Mediation Analysis, Moderation of Digital Transformation and Fintech Adoption and the Role of Financial Literacy in Improving Sustainable Performance

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Abstract
The banking industry is currently in an era of rapid transformation, driven by advances in digital technology and innovation in the financial sector. These changes create opportunities and challenges for banks in maintaining competitiveness and improving sustainable performance. This study aims to explore how increasing financial literacy can strategically influence the relationship between digital transformation, Fintech adoption, and competitive sustainability. The type of research used in this study is quantitative. The population in this study consists of employees of Bank BSI under the Malang Area Office. Using a simple random sampling technique. To measure the sample size to be studied, the researcher used the Slovin formula. Data analysis used Structural Equation Modeling, Partial Least Square (SEM PLS) techniques. The results of the study show that digital transformation has a positive effect on sustainable performance. Digital Transformation has a positive effect on fintech adoption. Fintech adoption has a positive effect on sustainable performance. The results also show that fintech adoption significantly mediates the relationship between digital transformation and sustainable performance. Digital transformation, financial literacy on fintech adoption shows a significant moderating effect. This can be explained that individuals with high financial literacy tend to be more selective in adopting new technology.

INTRODUCTION

The banking industry is currently undergoing rapid transformation, driven by advances in digital technology and innovation in the financial sector. Islamic banking is one type of financial service that has been significantly impacted by its presence in the current digital era. The Indonesian Islamic banking industry plays a significant role in the economic structure (Ana & Zunaidi, 2022). The Financial Services Authority (OJK) views digital transformation in the banking sector as inevitable (Linggadjaya et al., 2022). Bank Syariah Indonesia (BSI) is one of the banks that has adopted digital transformation. PT Bank Syariah Indonesia Tbk. One of the innovations undertaken is implementing digital transformation across BSI's various services. PT Bank Syariah Indonesia Tbk, or BSI, which operates in the Islamic banking industry, has actually addressed digital challenges in various corporate strategies. These technological changes facing the banking industry create both opportunities and challenges for banks in maintaining competitiveness and improving sustainable performance (Agrawal et al., 2023; Dabbous et al., 2023). In recent years, sustainable development has consistently emerged as a major challenge (Li et al., 2022). Riegler (2023) notes that sustainable banking involves the implementation of commercial practices that prioritize social, environmental, and ethical considerations, ultimately contributing to a stable and comprehensive financial system.

Banks are increasingly dependent on financial technology (fintech) solutions. The adoption of fintech in the banking sector has the potential to not only improve financial performance but also contribute to sustainable development goals (Urumsah et al., 2022a). By utilizing fintech solutions, banks can improve their sustainable performance (Moghadasnian & KheimeGard, 2024). Sustainable performance in banking is also influenced by how digital transformation is carried out (Chen & Hao, 2022). The digital transformation adopted by banks can significantly influence effectiveness and also impact sustainable performance (Chen & Hao, 2022); (Jiyanova et al., 2023). Several previous studies have confirmed the significant positive impact of digital transformation on sustainable company performance (Rehman Khan et al., 2022); (Alojail & Khan, 2023) and (Li et al., 2022).

Fintech adoption has a significant impact on the sustainability performance of the banking sector. Several previous studies have demonstrated the impact of Fintech implementation on improving banking sustainability performance (Dwivedi et al., 2021); (Hidayat-ur-Rehman, 2024); (Siddik et al., 2023). In addition to its direct impact, Sarfraz et al., 2022 showed that fintech adoption can moderate the relationship between digital transformation and sustainable performance. Fintech adoption is related to the Technology Acceptance Model (TAM) theory. This theory relates to perceived ease of use, perceived usefulness, and relative advantage, and influences various variables in consumer behavior and intentions (Venkatesh & Davis, 2000).

Fintech adoption, supported by financial literacy, is one strategy that enables companies to optimize their operations, improve customer experience, and remain competitive in a rapidly changing market (Siddik et al., 2023). This literacy forms the basis for effective Fintech adoption, which in turn will drive increased operational efficiency, cost-effectiveness, and customer engagement (Harris, 2021a); (Tripathy & Jain, 2020). When companies adopt Fintech, they will gain a competitive advantage, which is crucial in today's digital-driven economy (Hidayat-ur-Rehman and Hossain, 2024). The relationship from digital transformation to sustainable performance is a long-term one (Alojail & Khan, 2023) and begins with a company's capacity to understand and utilize digital technology, which is heavily influenced by its level of financial literacy (Koskelainen et al., 2023). The relationship between an individual's level of financial literacy and their propensity to use Fintech has been studied, among others, by (Morgan et al., 2019); (Yoshino & Kaji, 2020); (Hasan et al., 2024).

This study uses technological innovation systems (TIS) theory and the Resource-based view (RBV) as a basis to explore the relationship between financial literacy and sustainable corporate performance through FinTech adoption. Technological innovation systems (TIS) theory provides a systemic perspective on technology adoption. Technological innovation systems offer a robust framework for analyzing the development and diffusion of new technologies across specific sectors (Carlsson and Stankiewicz, 1991). Several researchers have even applied the technological innovation systems (TIS) theory framework to understand digital transformation and the sustainable performance of banks and financial firms (ULAS, 2023); (Kingiri & Fu, 2019).

On the other hand, the research theory is also supported by the resource-based view (RBV), which emphasizes internal resources as the main driver of competitive advantage and performance (Hidayat-ur-Rehman, 2024). In the context of digital transformation and the sustainable performance of banks and financial companies, the resource-based view (RBV) is used to understand how internal resources and capabilities influence these institutions' adaptation to digital change and their subsequent performance. The resource-based view (RBV) states that a company's lasting competitive advantage stems from the possession of valuable, rare, inimitable, and irreplaceable resources (Barney, 1991). The resource-based view (RBV) is a strategic management theory that states that a company's competitive advantage and performance are largely determined by its unique resources and capabilities (Enriquez de la O, 2015).

Previous research has largely focused on the direct impact of digital transformation or financial literacy separately. However, this study proposes a novel comprehensive model that integrates these elements, with a particular focus on the moderating role of financial literacy. By introducing moderated mediation analysis, this study not only fills the gap in previous research that has not been widely conducted but also offers new theoretical and empirical insights. This study explores how increased financial literacy can strategically influence the relationship between digital transformation, Fintech adoption, and competitive sustainability. Specifically, the objectives of this study are as follows: to determine and test whether digital transformation affects sustainable performance; whether digital transformation affects fintech adoption; whether fintech adoption affects sustainable performance; whether fintech adoption is able to mediate the effect of digital transformation on sustainable performance; and whether financial literacy is able to moderate the effect of digital transformation on fintech adoption.

METHODS

The type of research used in this study is quantitative. The population in this study consisted of employees of Bank BSI under the Malang Area Office. Bank BSI under the Malang Area Office has 22 branches with a total of 380 employees. The technique used to determine the sample in this study was a simple random sampling technique. To measure the sample size to be studied, the researcher used the Slovin formula, as follows:

$$n = \frac{N}{Ne^2+1}$$

From the formula above, the following numbers are obtained:

$$n = \frac{380}{380.(0{,}05)^2+1}$$

$$n = \frac{380}{0{,}95+1}$$

$$n = \frac{380}{1{,}95}$$

$$n = 194.8$$

The sample size used after rounding was 195 people. Data were collected using a questionnaire. The questionnaire included a series of questions designed to rank the following variables: customer experience, customer value, price perception, customer satisfaction, and repurchase intention. Each question was scored on a 5-point Likert scale by the researcher: A score of 1 indicates "strongly disagree," a score of 2 indicates "disagree," a score of 3 indicates "neutral," a score of 4 indicates "agree," and a score of 5 indicates "strongly agree." This study used a causality model or influence relationship. Structural equation modeling (SEM) based on components or variance, and Partial Least Squares (PLS) were used to accelerate the research hypothesis.

RESULTS AND DISCUSSION

1. Descriptive Statistical Analysis

Table 1. Descriptive Statistics

Variable	Theoretical Range	Actual Range	Mean	Standard Deviation
Digital Transformation (DT)	1-5	1-5	4.56	0.59
Financial Literacy (FL)	1-5	1-5	4.54	0.58
Fintech Adoption (FA)	1-5	1-5	4.22	0.75
Sustainable Performance (SP)	1-5	1-5	4.38	0.66

Source: Primary data, processed (2025

The mean and standard deviation values for each variable in Table 1 indicate that respondents generally agreed with the statements in the questionnaire. This is reflected in the mean values for all variables, which were above 3.8 on a Likert scale of 1 to 5, namely Digital Transformation (4.56), Financial Literacy (4.54), Fintech Adoption (4.22), and Sustainable Performance (4.38). The standard deviation values, which ranged from 0.58 to 0.75, indicate that there were no extreme deviations in respondents' responses, meaning their answers were relatively homogeneous and consistent.

2. Discriminant Validity Analysis

Table 2. Discriminant Validity Test Results

Variable	DT	FL	FA	SP
DT	0.876			
FL	0.625	0.860		
FA	0.812	0.616	0.849	
SP	0.715	0.724	0.811	0.886

Source: Primary data, processed (2025)

The processing results show that all constructs have adequate AVE values, namely above 0.70. In addition, all indicators in the constructs of Digital Transformation, Financial Literacy, Fintech Adoption, and Sustainable Performance show loading factors that have exceeded the minimum threshold of 0.70 as recommended by (Hair, 2019). Thus, the convergent validity in this model can be concluded to have been met. According to (Hair, 2019), discriminant validity can be proven if the square root value of the AVE (shown on the diagonal above) is higher than the correlation between the other constructs. The results in Table 3 show that all diagonal values are higher than the correlation between the other variables. This finding indicates that digital transformation contributes positively to improving sustainable performance, although the effect is relatively weaker compared to other relationship paths.

3. Reliability Test

Table 3. Reliability Test Results

Variable	Cronbach's Alpha	Composite Reliability

DT	0.899	0.930
FL	0.884	0.919
FA	0.935	0.947
SP	0.932	0.948

Source: Primary data, processed (2025)

Reliability refers to the internal consistency of indicators in measuring constructs. Reliability assessment is carried out with two main indicators: Cronbach's Alpha and Composite Reliability (CR). A construct is considered reliable if both values exceed 0.70 (Hair et al. 201). Based on Table 4, all constructs have very high alpha and CR values (DT = 0.899/0.930; FL = 0.884/0.919; FA = 0.935/0.947; SP = 0.932/0.948), so it can be concluded that all constructs show very good reliability.

4. Hypothesis Testing

Table 4. Direct Hypothesis Test Results

Hypothesis	Hypothesis Direction	Path Coefficient	t-statistics	p-values	Conclusion
H1: DT → SP	+	0.165	1,663	0.048	Supported
H2: DT → FA	+	0.648	9,838	0,000	Supported
H3: FA → SP	+	0.677	7,132	0,000	Supported

Source: Primary data, processed (2025)

Table 5. Mediation and Moderation Effect Test Results

Hypothesis	Hypothesis Direction	Path Coefficient	t-statistics	p-values	Conclusion
H4: DT → FA → SP	Mediated	0.439	6,735	0,000	Supported
H5: DT*FL → FA	Moderated	-0.104	2,384	0.009	Supported

Source: Primary data, processed (2025)

Hypothesis testing in this study was conducted using a significance level of 5% (α = 0.05), in accordance with general standards in inferential statistical analysis as explained by (Hair, 2019). The results of direct hypothesis testing in the table above show that all hypotheses (H1 to H3) are supported by the data, as follows:

• H1 (Digital Transformation → Sustainable Performance): There is a significant positive influence (β = 0.165; t = 1.663; p = 0.048), which indicates that digital transformation has an impact on improving sustainable performance, although the strength of the influence is relatively weaker compared to other paths.

• H2 (Digital Transformation → Fintech Adoption): Shows a highly significant positive influence (β = 0.648; t = 9.838; p = 0.000), which indicates that the higher the level of digital transformation, the higher the level of financial technology adoption.

• H3 (Fintech Adoption → Sustainable Performance): There is a significant positive influence (β = 0.677; t = 7.132; p = 0.000), which confirms the important role of fintech in supporting sustainable organizational performance.

In addition to direct influences, this study also tests mediation and moderation effects to identify indirect relationships between variables:

- H4 (Mediation: Digital Transformation → Fintech Adoption → Sustainable Performance): The test results show that fintech adoption significantly mediates the relationship between digital transformation and sustainable performance ($\beta = 0.439$; $t = 6.735$; $p < 0.000$). This means that digital transformation will have a stronger impact on sustainable performance if mediated through increased adoption of financial technology.
- H5 (Moderation: Digital Transformation × Financial Literacy → Fintech Adoption): The test results show a significant moderating effect ($\beta = -0.104$; $t = 2.384$; $p = 0.009$), with a negative direction indicating that a higher level of financial literacy tends to weaken the direct influence of digital transformation on fintech adoption. This can be explained by the fact that individuals with high financial literacy tend to be more critical and selective in responding to the use of new financial technology.

DISCUSSION

The Impact of Digital Transformation on Sustainable Performance

The research results show a significant positive effect of digital transformation on sustainable performance. This indicates that digital transformation has an impact on improving sustainable performance. Digital transformation brings changes in banking by automating processes, increasing efficiency, and reducing manual systems. This shift will significantly improve sustainability in banks (Hidayat-ur-Rehman & Hossain, 2024). By streamlining operations, banks will be able to reduce resource use, reduce carbon emissions and waste, thereby improving sustainable performance (Huang et al., 2023). The research results demonstrate the important role of digital transformation in the modern banking sector's strategy for long-term survival and resilience. This is in line with previous research by (Alojail & Khan, 2023; Li et al., 2022; Rehman Khan et al., 2022).

The research findings align with the Technology Acceptance Model (TAM) theory. The Technology Acceptance Model (TAM) is a model for companies to adopt new innovative solutions. The Technology Acceptance Model (Venkatesh & Davis, 2000) proposes that perceived usefulness and ease of use will influence customer acceptance of new technology, which directly influences behavioral intentions to use existing bank digital technology systems. Sustainable performance in banking is also influenced by digital transformation (Chen & Hao, 2022). The digital transformation adopted by banks can significantly impact effectiveness and also impact sustainable performance (Chen & Hao, 2022); (Jiyanova et al., 2023). By streamlining operations, banks can reduce resource usage, reduce carbon emissions, and waste, thereby improving sustainable performance (Huang et al., 2023); (Kaondera et al., 2023). Digital transformation enables banks to improve operational efficiency, reduce resource consumption, lower carbon footprints, and minimize waste, all of which contribute to improved sustainability performance (Zhang et al., 2023). Even banks that implement digital transformation to improve sustainability performance can attract and retain environmentally conscious customers (Park et al., 2023).

The Impact of Digital Transformation on Fintech Adoption

The analysis results show that Digital Transformation has a positive and significant effect

on Fintech Adoption. A significant positive effect means that the higher the implementation of digital transformation, the higher the level of financial technology adoption by organizations or individuals. Digital banking is the foundation of transformation that refers to the digitization of all activities (Nwoke, 2024). The shift to digital banking is due to the emergence of Fintech, which combines finance and technology (Serdarušić et al., 2024). The results of this study are in line with those of (Atikasari et al., 2025) and (Duong, 2023), which state that digital transformation has a direct and significant influence on increasing fintech adoption in the banking sector.
Financial technology is an innovation that emerged thanks to the limitless technological developments in today's digital era (Ahmed et al., 2024). The implementation of Fintech will increase banking competitiveness by reaching a wider market segment, thus making banking more inclusive for all levels of society (Dwivedi et al., 2021). Fintech has expanded financial inclusion, increasing access to financial services to a larger population, even in areas with limited or no traditional banking infrastructure (Yoshino & Kaji, 2020). The use of Fintech in this study is related to the Technology Acceptance Model (TAM) theory. This theory relates to perceived ease of use, perceived usefulness, and relative advantage, and influences various variables in consumer behavior and intentions (Venkatesh & Davis, 2000). With rising customer expectations and increasing competition from digital-first fintech companies, financial institutions must embrace digital transformation. Digital transformation is a change in the way work is handled using information technology to make it more effective and efficient (Danuri, 2019). Digital transformation plays a very significant role in driving fintech adoption. This transformation includes fundamental changes in digital infrastructure, ease of internet access, changes in consumer behavior, and rapid innovation in financial services.

Fintech Adoption Influences Sustainable Performance

The analysis shows that Fintech Adoption has a positive and significant impact on Sustainable Performance. This significant positive impact strengthens fintech adoption's position as a critical factor in supporting sustainable performance. Fintech adoption in the banking sector has the potential to not only improve financial performance but also contribute to sustainable development goals (Urumsah et al., 2022a). Sustainable performance in the banking sector involves maintaining high standards of governance and ethical behavior. By upholding strong governance principles, banks can build trust among stakeholders and mitigate reputational risk (Fang et al., 2023). The banking industry, as a vital part of the financial ecosystem, plays a crucial role in advancing sustainable development. To increase efficiency, improve risk management, and support decision-making, banks are increasingly adopting financial technology solutions (Moschella et al., 2019). Fintech integration in the banking sector has the potential to improve financial performance while advancing sustainability goals (Urumsah et al., 2022b). Integrating sustainability into competitive strategies allows banks to enhance their market position and reputation, attracting customers and investors who prioritize environmental responsibility.

The results of this study support the resource-based view (RBV) theory. The resource-based view (RBV) provides insight into Fintech adoption and banking sustainability. Information systems and digital capabilities are key assets in the banking sector (G. Gupta et al., 2018). Digital financial services will be leveraged as an advantage that ensures long-term success, in line with the core principles of the resource-based view (RBV) in utilizing resources for sustainable performance. The resource-based view (RBV) perspective integrates sustainability and customer value, suggesting that banking transformation can improve sustainability and customer satisfaction.

The research findings support (Rachmawati, 2024); (Urumsah et al., 2022a); (Yadav et al., 2022); (Nagy et al., 2018). (Shibin et al., 2020) also supports the findings of this study, which reveal how digital technology can drive sustainability. The implementation of fintech can also result in increased energy efficiency in bank operations (Lee et al., 2021). Several previous studies have demonstrated the impact of Fintech implementation in improving banking sustainability performance (Dwivedi et al., 2021); (Hidayat-ur-Rehman, 2024); (Siddik et al., 2023); (Bhuiyan & Islam, 2024). By utilizing Fintech solutions, banks can improve their sustainability performance (Moghadasnian & KheimeGard, 2024); (Hasan et al., 2024). Fintech empowers banks to integrate sustainability into their operations, deliver innovative products and services, and contribute to a more sustainable banking sector that supports economic growth, social welfare, and environmental protection.

Fintech Adoption mediates the relationship between Digital Transformation and Sustainable Performance

The analysis shows that Fintech Adoption can mediate the relationship between Digital Transformation and Sustainable Performance. This means that digital transformation will have a stronger impact on sustainable performance if mediated through increased adoption of financial technology. Today's growing business landscape demands that organizations prioritize sustainability to address environmental challenges. Implementing sustainable practices not only helps reduce environmental impact but also ensures regulatory compliance and aligns with increasing stakeholder expectations related to environmental responsibility (Ahn & Kim, 2019; Arulraj & Annamalai, 2020). The banking industry, as a vital part of the financial ecosystem, plays a crucial role in advancing sustainable development. To increase efficiency, improve risk management, and support decision-making, banks are increasingly adopting financial technology (Fintech) solutions (Moschella et al., 2019). Fintech integration in the banking sector has the potential to improve financial performance while aligning with sustainability goals (Urumsah et al., 2022).

The role of digital transformation between Fintech adoption and sustainable performance is related to digital technology where banks seek to improve operational efficiency, utilizing automation and artificial intelligence for informed decision-making (Chen & Hao, 2022; Yang et al., 2023). The research results are in line with (Sarfraz et al., 2022) which shows that fintech adoption can moderate the relationship between digital transformation and sustainable performance. The adoption of financial technology is not only seen as a technological improvement, but also as a transformative strategy related to customer engagement, risk management, and the provision of financial services (Harris (2021). These results are in line with (Rachmawati, 2024) Martínez-Pel aez et al. (2023) and Yan et al. (2022).

Sustainable performance in banking is increasingly dependent on Fintech. Fintech will assist banks in sustainability, offering innovative products and services aligned with environmental and social goals (Dwivedi et al., 2021); (Firmansyah et al., 2022); (Hidayat-ur-Rehman & Hossain, 2024). This integration is crucial for banks to achieve sustainable performance, enabling efficient resource management, financial inclusion, and ethical compliance. Fintech adoption will bridge the gap between sustainable performance and financial performance, enabling banks to implement digital innovation.

Financial Literacy moderates the influence of Digital Transformation on Fintech Adoption

The analysis results show that financial literacy can moderate the influence of digital transformation on fintech adoption. This can be explained by individuals with high financial literacy tend to be more selective in adopting new technologies. Fintech adoption, supported by financial literacy, is one strategy that allows companies to optimize their operations, improve customer experience, and remain competitive in a rapidly changing market (Siddik et al., 2023). Financial literacy, which includes the knowledge and skills for making financial decisions, plays a fundamental role in how companies understand and integrate digital transformation initiatives (F. Kurniasari et al., 2023). When companies adopt fintech, they will gain a competitive advantage, which is crucial in today's digital-driven economy (Hidayat-ur-Rehman, 2024). The relationship from digital transformation to sustainable performance is a long-term one and begins with a company's capacity to understand and utilize digital technology, which is strongly influenced by its level of financial literacy (Alojail & Khan, 2023) (Koskelainen et al., 2023). Digital transformation plays a crucial role in improving financial literacy (Nwoke, 2024). The relationship between financial literacy levels and propensity to use Fintech has been explored by, among others, (Morgan et al., 2019); (Yoshino & Kaji, 2020); (Hasan et al., 2024); (Barroso & Laborda, 2022). Fintech adoption, characterized by the integration of advanced technology into financial services, plays a crucial role in improving operational efficiency and service quality (Dwivedi et al., 2021; Firmansyah et al., 2022). Organizations with higher levels of Fintech literacy tend to experience stronger indirect effects of digital transformation on sustainable performance through Fintech adoption (Hidayat-ur-Rehman & Hossain, 2024).

CONCLUSION

Based on data analysis and discussion, the conclusion of this study is that digital transformation has a significant effect on Sustainable Performance, indicating that digital transformation has an impact on improving sustainable performance, although not as strong as other relationships. Digital transformation has a positive effect, indicating that the higher the implementation of digital transformation, the higher the level of adoption of financial technology by organizations or individuals. Fintech adoption has a positive effect, strengthening the position of fintech adoption as an important factor in supporting sustainable performance. In addition to the direct effect, this study also tested the mediation and moderation effects to understand the indirect relationship between variables. Digital transformation, fintech adoption on sustainable performance. This means that digital transformation will have a stronger impact on sustainable performance if mediated through increased adoption of financial technology. Digital transformation, financial literacy on fintech adoption. The results show a significant moderation effect. This can be explained that individuals with high financial literacy tend to be more selective in adopting new technology.

Suggestions for further research include expanding the study's scope and scope, for example, encompassing several Islamic banks in other major cities to obtain more generalizable results. Furthermore, new variables such as technological readiness, organizational culture, digital leadership, or trust in financial technology could be explored to enrich the research model and provide new insights.

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