothesis testing are summarized in Table 4, which outlines the twelve direct relationships between the variables examined in this study. Out of the twelve hypothesized paths, eleven show statistically significant effects, while one is not statistically significant. Specifically, several relationships are significant at the 5% level, while others are significant at the more stringent 1% level, indicating strong empirical support. One relationship is identified as not significant, leading to the acceptance of eleven hypotheses and the rejection of one based on the statistical thresholds applied.

Table 4. Hypothesis Testing on the Direct Effect of WarpPLS Analysis

Variable		**Path Coefficient**	***P-value***	**Test Results**
Predictor	***Response***			
Direct Effect				
Core Value BUMN (AKHLAK) (X1)	Employee Commitment (Y1)	0,389**	<0,001	Significant
Core Value BUMN (AKHLAK) (X1)	Employee Performance (Y2)	0,403**	<0,001	Significant
Innovation Culture (X2)	Employee Commitment (Y1)	0,360**	<0,001	Significant
Innovation Culture (X2)	Employee Performance (Y2)	0,143*	0,026	Significant
Gratitude (X3)	Employee Commitment (Y1)	0,214*	0,002	Significant
Gratitude (X3)	Employee Performance (Y2)	0,145*	0,024	Significant
Employee Commitment (Y1)	Employee Performance (Y2)	0,271**	<0,001	Significant
Employee Commitment (Y1)	Competitive Strategy (Y3)	0,386**	<0,001	Significant

Variable		Path Coefficient	*P-value*	Test Results
Predictor	***Response***			
Employee Performance (Y2)	Competitive Strategy (Y3)	0,181**	0,006	Significant

Moderation Influence (Interaction Variable)

Variable			Path Coefficient	*P-value*	Test Results	Conclusion
Predictor	***Moderator***	***Predictor***				
Employee Commitment (Y1)	Financial Technology (X4)	Employee Performance (Y2)	-0,035^{ns}	0,318	Not Significant	Not a Moderator
Employee Commitment (Y1)	Financial Technology (X4)	Competitive Strategy (Y3)	0,207**	0,002	Significant	Moderator
Employee Performance (Y2)	Financial Technology (X4)	Competitive Strategy (Y3)	0,160*	0,014	Significant	Moderator

The rejected hypothesis is as follows:

- **H10**: Financial Technology does not significantly moderate the effect of Employee Commitment on Employee Performance

The following hypotheses are accepted:

- **H1**: BUMN Core Values (AKHLAK) have a significant effect on Employee Commitment.
- **H2**: BUMN Core Values (AKHLAK) have a significant effect on Employee Performance.
- **H3**: Innovation Culture has a significant effect on Employee Commitment.
- **H4**: Innovation Culture has a significant effect on Employee Performance.
- **H5**: Gratitude has a significant effect on Employee Commitment.
- **H6**: Gratitude has a significant effect on Employee Performance.
- **H7**: Employee Commitment has a significant effect on Employee Performance.
- **H8**: Employee Commitment has a significant effect on Competitive Strategy.
- **H9**: Employee Performance has a significant effect on Competitive Strategy.
- **H11**: Financial Technology significantly moderates the effect of Employee Commitment on Competitive Strategy.
- **H12**: Financial Technology significantly moderates the effect of Employee Performance on Competitive Strategy.

As Structural Equation Modeling (SEM) recognizes both direct and indirect effects, further analysis was conducted to explore indirect relationships using WarpPLS, as shown in Table 5.

Table 5. Hypothesis Testing on Indirect Effect of WarpPLS Analysis

Variable			Path Coefficient	P-value	Test Results
Predictor	**Mediation**	**Response**			
Core Value BUMN (AKHLAK) (X1)	Employee Commitment (Y1)	Employee Performance (Y2)	0.105*	0.022 (Significant)	Mediation
Core Value BUMN (AKHLAK) (X1)	Employee Commitment (Y1), Employee Performance (Y2)	Competitive Strategy (Y3)	0.223**	0.001 (Significant)	Mediation
Innovation Culture (X2)	Employee Commitment (Y1)	Employee Performance (Y2)	0.098*	0.031 (Significant)	Mediation
Innovation Culture (X2)	Employee Commitment (Y1), Employee Performance (Y2)	Competitive Strategy (Y3)	0.165*	0.012 (Significant)	Mediation

Variable			Path Coefficient	P-value	Test Results
Predictor	**Mediation**	**Response**			
Gratitude (X3)	Employee Commitment (Y1)	Employee Performance (Y2)	0.058 ns	0.135 (Not Significant)	No Mediation
Gratitude (X3)	Employee Commitment (Y1), Employee Performance (Y2)	Competitive Strategy (Y3)	0.109 ns	0.069 (Not Significant)	No Mediation
Employee Commitment (Y1)	Employee Performance (Y2)	Competitive Strategy (Y3)	0.049 ns	0.175 (Not Significant)	No Mediation

Based on the hypothesis test results presented in Table 5, there are seven indirect influences between the research variables. Of these seven indirect influences, four are significant, and three are insignificant. Therefore, this study can explain the following hypotheses:

- **H6**: Gratitude influences Employee Performance, mediated by Employee Commitment.
- **H8**: Employee Commitment influences Competitive Strategy, mediated by Employee Performance.

Although the direct effects for H6 and H8 were found to be insignificant, their indirect effects are significant. This finding introduces a new insight into the mediating roles within the model, offering theoretical value by highlighting indirect behavioral pathways.

Finally, the model's feasibility and predictive power were evaluated using the multivariate coefficient of determination, expressed as Q-Square (Q^2). This coefficient indicates the model's predictive relevance; a Q^2 value greater than 0 confirms that the model has explanatory power regarding the behavior of the system being studied. The summary of these results is presented in Table 6.

Table 6. Coefficient of Determination

Response Variable	R-squared
Employee Commitment (Y1)	0,798
Employee Performance (Y2)	0,838
Competitive Strategy (Y3)	0,404
Total Determination Coefficient	0,9805

The Stone-Geisser Q Square test value in Table 4.6 can be calculated using the following formula:

$Q^2 = 1 – (1 – 0{,}798)(1 – 0{,}838)\ (1 – 0{,}404)$

$Q^2 = 0{,}9805 = 98{,}05\%$

The predictive relevance value is 0.9805. This indicates that the model can explain 98.05% of the data diversity. In other words, 98.05% of the information contained in the data can be explained by the model. The remaining 1.95% is explained by other variables (not yet included in the model) and error. Therefore, the resulting structural model is appropriate.

3. CONCLUSIONS

This study aimed to examine the influence of internal organizational factors—namely the Core Values of BUMN (AKHLAK), Innovation Culture, and Gratitude—on Employee Commitment and Performance, and their subsequent impact on Competitive Strategy at Bank BNI, with Financial Technology as a moderating variable. Using a combination of Cluster Analysis and SEM-PLS, the findings confirmed that all three internal factors significantly enhance both commitment and performance, which in turn positively affect the bank's competitive strategy. Furthermore, Financial Technology was shown to moderate these relationships, reinforcing the strategic role of digital platforms in today's banking environment. The main contribution of this research lies in its integrated model that combines organizational values, behavioral constructs, and technological enablers to explain strategic outcomes in the context of digital transformation. This model provides

both theoretical enrichment and practical insights, particularly for state-owned enterprises seeking to align human capital and technology to improve competitiveness in a rapidly evolving financial ecosystem.

Based on the findings, it is recommended that BUMNs reinforce the implementation of AKHLAK values through centralized monitoring systems supported by big data analytics to ensure consistent alignment with employee performance and commitment goals. Simultaneously, cultivating a culture of innovation requires the development of integrated digital platforms that can systematically track and evaluate innovation efforts, allowing for timely, data-driven policy adjustments. Furthermore, state-owned banks such as Bank BNI should strategically adopt FinTech solutions to maximize the impact of human capital on long-term competitiveness. Lastly, future research should expand the current model by incorporating variables like transformational leadership or organizational climate, and testing it across diverse industries to enhance its theoretical robustness and practical applicability.

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