PLS Predict vs. Cross-Validated Predictive Ability Testing in Knowledge-Based Transformation: A Comparative Assessment of Predictive Accuracy in Ghana's Banking Sector

Richard Berimah Twum[123], Abdul-Aziz Ibn Musah[2], Ernestina Hope Turkson[2]

[1] National Investment Bank PLC, Accra, Ghana

[2] TALI Graduate School, Dominion University College (now Southshore University College), Accra, Ghana

[3] Department of Statistics, University of Cape Coast, Cape Coast, Ghana

[1]Corresponding Author Email: richardberimah@gmail.com

Abstract—Accurate prediction is important for successful knowledge-based transformation in high-risk environments such as banking. However, disagreement remains about the best strategy for measuring predictive performance in complicated structural models. This work fills that gap by conducting a comprehensive comparative evaluation of Partial Least Squares Predict (PLS-Predict) and Cross-Validated Predictive Ability Test (CVPAT) in the context of Knowledge-Based Transformation Models (KBTMs) in Ghana's commercial banking industry. Using 310 bank workers' survey data and PLS-SEM, we examine prediction accuracy across nine latent constructs, including knowledge creation, retention, codification, and employee performance, using error-based metrics (RMSE, MAE) and relevance indicators (Q^2). PLS-Predict regularly outperforms CVPAT, with substantially smaller prediction errors and higher Q^2 values, especially for knowledge-intensive constructs (e.g., $Q^2 = 0.834$ for Knowledge Creation). While CVPAT is resistant to overfitting in smaller samples, PLS-Predict has greater out-of-sample prediction value in multicollinear, real-world organisational situations. We recommend PLS-Predict as the major tool for anticipating KBTM results and suggest hybrid validation frameworks for further research. This work adds methodologically to the predictive modelling literature and provides practical assistance for banks seeking data-driven decision-making in knowledge management.

Keywords: PLS-Predict; CVPAT; predictive accuracy; knowledge-based transformation; PLS-SEM; banking industry; Ghana; model validation.

I. INTRODUCTION

In a bid to promote innovation, ensure quality performance, negotiate regulatory complexity in industries such as the Banking sector, Organizations rely heavily on Knowledge Based Transformation Models (KBTMs). However, it is important to state that the efficacy of these models relies on theory and somewhat on predictive validity or its ability to showcase outcomes based on unobserved data. Advanced validation procedures, such as PLS-Predict (Shmueli et al., 2019) and Cross-validated predictive Ability Test (CVPAT) are tools that are created to test the predictive power which goes beyond traditional fit indices such as Coefficient Determination. Given their popularity, there are high evidences that compares real world methodologies, organizational situations, especially in emerging economies where quality of data and sample limits are particularly challenging. This paper responds to methodological clarity (Hair et al.,2022; Sharma et al., 2023) by answering a very critical question; Between PLS-Predict or CVPAT, which provides more accurate and dependable forecasts for KBTMs in the banking sector? Using a dataset of 310 employees from ten commercial banks in Accra, Ghana, we compare the two techniques across different latent dimensions important for knowledge management and performance. Our results show that PLS-Predict delivers much fewer prediction errors and increased predictive relevance, particularly for knowledge-centric factors, demonstrating its supremacy in applied organisational research. This study contributes significantly in three folds;

Methodology: this illustrates empirical comparison of PLS-Predict and CVPAT in an African banking sector and this provides standard measure for future investigations.

Practical: ensure banking professionals choose the most efficient and reliable predictive tool for knowledge management efforts. **Theoretical:** promotes the engagement of predictive modelling in PLS-SEM by maintaining the conditions under which each technique performs well.

II. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

II.I. KNOWLEDGE-BASED TRANSFORMATION MODELS (KBTMS)

The Knowledge-Based Transformation Models (KBTMs) are the second topic. (Nonaka & Takeuchi, 1995) Knowledge-based technology management (KBTM) integrates tacit and explicit knowledge in order to improve organisational learning, innovation, and performance. A number of processes, including knowledge development, sharing, and retention, are examples of how KBTMs have an impact on employee performance in the banking industry (Mbilla et al., 2020).

II.II. PREDICTIVE MODEL EVALUATION IN PLS-SEM

PLS-SEM places a greater emphasis on prediction, in contrast to covariance-based SEM, which places more of an emphasis on model fit (Hair et al., 2019). There are two primary techniques that have emerged: In order to create point predictions and evaluate out-of-sample error (RMSE, MAE), as well as relevance (Q2), the PLS-Predict algorithm employs k-fold cross-validation. Using statistical testing, the CVPAT evaluates the predictive loss of a model in comparison to naive benchmarks (such as the mean prediction) (Sharma et al., 2023). When it comes to high-dimensional, multicollinear data, previous research suggests that PLS-Predict performs exceptionally well (Shmueli et al., 2019). On the other hand, CVPAT is more conservative and resilient in small samples (Liengaard et al., 2021). On the other hand, this trade-off has not been tested in a real-world KBTM by any study.

II.III. RESEARCH HYPOTHESIS

H_1: In the banking sector, PLS-Predict will exhibit a substantially higher predictive accuracy than CVPAT for Knowledge-Based Transformation Models.

III. METHODOLOGY

III.I. DATA AND SAMPLE

We conducted a survey of 310 employees from 10 commercial banks in Accra, Ghana, with a response rate of 98.4%. Representation was guaranteed across departments and job categories through stratified random sampling.

III.II. MEASUREMENT MODEL

The following nine latent constructs were assessed using validated scales: **Knowledge Management**: KC, KAC, KS, KAP, KCO, and KR **Results**: Employee Performance (EP), Job Satisfaction (DJS) Moderator: Government Policies (GP) All constructs demonstrated exceptional reliability (Cronbach's $\alpha > 0.89$) and validity (AVE > 0.57, HTMT < 0.85).

III.III. ANALYTICAL PROCEDURE

Model Estimation: PLS-SEM via SmartPLS 4.

PREDICTIVE ASSESSMENT:

- PLS-Predict: 10-fold cross-validation; reported RMSE, MAE, Q^2.

- CVPAT: Compared PLS-SEM predictions against Indicator Average (IA) and Linear Model (LM) benchmarks using loss differentials and t-tests.

Decision Rule: With a lower RMSE/MAE value and a $Q^2 > 0$ we can conclude a superior predictive power.

IV. RESULTS

IV.I. PREDICTIVE ACCURACY COMPARISON

Construct	PLS-Predict Q^2	PLS-Predict RMSE	CVPAT Loss Diff. (vs. LM)	p-value
KC	0.834	0.41	0.536	0.000
KR	0.827	0.418	0.489	0.000
KCO	0.803	0.446	0.500	0.000
EP	0.191	0.905	0.002	0.975
DJS	0.172	0.916	0.114	0.048

In terms of performance constructs, CVPAT confirmed PLS-SEM's superiority over IA ($p < 0.001$) but did not demonstrate a significant advantage over LM ($p > 0.05$). Hypothesis H_1 is substantiated: PLS-Predict exhibits substantially superior predictive accuracy, particularly with respect to knowledge-related outcomes.

V. DISCUSSION

Our results verify that PLS-Predict is the optimal approach for predicting KBTM outcomes in multicollinear, data-rich environments such as banking. Its capacity to generate actionable predictions and manage the complexity of latent variables is essential for strategic knowledge management. Nevertheless, CVPAT continues to be a valuable tool for robustness testing, particularly when the sample size is limited or overfitting is a concern. The near-equivalence of PLS-SEM and LM for EP/DJS implies that simplified models may be sufficient for affective/performance outcomes.

VI. CONCLUSION AND IMPLICATIONS

This study makes a significant methodological contribution by resolving a critical debate in predictive modeling within the domain of knowledge-based transformation. Through rigorous empirical analysis grounded in a sample of 310 banking professionals in Accra, Ghana, the research conclusively demonstrates that PLS-Predict consistently outperforms Cross-Validated Predictive Ability Testing (CVPAT) in terms of predictive accuracy, particularly for latent constructs central to Knowledge-Based Transformation Models (KBTMs) such as knowledge creation, codification, and retention. The superiority of PLS-Predict is evidenced by substantially higher Q^2 predict values and markedly lower error metrics (RMSE and MAE), affirming its robustness in forecasting real-wo This study contributes significantly in terms of methodology by resolving by settling the debate in predictive modelling. Given a sample of 310 banking professionals with a grounded empirical analysis in Accra, Ghana. This paper shows and establishes that PLS-Predict consistently outweighs Cross-Validated Predictive Ability Testing (CVPAT) and this is in terms of predictive accuracy, mostly for latent constructs which is central to Knowledge-Based

Transformation Models (KBTMs) such as knowledge creation, codification, and even retention. The apparent superiority of PLS-Predict is evidential given its higher Q^2 predict values and lower error metrics (RMSE and MAE), this confirms the robustness in ensuring forecast of real world organizational outcomes given multicollinearity, moderate sample sizes, and complex interdependencies within latent variables.

For Ghanaian banks, emerging economies with similar institutional, technological, and even human capital constraints, the results carries profound implications practically. The adoption of PLS-Predict as a validation framework for evaluating knowledge management initiatives, financial institutions can improve reliability, strategic alignment, and return on investment of their knowledge-driven interventions.

Decision makers can actually leverage PLS-Predicts out of sample forecasting capabilities to anticipate the impact of knowledge strategies on employee performance, job satisfaction and operational efficiency with a great confidence rather than relying on traditional fit. This supports and strengthens evidence-based management but also supports more agile and responsive organizational learning systems.

Moreover, the study places more focus on the necessity for a context-sensitive methodology in evaluating the model, prioritizing predictive importance rather than focusing on explanatory capacity.

In dynamic, data-limited contexts such as Ghana's banking sector, where regulatory changes, worker movement, and digital transformation incessantly alter knowledge flows, the capacity to produce precise forecasts is not only a statistical benefit but a strategic need. This research enhances methodological rigour in PLS-SEM applications and provides a practical approach for practitioners aiming to convert theoretical knowledge management frameworks into quantifiable, sustained performance improvements. Prospective Investigations: Investigate hybrid models that integrate the precision of PLS-Predict with the prudence of CVPAT.

Organizational outcomes under conditions of multicollinearity, moderate sample sizes, and complex interdependencies among latent variables.

For banks operating in Ghana and by extension, other emerging economies facing similar institutional, technological, and human capital constraints this finding carries profound practical implications. By adopting PLS-Predict as the primary validation framework for evaluating knowledge management initiatives, financial institutions can significantly enhance the reliability, strategic alignment, and return on investment of their knowledge-driven interventions. Rather than relying on traditional fit indices or less sensitive benchmarks, decision-makers can leverage PLS-Predict's out-of-sample forecasting capabilities to anticipate the impact of knowledge strategies on employee performance, job satisfaction, and operational efficiency with greater confidence. This not only strengthens evidence-based management but also supports more agile and responsive organizational learning systems.

VII. LIMITATIONS

Cross-sectional design; self-reported data. Future work should use longitudinal or objective performance metrics.

REFERENCES

1. Hair, J. F., et al. (2019). PLS-SEM: Indeed a silver bullet. Journal of Marketing Theory and Practice.
2. Shmueli, G., et al. (2019). Predictive model assessment in PLS-SEM. European Journal of Information Systems.
3. Sharma, P. N., et al. (2023). Predictive model assessment using CVPAT. European Journal of Marketing.
4. Berimah Twum, R. (2025). Quantifying Predictive Accuracy in Knowledge-Based Transformation Model. Dominion University College.