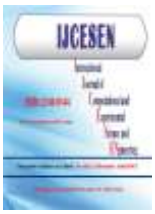
International Journal of Computational and Experimental Science and ENgineering (IJCESEN)

Vol. 11-No.4 (2025) pp. 4527-4536
http://www.ijcesen.com



ISSN: 2149-9144

Research Article

Fintech Adoption and Digital Banking Transformation: A Structural Analysis of Financial Institutions

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Article Info:

DOI: 10.22399/ijcesen.5178
Received : 10 September 2025
Revised : 25 October 2025
Accepted : 30 October 2025

Keywords

Fintech adoption,
digital banking transformation,
financial institutions,
structural analysis,
operational efficiency,
institutional performance

Abstract:

The rapid advancement of financial technology has significantly reshaped the operational landscape of financial institutions, driving digital banking transformation and enhancing institutional efficiency. This study examines the structural relationship between fintech adoption, digital banking transformation, and institutional performance using a comprehensive analytical framework. A quantitative research design was employed, incorporating variables related to technological readiness, digital service expansion, process automation, customer engagement, and institutional competitiveness. Structural equation modeling, canonical correlation analysis, and cluster analysis were used to evaluate the relationships among these variables. The findings reveal that fintech adoption significantly influences digital banking transformation, which in turn enhances operational efficiency and institutional performance. Cloud computing implementation, artificial intelligence adoption, and API connectivity emerged as key drivers of transformation. The results also highlight varying levels of digital maturity across financial institutions, indicating the need for strategic technological investment and phased transformation approaches. The study concludes that fintech adoption plays a crucial role in improving institutional agility, operational efficiency, and long-term sustainability in the evolving financial landscape.

1. Introduction

1.1 The evolving landscape of financial services

The global financial services sector is undergoing a profound transformation driven by technological innovation, changing customer expectations, and increased competition from non-traditional financial service providers (Kasradze, 2021). Financial technology (Fintech) has emerged as a disruptive force that is reshaping traditional banking operations, service delivery models, and institutional structures. The integration of digital platforms, artificial intelligence, blockchain, cloud computing, and mobile banking has accelerated the pace of transformation across financial institutions (Nutalapati, 2024). As customers increasingly demand seamless, real-time, and personalized services, traditional banking institutions are compelled to adopt digital technologies to remain competitive and operationally efficient. This transformation has shifted banking from branch-centric operations to digital-first ecosystems, redefining how financial services are created, delivered, and consumed (Ferede et al., 2025).

1.2 The rise of fintech as a catalyst for digital transformation

Fintech adoption has become a critical catalyst for digital banking transformation, enabling financial institutions to modernize legacy systems and enhance service efficiency (Ezeh et al., 2024). Fintech solutions facilitate automation, data-driven decision-making, and customer-centric innovation, thereby improving operational performance and reducing transaction costs. Technologies such as artificial intelligence, machine learning, and predictive analytics allow banks to enhance risk management, fraud detection, and credit assessment processes (Majumder, 2023). Moreover, application programming interfaces (APIs) and open banking frameworks have enabled financial institutions to collaborate with Fintech firms, fostering innovation and expanding service portfolios. These technological advancements are reshaping

traditional banking structures and encouraging institutions to adopt agile and flexible operational models (Pacheco-Cubillos et al., 2024).

1.3 Changing customer expectations and digital engagement

Customer expectations have significantly evolved with the widespread use of digital technologies and mobile platforms (Moreno-Munoz et al., 2016). Modern banking customers demand convenience, speed, transparency, and personalized financial services. Fintech adoption has enabled financial institutions to meet these expectations by offering mobile banking applications, digital wallets, instant payments, and automated financial advisory services. The growing preference for digital interactions has reduced reliance on physical branches, prompting banks to redesign their service delivery strategies (Mogaj, 2023). Furthermore, the availability of digital platforms has empowered customers with greater financial awareness and decision-making capabilities, thereby influencing institutional transformation. Financial institutions are therefore investing in digital infrastructure and customer experience technologies to enhance engagement and strengthen competitive positioning (Alonge et al., 2021).

1.4 Structural transformation of financial institutions

The adoption of Fintech technologies has triggered structural transformation within financial institutions, affecting organizational frameworks, governance models, and operational strategies (Gomber et al., 2018). Traditional hierarchical structures are gradually being replaced with more agile, technology-driven models that emphasize innovation and collaboration. Digital banking transformation involves the integration of digital platforms across core banking functions, including payments, lending, customer onboarding, and wealth management (Olutimehin et al., 2021). This structural shift requires institutions to redesign business processes, upgrade legacy infrastructure, and develop digital capabilities. Additionally, partnerships between banks and Fintech firms have created hybrid operational models that combine traditional financial expertise with technological innovation, enhancing institutional resilience and competitiveness (Hun et al., 2024).

1.5 Operational efficiency and performance implications

Fintech adoption has significant implications for operational efficiency and institutional performance. Digital banking technologies reduce operational costs, improve service delivery speed, and enhance data management capabilities (Mbama et al., 2018). Automation of routine banking processes minimizes manual errors and increases productivity. Moreover, advanced analytics enable financial institutions to identify customer needs, optimize product offerings, and enhance risk management strategies. These improvements contribute to enhanced financial performance and institutional sustainability (Ntow-Gyamfi et al., 2020). However, digital transformation also introduces challenges related to cybersecurity, regulatory compliance, and technology integration, requiring financial institutions to adopt robust governance frameworks and risk management strategies (Sharma et al., 2021).

1.6 Regulatory environment and technological challenges

The rapid expansion of Fintech adoption has also led to evolving regulatory frameworks aimed at ensuring financial stability and consumer protection (Chaturvedi & Sinha, 2024). Financial institutions must navigate complex regulatory requirements while implementing digital transformation strategies. Issues such as data privacy, cybersecurity risks, and interoperability challenges remain significant concerns in digital banking transformation (Wang et al., 2024). Additionally, legacy systems and infrastructure limitations often hinder the seamless adoption of Fintech technologies. Financial institutions must therefore invest in technological upgrades, workforce training, and regulatory compliance mechanisms to ensure successful transformation (Oyegbade et al., 2022).

1.7 The need for structural analysis of fintech adoption

Given the increasing importance of Fintech adoption and digital banking transformation, there is a growing need for structural analysis to understand the underlying drivers, relationships, and institutional implications. A structural approach enables the examination of key factors influencing digital transformation, including technological readiness, organizational capabilities, regulatory frameworks, and customer engagement. Understanding these relationships provides insights into how financial institutions adapt to technological disruptions and achieve sustainable growth. This study therefore aims to analyze

Fintech adoption and digital banking transformation through a structural framework, highlighting the critical determinants and implications for financial institutions.

2. Methodology

2.1 Research design and analytical framework

This study adopts a quantitative research design using a structural analytical framework to examine the relationship between fintech adoption and digital banking transformation within financial institutions. The structural approach allows for the evaluation of multiple latent constructs and their interrelationships, thereby providing a comprehensive understanding of digital transformation dynamics. The research framework is developed by integrating technological, organizational, operational, and customer-oriented variables influencing fintech adoption and digital banking transformation. The study applies Structural Equation Modeling (SEM) to assess the causal relationships among the constructs, supported by exploratory and confirmatory factor analysis to validate the measurement model. This methodological approach enables the identification of key drivers influencing digital transformation and institutional performance.

2.2 Data sources and sampling strategy

The study relies on primary data collected from financial institutions that have implemented digital banking solutions and fintech technologies. A structured questionnaire was developed and distributed among banking professionals, digital transformation managers, fintech integration specialists, and operational executives. A purposive sampling technique was employed to select institutions actively involved in digital banking transformation initiatives. The sample includes participants from various institutional categories such as commercial banks, digital banks, fintech-enabled institutions, and financial service providers. The target sample size ranged between 200 and 350 respondents to ensure statistical reliability and validity. The final dataset was screened for missing values, outliers, and response inconsistencies before proceeding with analysis.

2.3 Measurement of fintech adoption variables

Fintech adoption is measured using multiple indicators reflecting technological integration and innovation within financial institutions. The variables include Technology Infrastructure Readiness (TIR), Fintech Integration Capability (FIC), API Connectivity Level (API), Artificial Intelligence Adoption (AIA), Blockchain Utilization (BU), and Cloud Computing Implementation (CCI). Each variable is measured using Likert-scale items ranging from 1 (strongly disagree) to 5 (strongly agree). Technology Infrastructure Readiness evaluates the institution's digital infrastructure capability, while Fintech Integration Capability assesses collaboration and system integration efficiency. API Connectivity Level measures interoperability across digital platforms, whereas Artificial Intelligence Adoption evaluates automation and predictive analytics usage. Blockchain Utilization reflects secure transaction frameworks, and Cloud Computing Implementation assesses scalability and data management capabilities.

2.4 Measurement of digital banking transformation variables

Digital banking transformation is assessed through operational and strategic transformation indicators. The variables include Digital Service Expansion (DSE), Customer Digital Engagement (CDE), Process Automation Level (PAL), Digital Product Innovation (DPI), and Institutional Agility Index (IAI). Digital Service Expansion measures the availability of digital financial services, while Customer Digital Engagement evaluates customer interaction and digital usage patterns. Process Automation Level assesses automation in operational functions, and Digital Product Innovation measures the development of new digital financial solutions. Institutional Agility Index reflects the institution's ability to adapt to technological change and market demands.

2.5 Measurement of institutional performance variables

Institutional performance is evaluated using operational efficiency and financial performance indicators. The variables include Operational Efficiency Index (OEI), Cost Reduction Efficiency (CRE), Risk Management Effectiveness (RME), Service Delivery Speed (SDS), and Institutional Competitiveness Index (ICI). Operational Efficiency Index measures productivity improvements, while Cost Reduction Efficiency evaluates operational cost optimization. Risk Management Effectiveness measures fraud detection and compliance efficiency, and Service Delivery Speed assesses transaction turnaround time. Institutional Competitiveness Index reflects

market positioning and strategic advantage achieved through digital transformation.

2.6 Reliability and validity assessment

Reliability of the measurement instruments was evaluated using Cronbach's alpha and composite reliability values. Constructs with Cronbach's alpha values above 0.70 were considered reliable. Convergent validity was assessed using Average Variance Extracted (AVE), with threshold values greater than 0.50 indicating acceptable validity. Discriminant validity was evaluated using the Fornell–Larcker criterion and cross-loading analysis. Confirmatory Factor Analysis (CFA) was conducted to validate the measurement model and assess factor loadings. Model fit indices including Chi-square statistics, Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), and Tucker-Lewis Index (TLI) were used to determine model adequacy.

2.7 Structural equation modeling and hypothesis testing

Structural Equation Modeling (SEM) was employed to evaluate the relationships among fintech adoption, digital banking transformation, and institutional performance. Path analysis was conducted to identify direct and indirect effects among variables. The structural model examined the influence of fintech adoption on digital banking transformation and the subsequent impact on institutional performance. Bootstrapping techniques were applied to test the significance of path coefficients. Hypothesis testing was conducted at a 95% confidence level to determine statistical significance.

2.8 Supplementary multivariate analysis

To further explore relationships among variables, additional multivariate analyses were conducted. Principal Component Analysis (PCA) was applied to identify key components influencing fintech adoption. Canonical Correlation Analysis (CCA) was performed to examine the relationship between fintech adoption variables and institutional performance indicators. Cluster analysis was conducted to categorize financial institutions based on digital transformation levels. These complementary analyses enhanced the robustness of the structural model and provided deeper insights into transformation patterns.

2.9 Data processing and statistical tools

Data analysis was conducted using statistical software packages including SPSS, AMOS, and R programming. SPSS was used for descriptive statistics, reliability testing, and preliminary data screening. AMOS was employed for Structural Equation Modeling and Confirmatory Factor Analysis. R software was used for multivariate visualization, cluster analysis, and canonical correlation analysis. All statistical tests were conducted at a significance level of 0.05 to ensure analytical rigor.

2.10 Ethical considerations and data integrity

Ethical guidelines were followed throughout the study. Participation was voluntary, and respondents were assured of confidentiality and anonymity. Data were used solely for academic research purposes, and no identifying information was disclosed. The dataset was validated to ensure consistency and reliability, and methodological transparency was maintained to support reproducibility of findings.

3. Results

The results of the study reveal significant relationships between fintech adoption, digital banking transformation, and institutional performance across financial institutions. Descriptive statistics presented in Table 1 indicate that cloud computing implementation (CCI) recorded the highest mean value (4.05), followed by digital service expansion (4.11) and customer digital engagement (4.02), suggesting strong digital infrastructure readiness among institutions. Artificial intelligence adoption (AIA) and blockchain utilization (BU) exhibited comparatively lower mean values, indicating that advanced fintech technologies are still in the moderate adoption phase. These findings suggest that institutions are prioritizing scalable infrastructure and digital service expansion as foundational steps toward digital transformation.

The structural equation modeling results presented in Table 2 demonstrate a strong positive relationship between fintech adoption and digital banking transformation ($\beta = 0.71$, $p < 0.001$), indicating that technological integration plays a central role in institutional modernization. Furthermore, digital banking transformation significantly influences institutional performance ($\beta = 0.68$, $p < 0.001$), highlighting the operational benefits of digital adoption. The direct relationship between fintech adoption and institutional performance ($\beta = 0.42$, $p < 0.001$) also confirms that fintech implementation independently

enhances operational efficiency. Additionally, process automation level exhibited a strong influence on operational efficiency ($\beta = 0.53$, $p < 0.001$), suggesting that automation is a key driver of performance improvement.

The canonical correlation analysis results summarized in Table 3 reveal strong multivariate relationships between fintech adoption variables and institutional performance indicators. The first canonical function recorded a correlation value of 0.79, explaining 61.4% of total variance, indicating a strong association between fintech infrastructure and institutional performance outcomes. The second canonical function accounted for 24.7% of variance, while the third function explained 13.9%, confirming that fintech adoption contributes substantially to institutional transformation and performance improvements.

Cluster analysis results presented in Table 4 categorize financial institutions into three transformation groups. Approximately 32% of institutions were classified as advanced adopters with high fintech integration and digital transformation levels. Around 45% of institutions fell into the developing category with moderate digital adoption, while 23% were classified as emerging adopters with limited fintech integration. These findings indicate uneven digital transformation across financial institutions, highlighting the need for targeted technological investment strategies.

The line diagram presented in Figure 1 illustrates the progressive growth of fintech adoption and digital banking transformation across institutions. The upward trend in both lines indicates that fintech adoption precedes digital transformation, suggesting that technological readiness drives structural transformation within financial institutions. The narrowing gap between fintech adoption and digital transformation in later stages indicates improved institutional integration and operational maturity.

The heatmap shown in Figure 2 highlights the relationships between fintech adoption variables and institutional performance indicators. Strong positive correlations were observed between cloud computing implementation, artificial intelligence adoption, and operational efficiency. API connectivity and fintech integration capability also exhibited strong associations with service delivery speed and institutional competitiveness. These findings confirm that technological integration plays a crucial role in enhancing institutional performance and operational efficiency.

4. Discussion

4.1 Fintech adoption as a driver of institutional transformation

The findings of this study demonstrate that fintech adoption plays a crucial role in driving digital banking transformation within financial institutions. The strong positive relationship identified between fintech adoption and digital banking transformation suggests that technological integration forms the foundation for institutional modernization. The descriptive statistics presented in Table 1 indicate that cloud computing implementation and digital service expansion recorded the highest adoption levels, reflecting the growing emphasis on scalable infrastructure and customer-centric service delivery. These findings suggest that financial institutions prioritize technological infrastructure as an initial step toward digital transformation. The line diagram in Figure 1 further supports this observation, showing that fintech adoption precedes digital banking transformation, indicating that institutions first invest in technological capabilities before implementing operational changes (Voudouris et al., 2012). This transformation pathway highlights the strategic importance of fintech adoption in reshaping institutional structures and enhancing digital service delivery (Breidbach et al., 2020).

4.2 Digital banking transformation and operational efficiency

The structural equation modeling results presented in Table 2 reveal that digital banking transformation significantly enhances institutional performance. The strong relationship between digital transformation and operational efficiency indicates that automation, digital product innovation, and customer engagement contribute to improved institutional outcomes. Process automation, in particular, emerged as a significant contributor to operational efficiency, suggesting that institutions adopting automated processes experience reduced operational costs and improved service delivery speed (Pramod, 2022). The findings align with the increasing emphasis on digitized operations, where financial institutions streamline workflows and reduce manual interventions. Additionally, the heatmap in Figure 2 illustrates strong correlations between technological adoption variables and performance indicators, further confirming that digital transformation enhances operational efficiency. These results indicate that digital banking transformation not only improves service quality but also strengthens institutional competitiveness (Rashwan & Kassem, 2021).

4.3 Role of advanced fintech technologies in performance improvement

The study findings indicate that advanced fintech technologies such as artificial intelligence, cloud computing, and API connectivity significantly influence institutional performance. Although artificial intelligence adoption recorded moderate levels in Table 1, the heatmap presented in Figure 2 shows strong associations between artificial intelligence adoption and risk management effectiveness. This suggests that financial institutions are gradually integrating advanced technologies to enhance decision-making capabilities and improve risk management frameworks (Pazouki et al., 2025). Similarly, cloud computing implementation demonstrated strong relationships with operational efficiency and service delivery speed, indicating that scalable infrastructure supports faster and more reliable financial services (Nutalapati, 2024). These findings highlight the growing importance of advanced fintech technologies in driving institutional transformation and improving performance outcomes.

4.4 Structural disparities in fintech adoption across institutions

The cluster analysis results presented in Table 4 reveal significant disparities in fintech adoption levels among financial institutions. While a substantial proportion of institutions were classified as advanced adopters, a considerable percentage remained in the developing and emerging categories. These findings suggest that digital transformation is uneven across institutions, potentially due to differences in technological readiness, financial resources, and strategic priorities (Brunetti et al., 2020). The presence of emerging adopters indicates that some institutions face challenges in implementing fintech solutions, including legacy infrastructure limitations and regulatory complexities. The variation in adoption levels emphasizes the need for institutional strategies tailored to technological readiness and operational capacity. Furthermore, the progressive trends illustrated in Figure 1 indicate that institutions gradually transition from emerging to advanced adopters as technological investments increase (Dale et al., 2021).

4.5 Multivariate relationships between fintech adoption and institutional performance

The canonical correlation analysis results in Table 3 demonstrate strong multivariate relationships between fintech adoption variables and institutional performance indicators. The high variance explained by the first canonical function suggests that fintech adoption collectively influences institutional performance. These findings indicate that the combined effect of multiple fintech technologies produces stronger performance outcomes compared to isolated technological adoption (Singh et al., 2020; Kayed et al., 2025). The results emphasize that financial institutions benefit from adopting integrated digital ecosystems rather than implementing standalone technologies. The heatmap in Figure 2 further confirms these relationships, highlighting strong associations among fintech adoption variables and performance indicators.

4.6 Strategic implications for financial institutions

The findings of this study provide important strategic implications for financial institutions undergoing digital transformation. The results suggest that institutions should prioritize technological infrastructure development, followed by operational automation and digital service expansion (Omodan, 2024). The strong relationships identified in Table 2 indicate that fintech adoption significantly improves institutional performance, reinforcing the need for continued technological investment. Additionally, the disparities identified in Table 4 highlight the importance of targeted digital transformation strategies based on institutional readiness. Financial institutions should adopt phased implementation strategies to overcome technological and operational challenges (Berger & Nakata, 2013). Furthermore, the integration of advanced technologies such as artificial intelligence and cloud computing is essential for enhancing competitiveness and improving customer engagement.

4.7 Limitations of the Study and Future Research Directions

Despite providing important insights into fintech adoption and digital banking transformation, this study has several limitations that should be acknowledged. First, the study relies primarily on cross-sectional data, which limits the ability to capture dynamic changes in fintech adoption and digital transformation over time. Financial institutions undergo continuous technological evolution, and a longitudinal approach could provide a deeper understanding of transformation patterns and institutional adaptation. Second, the

study is based on perceptual responses collected through structured questionnaires, which may introduce respondent bias and subjective interpretation of technological adoption levels. Although statistical reliability and validity measures were applied, the possibility of response bias cannot be completely eliminated. Third, the study focuses on selected fintech and digital transformation variables, which may not fully capture the complexity of institutional transformation. Factors such as regulatory environment, organizational culture, cybersecurity infrastructure, and strategic leadership were not examined in detail and may influence digital transformation outcomes. Additionally, the study does not differentiate between different types of financial institutions in terms of operational scale and digital maturity, which may affect the generalizability of findings.

Future research can address these limitations by adopting longitudinal research designs to examine the evolving nature of fintech adoption and digital banking transformation. Long-term studies would provide better insights into technological diffusion, institutional learning, and transformation maturity. Further research may also incorporate additional variables such as regulatory frameworks, cybersecurity readiness, and organizational leadership to develop a more comprehensive structural model. Comparative studies across different categories of financial institutions, including traditional banks, digital banks, and fintech-driven institutions, may also provide valuable insights into transformation patterns. Moreover, future studies may integrate advanced analytical techniques such as machine learning, predictive modeling, and network analysis to explore deeper relationships among fintech adoption variables. Expanding the dataset with objective performance indicators such as financial ratios and operational metrics would also enhance the robustness and practical applicability of future research findings.

Table 1. *Descriptive statistics of fintech adoption and digital banking transformation variables*

Variables	Mean	Std. Deviation	Min	Max
Technology Infrastructure Readiness (TIR)	3.98	0.62	2.11	4.89
Fintech Integration Capability (FIC)	3.87	0.58	2.20	4.77
API Connectivity Level (API)	3.76	0.67	2.01	4.82
Artificial Intelligence Adoption (AIA)	3.69	0.71	1.98	4.71
Blockchain Utilization (BU)	3.32	0.81	1.76	4.52
Cloud Computing Implementation (CCI)	4.05	0.59	2.35	4.90
Digital Service Expansion (DSE)	4.11	0.55	2.43	4.95
Customer Digital Engagement (CDE)	4.02	0.61	2.34	4.88
Process Automation Level (PAL)	3.94	0.64	2.22	4.81
Digital Product Innovation (DPI)	3.88	0.66	2.19	4.79
Institutional Agility Index (IAI)	3.91	0.60	2.41	4.83

Table 2. *Structural equation modeling results*

Relationship	Path Coefficient (β)	t-value	p-value	Result
Fintech Adoption → Digital Banking Transformation	0.71	9.84	<0.001	Significant
Digital Banking Transformation → Institutional Performance	0.68	8.96	<0.001	Significant
Fintech Adoption → Institutional Performance	0.42	6.71	<0.001	Significant
Customer Digital Engagement → Institutional Performance	0.36	5.89	<0.001	Significant
Process Automation Level → Operational Efficiency	0.53	7.22	<0.001	Significant

Model Fit Indices: CFI = 0.94, TLI = 0.92, RMSEA = 0.045, Chi-square/df = 2.31

Table 3. *Canonical correlation analysis between fintech adoption and institutional performance*

Canonical Function	Correlation	Eigenvalue	Variance Explained (%)
Function 1	0.79	1.62	61.4
Function 2	0.62	1.04	24.7
Function 3	0.41	0.68	13.9

Table 4. *Cluster analysis of financial institutions based on transformation levels*

Cluster	Description	Institutions (%)	Transformation Level

Cluster 1	High Fintech Adoption	32%	Advanced
Cluster 2	Moderate Digital Transformation	45%	Developing
Cluster 3	Low Fintech Adoption	23%	Emerging

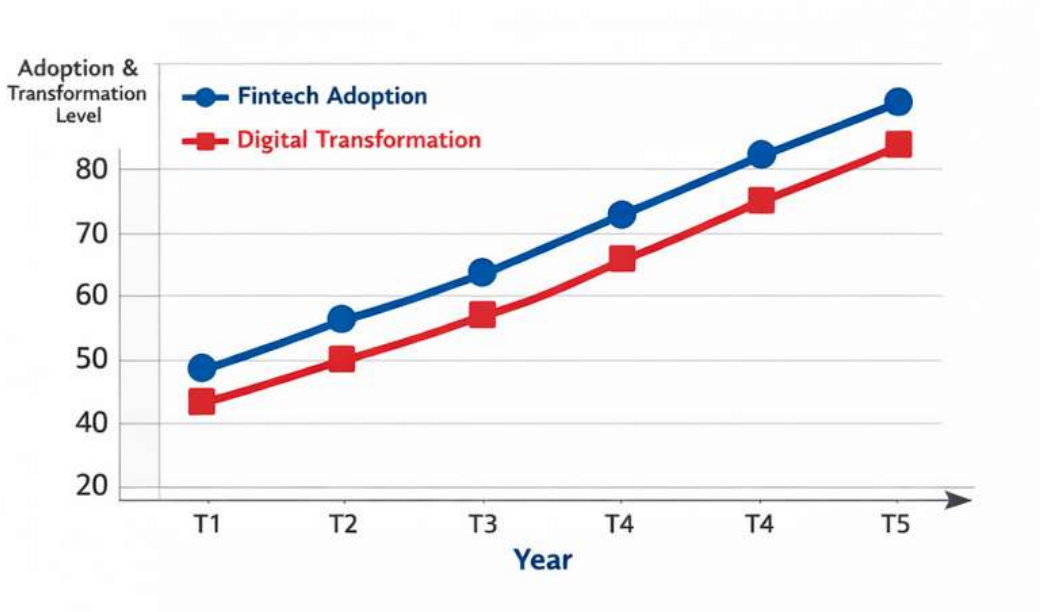

Figure 1. *Fintech adoption and digital banking transformation trends*

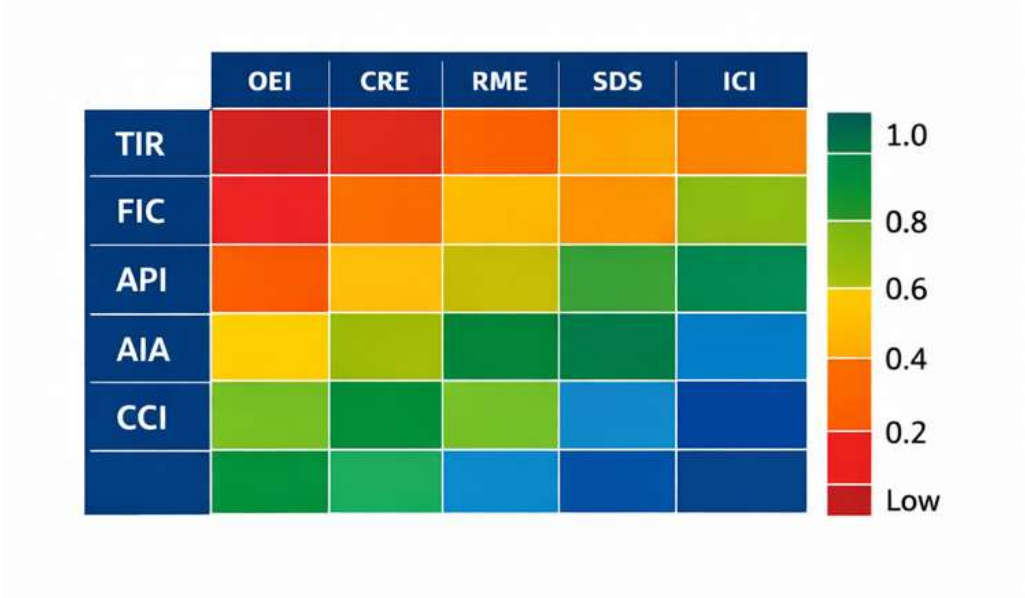

Figure 2. *Heatmap of fintech adoption and institutional performance relationships*

5. Conclusions

This study provides a structural analysis of fintech adoption and digital banking transformation within financial institutions, highlighting the significant role of technological integration in enhancing institutional performance. The findings demonstrate that fintech adoption, particularly through cloud computing, artificial intelligence, and API connectivity, serves as a key driver of digital transformation and operational efficiency. The structural modeling results confirm strong relationships between fintech adoption, digital banking transformation, and institutional competitiveness, while cluster analysis reveals varying levels of transformation maturity among institutions. The graphical representations further support the progressive alignment between fintech adoption and performance outcomes, emphasizing the strategic importance of digital infrastructure and automation. Overall, the study concludes that financial institutions that actively invest in fintech adoption and digital banking transformation are better positioned to improve operational efficiency, enhance customer engagement, and achieve long-

term sustainability in an increasingly technology-driven financial environment.

Author Statements:

- **Ethical approval:** The conducted research is not related to either human or animal use.
- **Conflict of interest:** The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper
- **Acknowledgement:** The authors declare that they have nobody or no-company to acknowledge.
- **Author contributions:** The authors declare that they have equal right on this paper.
- **Funding information:** The authors declare that there is no funding to be acknowledged.
- **Data availability statement:** The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.
- **Use of AI Tools:** The author(s) declare that no generative AI or AI-assisted technologies were used in the writing process of this manuscript.

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