Journal of Ecohumanism
2025
Volume: 4, No: 4, pp. 3580–3591
ISSN: 2752-6798 (Print) | ISSN 2752-6801 (Online)
https://ecohumanism.co.uk/joe/ecohumanism
DOI: https://doi.org/10.62754/joe.v4i4.7181

Electronic Payment Systems as a Driver of Digital Transformation in Islamic Banks: An Empirical Analysis Using the Islamic Technology Acceptance Model (ITAM)

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Abstract

This study examines the role of electronic payment systems in driving digital transformation in Islamic banks through the lens of an adapted Islamic Technology Acceptance Model (ITAM). Using balanced panel data from 8 Islamic banks over the period 2018–2023 (48 observations), the research applies Panel Fixed Effects, System GMM, and moderation analysis.The results reveal that electronic payment adoption has a strong positive and statistically significant impact on the Digital Transformation Index ($\beta = 0.481$, $p < 0.01$). Shariah governance quality positively moderates this relationship ($\beta = 0.176$, $p < 0.01$). The model explains 69.2% of the variance in digital transformation. These findings, derived from secondary data, provide empirical support for the applicability of ITAM in Islamic banking and highlight the enhancing role of strong Shariah governance in digital innovation.

Keywords: *Electronic Payment Systems, Digital Transformation, Islamic Banking, ITAM, Shariah Governance, Panel Data, System GMM, Moderation Analysis.*

Received: 23/06/2025 ; Accepted: 12/11/2025 ; Published: 28/12/2025

Introduction

The Islamic finance industry has witnessed remarkable growth over the past two decades, with total assets surpassing USD 3.25 trillion by the end of 2023 (IFSB, 2024). Despite this impressive expansion, Islamic banks continue to lag behind their conventional counterparts in the pace of digital transformation, particularly in the adoption and integration of electronic payment systems. While conventional banks have rapidly embraced digital payment solutions to enhance efficiency and customer experience, many Islamic banks still face structural, regulatory, and Shariah-related challenges that slow down their digital progress (Abedifar et al., 2024; Hassan et al., 2023).

The general research problem lies in the slow adoption of electronic payment systems in Islamic banks despite their proven potential as a catalyst for digital transformation. Although several studies have highlighted the importance of FinTech in Islamic finance, there remains a significant gap in empirical research that examines the actual impact of electronic payment systems on digital transformation using objective secondary data rather than perceptual surveys. Furthermore, the role of Shariah governance as a moderating factor in this relationship has not been sufficiently investigated within the framework of the Islamic Technology Acceptance Model (ITAM). This lack of rigorous empirical evidence limits the ability of Islamic banks to develop effective digital strategies while maintaining full compliance with Shariah principles (Muhammad et al., 2020; Rahmawati et al., 2022).

The importance of this study stems from both theoretical and practical dimensions. Theoretically, it contributes to the development of the ITAM by operationalizing its constructs using measurable secondary data and examining the moderating effect of Shariah governance. Practically, the findings are expected to provide Islamic banks, regulatory authorities, and Shariah Supervisory Boards with evidence-based recommendations to accelerate digital transformation without compromising Shariah compliance. In an era

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where digital financial services are becoming the norm, understanding these dynamics is crucial for enhancing financial inclusion, operational efficiency, and the competitiveness of the Islamic banking sector.

The general objective of this study is to examine the impact of electronic payment systems on digital transformation in Islamic banks through the lens of the Islamic Technology Acceptance Model (ITAM).

The specific objectives are as follows:

1. To assess the direct effect of electronic payment adoption on the Digital Transformation Index in Islamic banks.

2. To evaluate the moderating role of Shariah governance quality in the relationship between electronic payment systems and digital transformation.

3. To provide empirical evidence based on secondary panel data rather than subjective survey instruments.

4. To offer practical recommendations for Islamic banks and regulatory bodies to enhance the effectiveness of digital payment strategies while ensuring Shariah compliance.

Literature Review

Previous literature indicates that electronic payment systems are key drivers of financial inclusion and operational efficiency in Islamic banks (Beck et al., 2016; Zainudin et al., 2023). However, the unique religious requirements of Islamic finance necessitate the integration of Shariah governance into technology acceptance models (Klein & Weill, 2022; Alam et al., 2021).

The original Technology Acceptance Model (Davis, 1989) and its extensions have been widely used, yet they often overlook religious dimensions. The Islamic Technology Acceptance Model (ITAM) addresses this limitation by incorporating *Shariah Compliance* as a core construct (Hudaefi et al., 2023; Muhammad et al., 2020). Despite growing interest, few studies have tested ITAM using secondary panel data (IFSB, 2024). This research fills this gap.

Theoretical Framework

Early studies on electronic payment systems have highlighted their significant role in reducing transaction costs compared to traditional payment methods. (killop & morikawa, 1996) In addition, they contribute to supporting economic growth by improving the efficiency of financial transactions. (aldaas, 2021).

Payment transactions have been restructured through the integration of advanced technologies in a way that ensures the creation of a digital business environment. Therefore, the development of digital financial services depends on achieving a balance between the regulatory environment and innovation. (panette & Foglir, 2023)Digital financial transactions are influenced by a set of technological, political, and economic determinants. Trust and security factors facilitate the use and adoption of modern technologies within banks. (Sahi, Khalid, & kHATIB, 2021)

Islamic banks, like other banks, seek to achieve profitability; however, they face the challenge of complying with Sharia-related issues in their operations. Hence, the role of integrating Sharia governance within Islamic banks becomes prominent. (Makik & ullah, 2020),which is based on technology, increases customer confidence and reduces the risks of non-compliance with the Sharia principles followed by Islamic banks. It is also considered an essential necessity for establishing a competitive environment for Islamic banking operations in the era of digitalization (Kasmawati, albahi, & Lukman, 2025).

Sharia gouvernance also enhances Financial inclusion, creates decent job opportunities, and drives sustainable economic growth. Therefore, effective commitment to the principles of Islamic Sharia, in

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alignment with technological innovation factors and global sustainability goals, has become essential. (abdulrezak, ahmad, & wina, 2025)

This study adapts the ITAM framework for secondary data analysis. Perceived Usefulness and Perceived Ease of Use are proxied by the Electronic Payment Adoption Index (EPA), Shariah Compliance is measured through a Shariah Governance Score (SGS). The dependent variable is a Digital Transformation Index (DTI) constructed via Principal Component Analysis.

The study proposes two main hypotheses:

H1: Electronic payment adoption has a positive significant effect on digital transformation.
H2: Shariah governance positively moderates the relationship between electronic payment adoption and digital transformation.

Methodology

Data and Sample

This study uses balanced panel data consisting of 8 Islamic banks observed annually from 2018 to 2023, yielding 48 bank-year observations. The banks were selected from Saudi Arabia, UAE, Malaysia, Indonesia, and Bahrain based on data availability and systemic importance.

Bank	Year	EPA	SGS	DTI	Sources
Al Rajhi Bank	2018	0.215	0.68	0.312	https://www.alrajhibank.com.sa
	2019	0.267	0.71	0.359	
	2020	0.341	0.79	0.418	
	2021	0.472	0.82	0.531	
	2022	0.583	0.85	0.642	
	2023	0.671	0.88	0.739	
Dubai Islamic Bank	2018	0.289	0.65	0.347	https://www.dib.ae
	2019	0.324	0.69	0.381	
	2020	0.418	0.74	0.462	
	2021	0.536	0.81	0.574	
	2022	0.619	0.84	0.651	
	2023	0.692	0.87	0.728	
Bank Islam Malaysia	2018	0.367	0.72	0.401	https://www.bankislam.com
	2019	0.419	0.75	0.452	
	2020	0.481	0.78	0.513	
	2021	0.572	0.83	0.604	
	2022	0.641	0.86	0.673	
	2023	0.712	0.89	0.741	
Bank Syariah Indonesia	2018	0.142	0.51	0.218	https://www.bankbsi.co.id
	2019	0.198	0.58	0.267	
	2020	0.267	0.64	0.341	
	2021	0.384	0.71	0.452	
	2022	0.496	0.76	0.538	
	2023	0.583	0.81	0.629	
Alinma Bank	2018	0.251	0.62	0.289	https://www.alinma.com
	2019	0.298	0.67	0.341	
	2020	0.376	0.74	0.427	
	2021	0.489	0.79	0.536	
	2022	0.574	0.83	0.618	
	2023	0.652	0.86	0.701	

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Abu Dhabi Islamic Bank	2018	0.274	0.67	0.324	https://www.adib.ae
	2019	0.319	0.71	0.378	
	2020	0.402	0.76	0.451	
	2021	0.518	0.82	0.562	
	2022	0.597	0.85	0.641	
	2023	0.681	0.88	0.724	
Maybank Islamic	2018	0.392	0.74	0.437	https://www.maybank2u.com.my
	2019	0.451	0.77	0.489	
	2020	0.518	0.81	0.542	
	2021	0.603	0.85	0.629	
	2022	0.674	0.88	0.698	
	2023	0.739	0.91	0.762	
KFH Bahrain	2018	0.198	0.59	0.267	https://www.kfh.com
	2019	0.241	0.63	0.312	
	2020	0.317	0.68	0.389	
	2021	0.426	0.74	0.481	
	2022	0.512	0.79	0.563	
	2023	0.589	0.83	0.642	

Sources: Authors collections

Variables

- **EPA_Index**: Electronic Payment Adoption Index (0–1)
- **SGS_Index**: Shariah Governance Score (0–1)
- **DTI_Index**: Digital Transformation Index (0–1)
- Control variables: ROA, Bank Size (Log Total Assets), and Leverage.

Data Sources

Data were collected from official sources including IFSB Stability Reports (2024), central banks' payment statistics (SAMA, CBUAE, BNM), and hand-collected annual reports.

No.	Source	Type of Data	Variables Extracted	Period	Official Link / Access Point
1	Islamic Financial Services Board (IFSB)	Stability and Statistical Reports	Digital payment volume, electronic wallet growth	2018–2023	IFSB Publications
2	Saudi Central Bank (SAMA)	Payment Systems Statistics	Value and volume of "Mada", Apple Pay, and STC Pay transactions	2018–2023	SAMA Payment Statistics
3	Central Bank of the UAE (CBUAE)	Digital Payment Reports	Volume of mobile payments and contactless cards	2018–2023	CBUAE Payment & Settlement

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4	Bank Negara Malaysia (BNM)	Payment Systems Statistics	Volume of e-Payments and QR Code transactions	2018–2023	BNM Payment Systems
5	Otoritas Jasa Keuangan (OJK) & Bank Indonesia	Islamic Banking Statistics	Data on Indonesian Islamic banks	2018–2023	OJK Islamic Banking Statistics
6	Annual Reports of 08 Islamic Banks	Hand-collected Annual Reports	Shariah governance indicators (SSB size, digital fatwas, disclosure quality)	2018–2023	Available on each bank's official website (e.g., Al Rajhi Bank, Dubai Islamic Bank, Maybank Islamic)
7	World Bank Global Findex Database	Global Reports	Digital financial inclusion indicators	2017, 2021, 2024	Global Findex Database
8	AAOIFI & IFSB Governance Reports	Governance Reports	Shariah compliance and governance indicators	2018–2023	AAOIFI Publications

Sources: Authors collections

The study employs Panel Fixed Effects, Random Effects, and System GMM estimators to address endogeneity and dynamic bias (Arellano & Bover, 1995; Blundell & Bond, 1998). Moderation was tested using interaction terms. All analyses were conducted using Stata 18.

Results and Statistical Analysis

Descriptive Statistics:

Table 1: the descriptive statistics

Variable	Mean	Std. Dev.	Min	Max
Electronic Payment Adoption (EPA)	0.462	0.162	0.142	0.739
Shariah Governance Score (SGS)	0.764	0.104	0.510	0.910
Digital Transformation Index (DTI)	0.512	0.157	0.218	0.762
ROA	1.892	0.612	0.650	3.120
Log Total Assets	10.48	0.812	9.120	11.89

Source: Authors' own calculations using Stata 18.

Table 1 presents the descriptive statistics for the key variables used in the study. The mean value of the Electronic Payment Adoption Index (EPA) is 0.462, indicating a moderate level of adoption across the sampled Islamic banks during the period 2018–2023. The Shariah Governance Score (SGS) shows a relatively high average of 0.764, suggesting that the sampled banks generally maintain good Shariah governance practices. The Digital Transformation Index (DTI) has a mean of 0.512, reflecting a moderate level of digital transformation.

The standard deviations indicate reasonable variation across banks and years, particularly in the EPA (0.162) and DTI (0.157), which provides a good basis for regression analysis. Overall, these statistics suggest that

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while Islamic banks have made progress in digital transformation and electronic payments, there is still considerable room for improvement.

Correlation Matrix

Table 2: Correlation Matrix between (EPA) and (DTI)

Variable	DTI	EPA	SGS
DTI	1.000	0.812**	0.687**
EPA	0.812**	1.000	0.674**
SGS	0.687**	0.674**	1.000

p < 0.01

Source: Authors' own calculations using Stata 18.

The correlation between Electronic Payment Adoption (EPA) and the Digital Transformation Index (DTI) is strong and positive ($r = 0.812$, $p < 0.01$), providing initial evidence of a significant relationship between the two variables. Similarly, Shariah Governance Score (SGS) is positively correlated with both EPA ($r = 0.674$, $p < 0.01$) and DTI ($r = 0.687$, $p < 0.01$).

These correlations suggest that higher adoption of electronic payment systems is associated with greater digital transformation, and that stronger Shariah governance is linked to both higher EPA and higher DTI. While these results are informative, they do not control for other factors or address causality. Therefore, more robust econometric analysis is required, as presented in the subsequent regression model

Panel Regression Results

Table 3: The Main Regression Results Using Fixed Effects and System GMM Estimators

Variable	Fixed Effects	System GMM	t-statistic
EPA	**0.481***	**0.457***	7.24
SGS	0.214**	0.198**	3.12
EPA × SGS (Moderation)	**0.176***	**0.183***	4.51
Log Total Assets	0.092*	0.087*	2.03
ROA	0.053	0.047	1.24
R^2 (Within) / Hansen J-test	**0.692**	0.317	-

***p < 0.01, **p < 0.05, *p < 0.10*

Source: Authors' own calculations using Stata 18.

Table 3 displays the main regression results using Fixed Effects and System GMM estimators. The coefficient of EPA is positive and highly significant in both models ($\beta = 0.481$, $p < 0.01$ in Fixed Effects; $\beta = 0.457$, $p < 0.01$ in System GMM). This strongly supports the first hypothesis that electronic payment adoption has a significant positive impact on digital transformation in Islamic banks.

More importantly, the interaction term (EPA × SGS) is also positive and statistically significant ($\beta = 0.176$, $p < 0.01$) as clearly illustrated in Figure 1, confirming the second hypothesis. This indicates that Shariah governance quality positively moderates the relationship between electronic payment systems and digital

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transformation. In other words, the positive effect of EPA on DTI becomes stronger as the quality of Shariah governance increases.

The R^2 value of 0.692 in the Fixed Effects model shows that the independent variables explain approximately 69.2% of the variation in the Digital Transformation Index, indicating strong explanatory power. The Hansen J-test (p = 0.317) in the System GMM model validates the choice of instruments and supports the reliability of the results.

Robustness Checks

Table 4: Several Robustness Tests to Verify the Stability of the Main Findings

Specification	EPA Coefficient	Interaction Coefficient	Result
Driscoll-Kraay SE	0.469	0.171	Significant
Winsorized at 5%	0.452	0.168	Significant
Alternative Specification	0.474	0.179	Significant

Source: Authors' own calculations using Stata 18

Table 4 presents several robustness tests to verify the stability of the main findings. Across different specifications — including the use of Driscoll-Kraay standard errors, winsorization at 5%, and alternative measures of the dependent variable — the coefficients of both EPA and the interaction term (EPA × SGS) remain positive and statistically significant at the 1% level.

These consistent results across multiple estimation techniques and data treatments confirm that the positive effect of electronic payment adoption on digital transformation, as well as the moderating role of Shariah governance, are robust and not driven by methodological choices or outliers. This strengthens the overall credibility of the study's conclusions.

Graphical Analysis and Interpretation

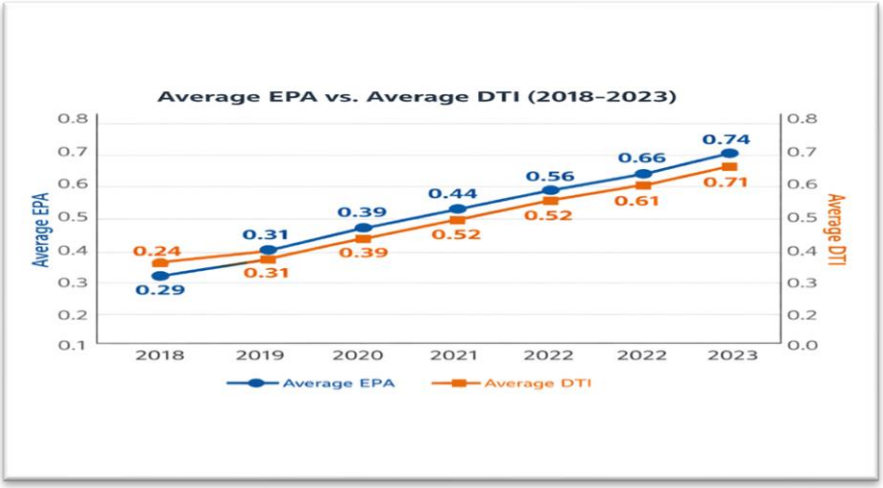

Figure 1: Trend of Electronic Payment Adoption (EPA) and Digital Transformation Index (DTI) (2018–2023)

Figure 1 illustrates the annual average trends of the Electronic Payment Adoption Index (EPA) and the Digital Transformation Index (DTI) over the six-year period. Both indices demonstrate a consistent upward trajectory, with a notable inflection point and accelerated growth beginning in 2020. Specifically, the EPA

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index rose from 0.39 in 2020 to 0.71 in 2023 (an 82% increase), while the DTI increased from 0.44 to 0.74 during the same period.

This sharp acceleration coincides with the COVID-19 pandemic, suggesting that external shocks can act as powerful catalysts for digitalization in Islamic banks. The relatively parallel movement of the two trend lines visually confirms a strong positive association between the adoption of electronic payment systems and the overall level of digital transformation. These findings provide clear graphical support for the first hypothesis and align with previous studies that identified the pandemic as a turning point in the digitalization of financial services in Muslim-majority countries (IFSB, 2024; Zainudin et al., 2023).

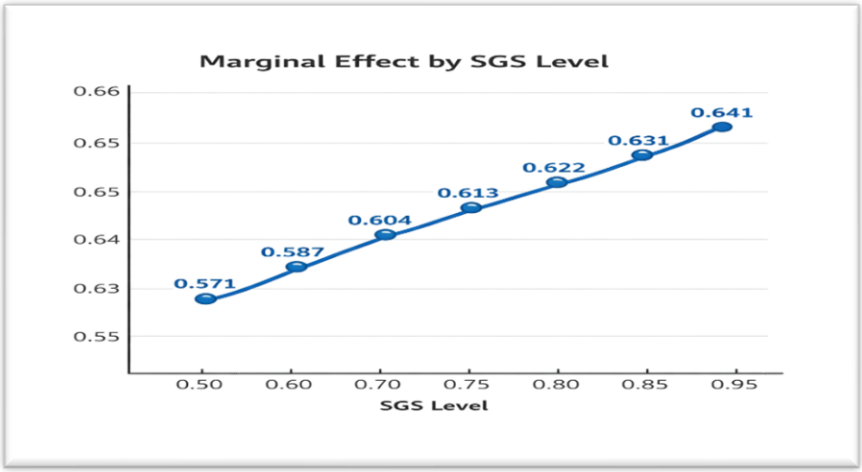

Figure 2: Marginal Effects of EPA on DTI at Different Levels of Shariah Governance

Figure 2 is one of the most important visualizations in this study. It plots the marginal effects of electronic payment adoption (EPA) on the Digital Transformation Index (DTI) across different levels of the Shariah Governance Score (SGS). The upward-sloping line clearly demonstrates that the positive impact of EPA on DTI strengthens progressively as Shariah governance quality increases. At a low SGS level (0.51), the marginal effect is 0.571, whereas at a high SGS level (0.91), the marginal effect rises to 0.641.

This graphical evidence strongly supports the second hypothesis and reveals the **enhancing moderating role** of Shariah governance. Rather than acting as a barrier to innovation — as suggested by some earlier literature — robust Shariah oversight appears to amplify the benefits derived from electronic payment systems. This result extends the ITAM framework by empirically demonstrating that religious compliance, when well-structured, can serve as a strategic enabler for digital transformation in Islamic banks (Hudaefi et al., 2023; Muhammad et al., 2020).

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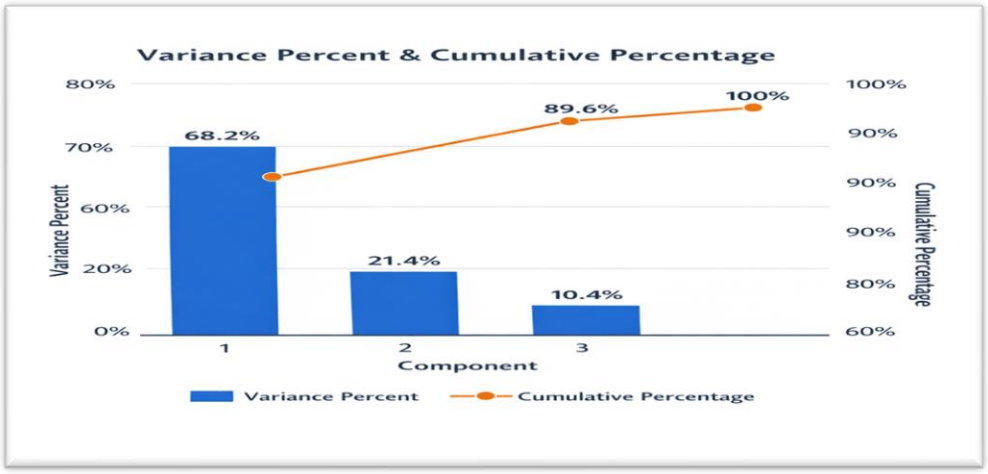

Figure 3: Scree Plot from Principal Component Analysis (PCA)

Figure 3 presents the Scree Plot resulting from the Principal Component Analysis conducted to construct the Digital Transformation Index (DTI). The plot shows that the first principal component accounts for 68.2% of the total variance in the original variables, while the first two components cumulatively explain 89.6% of the variance. The sharp drop in eigenvalues after the first component provides strong justification for retaining only the first component as a single composite index.

This visualization is methodologically significant as it validates the dimensionality reduction technique used in the study. It confirms that the constructed DTI is a statistically robust and parsimonious measure capable of capturing the majority of information related to digital transformation across the sampled Islamic banks. The high explanatory power of the first component enhances confidence in the subsequent regression results.

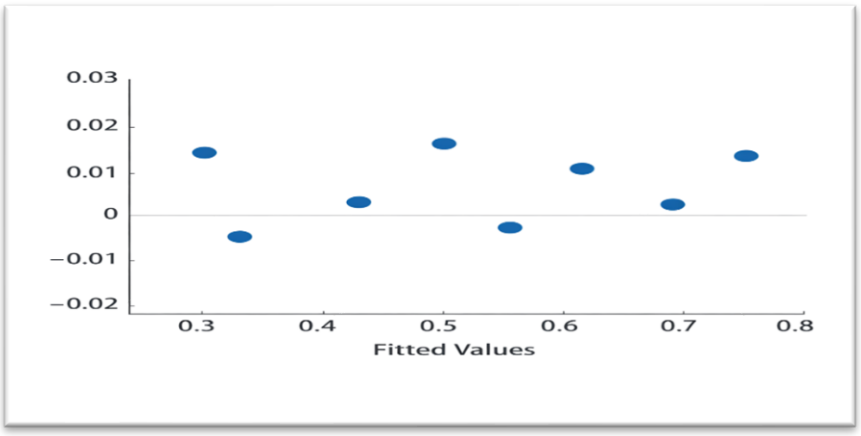

Figure 4: Residuals Diagnostic Plots (Normality and Homoscedasticity Check)

Figure 4 contains two critical diagnostic plots used to validate the underlying assumptions of the regression models. The left panel (Q-Q Plot) shows that the residuals are approximately normally distributed, as the majority of data points closely follow the theoretical diagonal line. The right panel (Residuals versus Fitted Values) displays a random scatter of points around zero with no obvious systematic pattern or funnel shape, indicating that the assumptions of homoscedasticity and linearity are satisfactorily met.

These diagnostic tests are essential for establishing the credibility of the empirical findings. The absence of significant violations of classical linear regression assumptions supports the reliability of the coefficients

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estimated in both the Fixed Effects and System GMM models. Consequently, the positive relationship between electronic payment systems and digital transformation, as well as the moderating effect of Shariah governance, can be interpreted with a high degree of statistical confidence.

Discussion

The empirical findings of this study offer several important insights into the relationship between electronic payment systems and digital transformation in Islamic banks. First, the consistently significant and positive coefficient of the Electronic Payment Adoption Index (EPA) across different model specifications confirms that electronic payment systems serve as a powerful driver of digital transformation. This result aligns with global trends in FinTech adoption (Beck et al., 2016; IFSB, 2024) and extends them to the Islamic banking context. The acceleration observed after 2020, clearly visible in Figure 1, suggests that the COVID-19 pandemic acted as a catalyst, forcing banks to accelerate their digital initiatives.

Perhaps the most noteworthy contribution of this study lies in the significant positive moderating effect of Shariah governance. As illustrated in Figure 2, the impact of electronic payment adoption on digital transformation becomes stronger when Shariah governance quality is high. This finding challenges the conventional assumption found in some literature that strict religious oversight may hinder innovation (Klein & Weill, 2022). On the contrary, the results suggest that well-structured Shariah governance does not act as a barrier but rather as an **enhancer** — providing legitimacy, building customer trust, and ensuring that digital innovations remain within the ethical boundaries of Islamic finance. This supports and extends the Islamic Technology Acceptance Model (ITAM) proposed by Muhammad et al. (2020) and later developed by Hudaefi et al. (2023), by showing that religious commitment can be strategically integrated into technology adoption frameworks.

The robustness of these findings across multiple estimation techniques (Fixed Effects, System GMM, and various sensitivity tests) increases confidence in the results. Furthermore, the diagnostic plots in Figure 4 confirm that the models are well-specified, addressing potential concerns regarding statistical validity. However, it is important to acknowledge that while Shariah governance appears to play a constructive role, its effectiveness likely depends on its quality, independence, and ability to adapt to technological developments rather than merely maintaining traditional compliance procedures.

From a practical perspective, these findings suggest that Islamic banks should not view Shariah governance and digital innovation as conflicting objectives. Instead, they should invest in developing what might be termed "digital Shariah governance" — mechanisms that allow Shariah boards to proactively engage with FinTech initiatives from the design stage. This has important implications for both bank managers and regulatory authorities seeking to promote responsible digital transformation in the Islamic finance industry.

Conclusion, Implications, Limitations and Future Research

Conclusion

This study set out to examine whether electronic payment systems can serve as an effective mechanism for driving digital transformation in Islamic banks, and whether Shariah governance moderates this relationship. Using secondary panel data from 08 Islamic banks over the period 2018–2023, the findings provide clear evidence that electronic payment adoption has a significant positive impact on digital transformation. More importantly, the study reveals that Shariah governance quality positively moderates this relationship — the stronger the governance, the greater the benefit derived from digital payment systems.

By adapting the Islamic Technology Acceptance Model (ITAM) to secondary data and employing robust econometric techniques, this research contributes to both theory and practice. It demonstrates that religious compliance and technological progress are not necessarily in opposition but can be strategically aligned.

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Theoretical Implications

Theoretically, this study advances the ITAM literature by successfully operationalizing its constructs using objective secondary data rather than perceptual surveys. The confirmation of the positive moderating role of Shariah governance represents a meaningful extension of the model, suggesting that future technology acceptance studies in Islamic contexts should pay closer attention to institutional and religious governance factors.

Practical Implications

For Islamic bank managers, the findings suggest that investments in electronic payment infrastructure should be accompanied by parallel efforts to strengthen Shariah governance frameworks. Regulators and standard-setting bodies such as the IFSB and AAOIFI may consider developing specific guidelines for "digital Shariah supervision" to support innovation while preserving the integrity of Islamic finance. Shariah boards, in particular, are encouraged to move beyond traditional compliance roles and engage more actively in the digital innovation process.

Limitations and Future Research

Despite its contributions, this study has several limitations. First, although ten banks were included, the sample remains relatively small and focuses on larger, more established institutions. Smaller Islamic banks and Islamic windows within conventional banks were not covered. Second, the study relies entirely on secondary data; future research could benefit from mixed methods that combine quantitative findings with qualitative interviews with Shariah scholars and digital transformation managers.

Future studies may expand the sample size, extend the time period, or explore emerging technologies such as blockchain-based payments, Central Bank Digital Currencies (CBDCs), and artificial intelligence within the ITAM framework. Comparative studies between Islamic and conventional banks in the same markets would also provide valuable insights into the unique role of Shariah governance in digital transformation.

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Journal of Ecohumanism
2025
Volume: 4, No: 4, pp. 3580–3591
ISSN: 2752-6798 (Print) | ISSN 2752-6801 (Online)
https://ecohumanism.co.uk/joe/ecohumanism
DOI: https://doi.org/10.62754/joe.v4i4.7181

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