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Risk Management in Islamic Banking: The Impact of Financial Technologies through Empirical Insights from the UAE

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Abstract: Financial technology (fintech) innovations are transforming banking globally. Their adoption poses new opportunities and risks for Islamic banks with unique requirements. This study examines fintech's implications for risk management effectiveness in United Arab Emirates Islamic banks. A conceptual model incorporates factors like fintech adoption, emerging capabilities, digital maturity, and IT security influencing outcomes. Primary data were collected via survey from nine UAE Islamic banks and analyzed using PLS-SEM. Results show that fintech adoption and capabilities positively impacted effectiveness, while digital transformation alone did not. The findings also show that the regulatory environment did not moderate relationships as hypothesized. The findings provide empirical evidence on optimizing risk management through responsible fintech enablement and oversight alignment in the UAE context.

Keywords: fintech; Islamic banking; risk management; UAE; digital transformation; regulatory environment; PLS-SEM



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1. Introduction

Financial technology (fintech) innovations are transforming the global financial services landscape. Emerging technologies like artificial intelligence, blockchain, big data analytics, and robotic process automation create new opportunities and challenges for banks (Saiti et al. 2020). While offering potential efficiency gains, fintech introduces new risks, such as cybersecurity, model reliability, and regulation. This dynamic is particularly salient for Islamic banks given their unique risk management requirements arising from profit-and-loss sharing models, sharia compliance, and ethical financing goals (Ahmed 2019a, 2019b).

This research examines the implications of increasing fintech adoption for risk management effectiveness in Islamic banks in the United Arab Emirates (UAE). As pioneers in digital transformation initiatives in the Middle East, the UAE provides a relevant context to study the nexus between technological innovations and prudent risk management in Islamic banking (Farooq and El Alaoui 2020b).

While fintech innovations offer benefits, previous research has identified challenges in leveraging these tools to improve risk management outcomes in Islamic banks. Concerns have been raised around data privacy, the interpretation of sharia contracts, and model reliability (Laldin et al. 2021b; Kabir and Worthington 2017). However, empirical assessments of the impact of fintech on core risk management functions remain limited. It underlines

the research problem of understanding how emerging technologies can be leveraged to strengthen risk management capabilities in Islamic banks.

Given the country's focus on developing its fintech ecosystem and Islamic financial sectors, the UAE offers an attractive setting for this study. Government policies for the transition to a digital economy and the central bank's progressive regulatory environment set the UAE apart from other countries in facilitating the adoption of financial technologies (Siddique 2021). The UAE is also home to many leading Islamic financial institutions well positioned to integrate fintech.

Using the partial-least-squares methodology as well as the Smart-PLS software and applying the survey tool with 300 surveys to three types of financial entities based on their size, small, medium, and large, the study evaluates the impact of fintech solutions on the capabilities of UAE Islamic banks to identify, measure, monitor, control, and report critical risks. The research model incorporates direct causal relationships between fintech adoption, emerging capabilities, digital maturity, and IT security as critical factors influencing risk management outcomes, as well as indirect causal relationships modulating the regulatory environment of the United Arab Emirates on direct causal relationships. Thus, the model contrasts the influence of fintech adoption, emerging capabilities, digital maturity, and IT security on risk management results.

The literature review indicates significant research interest in fintech adoption in Islamic banks. However, assessments of the impact of implemented fintech solutions on the effectiveness of core risk management remain scarce. This study is interesting for readers and researchers since it provides new results on the adoption of fintech in the scarce literature in Islamic countries. Previous studies predominantly focused on perceived benefits, potential risks and challenges, and proposed conceptual frameworks. Therefore, it is considered necessary that empirical research examining the influence of fintech on risk management capabilities can provide valuable and timely insights for academics and policymakers. The proposed study addresses this knowledge gap by surveying UAE Islamic banks on critical aspects of fintech adoption, risk management processes and the regulatory environment. The findings can guide policies to optimize technological innovations to strengthen prudential risk management while meeting the regulatory, ethical, and profit-loss sharing requirements unique to Islamic finance.

The findings provide insights into how to optimize risk management through fintech adoption while ensuring sharia compliance and ethics. This adoption has implications for fintech regulations in Islamic finance (Siddique 2021). The research aims to guide the effective integration of the fintech promise with the risk management imperative.

2. Literature Review

Financial technology (fintech) innovations are transforming business models and operations in the banking sector globally. Emerging technologies like artificial intelligence, big data analytics, blockchain, robotics, and biometrics create new opportunities and risks for financial institutions (Saiti et al. 2020). The unique risk and compliance requirements of Islamic banking add further complexity when adopting new fintech solutions (Ahmed 2019a). Therefore, research interest has grown around understanding the nexus between fintech adoption and risk management outcomes in Islamic banking.

Several studies have assessed the state of fintech development, its benefits, and associated risks and challenges Islamic banks face. Rahman (2019) noted that while Islamic banks lag in technology adoption compared to conventional banks, they recognize the value fintech innovations can provide in improving services, reducing costs, and managing risks. However, concerns around fintech's potential to undermine the profit-and-loss sharing principles and equitable risk distribution mandate of Islamic finance were raised.

Other studies found that Islamic banks face data limitations in implementing cutting-edge technologies like machine learning. Kabir and Worthington (2017) highlighted the scarcity of standardized benchmark data specific to Islamic finance as a critical obstacle.

Warsame and Ileri (2018) pointed out the difficulties in automating back-office screening of contracts for sharia compliance.

Several conceptual frameworks have been proposed on how Islamic banks can effectively leverage fintech for risk management. Ahmed (2019a) presented an integrated model emphasizing governance mechanisms to balance digitization with maqasid al-shariah (Islamic law's objectives). Miah and Uddin (2021) recommended the OECD fintech risk management framework be customized for Islamic banks by incorporating dimensions of sharia governance.

A recent study by Abu-Alkheil et al. (2017) surveyed Islamic banks in Saudi Arabia and found that an excellent implementation of AI and big data analytics was associated with improved risk profiling of financing products. It points to the value of fintech adoption in enhancing risk management capabilities.

Empirical assessments of fintech adoption on core risk management outcomes have been limited. An exception is Boussaoud (2019a), who found that Islamic banks with a higher use of fintech innovations had improved risk identification and reporting capabilities. Laldin et al. (2021b) provided a case study indicating how Malaysian Islamic banks used automation to strengthen sharia compliance in operational risk management.

Much of the existing research on fintech in Islamic banking has focused on countries like Malaysia, Bahrain, and Bangladesh. There has been relatively less empirical investigation in the context of the UAE, despite its leadership in promoting the fintech and Islamic finance sectors. This research addresses this gap by examining fintech adoption within UAE Islamic banks.

While conceptual models have mapped the potential of fintech to transform risk management in Islamic banks, empirical assessments of whether these benefits have translated into practice remain limited. Most prior studies are either descriptive or based on industry experts' perceptions rather than complex data from Islamic banks that have adopted fintech solutions. It highlights the need for quantitative, empirical research to evaluate the effect of increasing fintech adoption on core risk management capabilities and processes. The survey-based approach of this study to gather data from UAE Islamic banks aims to provide much-needed empirical evidence on the interrelationships between fintech, risk management effectiveness, and other organizational factors.

The literature on fintech adoption in Islamic banking reveals an overall positive tone regarding the potential benefits but also highlights some risks and challenges that require mitigation. While most studies perceive that emerging technologies can strengthen data analytics, process automation, customer service, and risk management capabilities, empirical evidence on realized outcomes remains limited (Ahmed 2019b; Rahman 2019).

There are contradictions between the predominantly optimistic tone regarding fintech's promise and studies that found Islamic banks lagging in adoption and facing data limitations (Kabir and Worthington 2017; Warsame and Ileri 2018). Potential explanations could be a lack of specialized Islamic fintech solutions, insufficient digital maturity within banks, or cultural inertia. More research is needed to clarify these discrepancies.

Broadly, though, there appears to be an agreement that Islamic banks can derive significant advantages from the mindful adoption of fintech, provided its alignment with religious principles and ethics. Scholars recommend developing governance frameworks and specialized capabilities (Laldin et al. 2021b; Saiti et al. 2020).

Given its focus on developing both sectors, the UAE provides a compelling setting to examine fintech-risk management dynamics in Islamic banking. The country's intelligent government initiatives, tech-savvy population, and progressive regulatory environment distinguish it from other Middle Eastern countries and make it conducive to fintech growth (Farooq and El Alaoui 2020b; Siddique 2021).

Abu Hussain and Al-Ajmi (2012) address risk management in the banking sector, with a focus on conventional and Islamic institutions, and examine risk management practices in conventional and Islamic banks in Bahrain, highlighting the differences between the two systems. Al Rahahleh et al. (2019) provide a review of advances in risk management in

Islamic finance, highlighting the evolution and challenges in this area. Finally, Khan et al. (2023) investigate the determinants of nonperforming loans in conventional and Islamic banks, providing evidence from emerging markets. These studies provide a comprehensive perspective on risk management in financial institutions, exploring both specific practices and determinants of loan performance in conventional and Islamic contexts.

UAE regulators like the central bank have taken a collaborative “test and learn” approach to fintech, using regulatory sandboxes and innovation labs (Siddique 2021). Such policies appear aligned with recommendations for participative strategies for Islamic fintech (Warsame and Ileri 2016). Nevertheless, research focused exclusively on UAE Islamic banks is limited despite their significant presence. This study addresses this context-specific gap.

Studies have also examined the optimal strategic approach for Islamic banks in embracing fintech innovations. Warsame and Ileri (2016) proposed the “participation and engagement strategy”, where Islamic banks actively collaborate with fintech firms during technology development and validation stages to address sharia-compliance considerations proactively. Saiti et al. (2020) emphasized developing specialized skill sets within Islamic banks to adapt generic fintech solutions to their unique needs.

Further research was recommended on fintech’s implications on financial stability and systemic risks in Islamic banking (Kabir and Worthington 2017; Smolo and Hassan 2021). The critical role of regulatory oversight and governance mechanisms for emerging technologies was also highlighted (Farooq and El Alaoui 2020b; Siddique 2021).

3. Hypothesis Development

The UAE has focused on developing its fintech ecosystem and boasts high technology adoption rates (Farooq and El Alaoui 2020b). Prior studies show that the increased use of emerging technologies improves global risk management capabilities in Islamic banks (Boussaoud 2019a; Laldin et al. 2021b). In the Gulf region, greater fintech adoption has been linked to better risk identification, measurement, and reporting (Rahman 2019). Islamic banks in the UAE aiming to become more digitally driven recognize the need to develop enhanced capabilities in data analytics, automation, customer engagement, and forecasting enabled by fintech solutions (Saiti et al. 2020). Studies on the region highlight how more potent data analytics abilities lead to a better credit risk assessment (Hassan et al. 2019a), and increased automation improves regulatory compliance (Warsame and Ileri 2018). Therefore, it is hypothesized that greater fintech adoption and improved fintech capabilities will positively impact risk management effectiveness in Islamic banks in the UAE. Accordingly, based on this rationale, we propose the first hypothesis:

H1. *Greater fintech adoption is positively associated with risk management effectiveness in Islamic banks in the UAE.*

Islamic banks in the UAE are focused on developing capabilities in data analytics, automation, customer engagement, and forecasting, which are enabled by adopting new fintech solutions (Saiti et al. 2020). Studies have found that enhanced data analytics capabilities enabled by AI and big data can improve risk profiling, monitoring, and reporting (Rahman 2019; Hassan et al. 2019b). For example, machine learning algorithms can analyze customer data to identify potential credit risks. Similarly, increased automation of processes through fintech innovations like smart contracts and robotic process automation can reduce operational risks and improve regulatory compliance in Islamic banks (Warsame and Ileri 2018; Laldin et al. 2021b). By adopting fintech solutions for customer engagement, like digital channels and self-service options, Islamic banks in the UAE can also gain better visibility into customer behaviors and needs relevant to risk management (Farooq and El Alaoui 2020b). Developing such emerging capabilities through targeted fintech adoption can enhance risk management effectiveness in Islamic banks in the UAE. Given these insights, we hypothesize that:

H2. *Improved fintech capabilities positively influence risk management outcomes in Islamic banks in the UAE.*

While conceptual models highlight that emerging technologies can potentially transform global risk management in Islamic banks, empirical evidence remains limited (Ahmed 2019b; Miah and Uddin 2021). In the UAE context, Islamic banks vary in their digital maturity levels despite government mandates for digital transformation (Rahman 2019). Upgraded IT systems, digitally skilled talent, and organizational readiness are vital enablers for fintech success in adopting fintech for risk management in the country (Siddique 2021). It leads us to hypothesize H3:

H3. *Higher levels of digital transformation maturity enable better risk management through fintech adoption in Islamic banks in the UAE.*

Studies focused on the UAE banking sector have underlined the critical importance of cybersecurity policies and robust IT safeguards when increasing dependence on technology through fintech adoption (Farooq and El Alaoui 2020b; Siddique 2021). Thus, it is hypothesized that strong IT security capabilities will positively moderate the impact of greater fintech adoption on risk management outcomes in Islamic banks in the UAE. Therefore, we hypothesize the following:

H4. *Advanced IT security capabilities positively influence risk management effectiveness throughout the fintech adoption in Islamic banks in the UAE.*

The UAE has taken a collaborative “test and learn” approach to fintech regulation using regulatory sandboxes (Siddique 2021). Such policies are believed to aid Islamic banks in adopting fintech more effectively for risk management. The UAE government has created innovation offices, incubators, and accelerators to promote fintech growth in a controlled environment.

For example, the Abu Dhabi Global Market (ADGM) established a regulatory framework covering crypto assets and digital securities to encourage fintech innovation (ADGM 2018). The ADGM Digital Lab allows fintech companies to develop solutions and collaborate with regulators on appropriate governance mechanisms before full launch (ADGM 2022).

The Dubai International Financial Center (DIFC) also introduced an innovation testing license for fintech firms to operate on a limited scale under supervised conditions. The DIFC FinTech Hive accelerator further promotes access to regulators and advisors to shape beneficial fintech regulations (DIFC).

Such proactive regulatory efforts create a tailored environment for fintech in UAE Islamic banking. They provide appropriate standards and oversight mechanisms guiding the adoption of emerging technologies. That environment is believed to enable Islamic banks to implement fintech more effectively for risk management. Considering this facilitative regulatory approach for fintech in the UAE, we posit the following hypothesis:

H5. *A supportive regulatory environment for fintech in the UAE strengthens the positive impact of fintech adoption on risk management in Islamic banks.*

4. Methodology

This study employed a quantitative research design using a survey questionnaire to collect primary data. This approach is suitable given the objectives of assessing relationships between variables and gathering factual information from key informants.

4.1. Population and Sampling

The target population comprised all full-fledged Islamic banks licensed and operating in the UAE. According to the latest data from the central bank, there were 9 Islamic

banks in the country. The sampling frame included the banks listed on the central bank website implementing fintech solutions in the past five years. A stratified random sampling technique selected all nine banks, proportionately representing large, medium, and small institutions based on assets under management. Within each selected bank, the target respondents were midlevel managers and above from key departments dealing with risk management, compliance, IT, and digital banking initiatives. A sample of 300 respondents was invited to participate in an online survey to ensure adequate responses for statistical analysis based on the popular sample size formulae. Table 1 shows the classification and distribution of respondents across Islamic banks in the UAE.

Table 1. Classification and estimated sample size by individual Islamic banks in the UAE.

| Bank Name and Classification | No. of Distributed Questionnaires |
|------------------------------|-----------------------------------|
| Large | |
| Abu Dhabi Islamic Bank | 40 |
| Dubai Islamic Bank | 40 |
| Al-Hilal Islamic bank | 40 |
| Sharjah Islamic Bank | 40 |
| Emirates Islamic Bank | 40 |
| Medium | |
| Ajman Bank | 30 |
| First Abu Dhabi Bank | 30 |
| Small | |
| AJIB Bank | 20 |
| Mashreq Bank | 20 |
| Total | 300 |

This table assigns a fixed estimated sample size for each bank based on its total employee population to aim for representation. The actual sample obtained may vary slightly. The total sample targeted across all banks remained 300 respondents.

Primary data were collected using a self-administered online questionnaire. The questionnaire was developed based on validated scales adapted from prior literature. It was pilot-tested on a small sample before full deployment to ensure clarity, wording, and flow. Reminder emails were sent two weeks after initial contact to boost response rates.

4.2. Measurement

Items measured constructs on 5-point Likert scales ranging from strongly disagree (1) to agree (5) strongly. Fintech adoption assessed the degree/depth of implementing various solutions. Capabilities reflected banks' skills enabled by fintech. Risk management effectiveness covered vital processes. Moderating variables used Likert and multiple-choice items. The following are the statements that were used to measure the study variables (Table 2).

4.3. Data Analysis

Data were analyzed using partial-least-squares structural equation modelling (PLS-SEM) through SmartPLS 3 software. It allows the assessment of measurement models and structural path modeling together. Descriptive statistics summarized profiles and variables. Inner VIF values and outer loadings prevented collinearity/discriminant validity issues. Bootstrapping determined the significance of paths to test hypotheses.

Table 2. Observed and latent variable.

| Type of Variable | Groups of Variables | Variables |
|-----------------------|---------------------------------|---|
| Independent variables | Fintech adoption | Our bank has adopted AI and machine learning tools for process automation. (Hassan et al. 2019b) Our bank utilizes blockchain technology in operations and transactions. (Laldin et al. 2021a) Our bank leverages big data analytics for customer insights. Our bank has adopted fintech solutions aligned with UAE intelligent government initiatives. Our bank follows guidance from the UAE central bank on emerging fintech like cryptocurrencies and blockchain. |
| | Fintech capabilities | Fintech has enhanced our bank's data analytics capabilities. (Rahman 2019) Fintech has improved our forecasting and predictive modeling capabilities. (Warsame and Ireri 2016) Fintech has increased our ability to automate manual processes. (Warsame and Ireri 2018) Fintech has upgraded our bank's cybersecurity and access control capabilities. (Siddique 2021) Fintech strengthens our bank's ability to engage digitally savvy customers in the UAE. Fintech helps our bank leverage the UAE's advanced telecom infrastructure for digital banking. |
| | Digital transformation maturity | Our bank has digitized vital business processes. Our bank has upgraded its technology infrastructure. Our bank has built capabilities to manage digital transformations. Our bank's employees have the digital skills to leverage new technologies. Our bank's leadership actively supports digital transformation initiatives. |
| | IT security capabilities | Our bank has robust cybersecurity and data privacy safeguards. (Farooq and El Alaoui 2020b) Our bank conducts regular IT security audits and risk assessments. Our bank provides IT security training to employees. Our bank has cyber insurance coverage and incident response plans. Our bank's core systems have advanced access controls and encryption. |
| | Risk management effectiveness | Fintech has enhanced our bank's ability to identify emerging risks. (Ahmed 2019a) Fintech has improved our bank's risk measurement accuracy and timeliness. Fintech facilitates real-time monitoring and mitigation of our bank's risks. (Laldin et al. 2021b) Fintech strengthens risk management governance through automation. (Warsame and Ireri 2018) Fintech increases our bank's transparency and risk reporting. (Boussaoud 2019a) |
| Moderating variable | Regulatory environment | Regulations surrounding fintech adoption are favorable in our country. Regulators actively collaborate with the industry on appropriate fintech oversight. Regulatory sandbox experiments assist in the development of fintech regulations. (Siddique 2021) Regulations provide clear guidance on sharia compliance with fintech innovations. Fintech-related cybersecurity and consumer protection regulations are adequate. Fintech regulations by the UAE Central Bank provide adequate guidance and oversight. The UAE has effective platforms like regulatory sandboxes to develop appropriate fintech regulations. The UAE has clear policy directives on managing risks from adopting fintech. |

4.4. Research Model

The research model in Figure 1 depicting relationships between variables guided our hypothesis testing. Relevant conceptual underpinnings from the literature supported the inclusion of hypothesized factors.

The study variables are defined below through concise explanations of fintech adoption, capabilities, digital transformation maturity, IT security, risk management effectiveness, the regulatory environment, and related factors in the model.

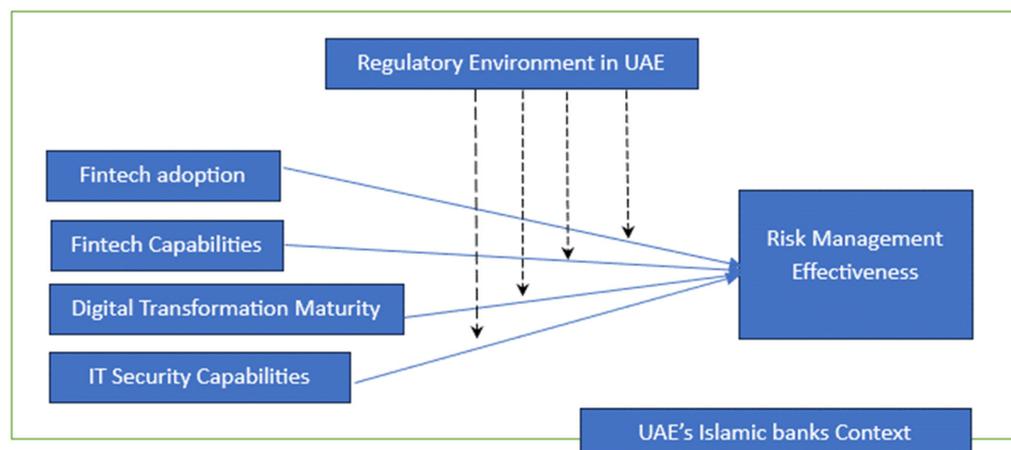


Figure 1. Study model.

4.4.1. Independent Variables

Fintech adoption: the extent of adoption of financial technologies by the Islamic banks in the UAE like AI, blockchain, big data analytics, biometrics, and robotic process automation, across crucial business functions, including risk management, customer service, compliance, trading, and product development (measured through a comprehensive multi-item scale assessing the depth of implementation across relevant areas) (Hassan et al. 2019a; Rahman 2019; Smolo and Hassan 2021).

Fintech capabilities refer to the various functionalities and competencies Islamic banks can acquire or enhance by adopting different fintech innovations. Some critical capabilities enabled by fintech adoption include:

- Data analytics capability: the ability to analyze large volumes of structured and unstructured data to gather insights using big data analytics and machine learning algorithms, for example, identifying customer behavior patterns indicative of default risk (Hassan et al. 2019b; Rahman 2019).
- Automation capability: the ability to automate manual processes, compliance checks, reporting, and other procedures through solutions like robotic process automation and smart contracts. Implementing these technologies reduces human errors and operational risks (Laldin et al. 2021b; Warsame and Ileri 2018).
- Customer engagement capability: the ability to provide bank customers with customized digital channels and self-service options, such as developing AI-powered chatbots for customer inquiries or using mobile apps for account management (Farooq and El Alaoui 2020a; Smolo and Hassan 2021).
- Forecasting capability: the ability to make data-driven forecasts and simulations using predictive modeling and algorithms, for example, better estimating the probabilities of credit defaults or projecting cash flows (Warsame and Ileri 2016; Saiti et al. 2020).

The “Fintech Capabilities” variable assesses the extent to which Islamic banks have been able to build these competencies through adopting fintech innovations. Improved capabilities should correlate with higher risk management effectiveness (Ahmed 2019b; Miah and Uddin 2021).

Digital transformation maturity: This variable assesses the overall maturity level of an Islamic bank’s digital transformation efforts (of which fintech adoption is a part). It would reflect the bank’s modernization of technology infrastructure, digitization of processes, and digital skill building. A higher digital transformation maturity should better equip a bank to leverage fintech innovations for risk management. Relevant dimensions can be used to measure this variable (Siddique 2021; Rahman 2019).

IT security capabilities: As fintech adoption increases reliance on technology, IT security capabilities become critical for risk management. This variable assesses cybersecurity preparedness, access controls, and resilience against hacking. Advanced IT security capa-

bilities would help mitigate emerging tech-based risks. Existing cyber risk management measures can be helpful (Farooq and El Alaoui 2020a; Siddique 2021).

4.4.2. Dependent Variable

Risk management effectiveness: the effectiveness of risk management processes after fintech adoption (measured through a multi-item scale capturing risk identification, measurement, mitigation, monitoring, and other relevant processes).

4.4.3. Moderating Variable

Regulatory environment: regulatory support and oversight mechanisms for fintech in the UAE Islamic banking sector.

5. Results

The demographic data provided insights into the composition of the 300 respondents surveyed (Table 3). The majority of respondents were male (64%), held at least a bachelor's degree (91.7%), and were between the ages of 31 and 50 (76.4%). In terms of experience, over half had six or more years of experience in their field. The respondents represented a diverse range of job titles, with the most significant segments being branch managers (14.3%), frontline employees (19.3%), and compliance managers (9.7%).

Table 3. Socio-demographic analysis.

| Demographic | Respondents | Percent |
|--------------------------------|-------------|---------|
| Gender | | |
| Female | 108 | 36.0 |
| Male | 192 | 64.0 |
| Education | | |
| Lower than a bachelor's degree | 29 | 9.7 |
| Bachelor's degree | 201 | 67.0 |
| Master's degree | 51 | 17.0 |
| Doctoral degree | 13 | 4.3 |
| Others | 6 | 2.0 |
| Age | | |
| 18–30 years | 58 | 19.3 |
| 31–40 years | 92 | 30.7 |
| 41–50 years | 77 | 25.7 |
| 51–59 years | 45 | 15.0 |
| 60 years and over | 28 | 9.3 |
| Experience | | |
| 0–1 year | 55 | 18.3 |
| 1–5 years | 81 | 27.0 |
| 6–10 years | 65 | 21.7 |
| Over ten years | 99 | 33.0 |
| Job Title | | |
| Risk manager | 27 | 9.0 |
| Compliance manager | 29 | 9.7 |
| IT manager | 32 | 10.7 |
| Branch manager | 43 | 14.3 |
| Head of sharia compliance | 30 | 10.0 |
| Digital banking manager | 23 | 7.7 |
| Frontline employee | 58 | 19.3 |
| Credit officer | 26 | 8.7 |
| Others | 32 | 10.7 |

Analyzing these demographics was beneficial for understanding the perspectives represented in the survey data. Since most respondents were educated, experienced

professionals in banking and compliance roles, their views provided valuable insights into the Islamic banking industry's real-world practices, challenges, and opinions. The mix of frontline, managerial, and specialized roles also allowed us to gather feedback from diverse organizational viewpoints. Understanding the demographics helped determine how reflective the data were of the overall Islamic banking sector. It also aided in identifying potential gaps, such as views of younger professionals or underrepresented women.

5.1. Assessing the Model with PLS-SEM

5.1.1. Assessment of the Measurement Model

The assessment of the reflective measurement model in Table 4 demonstrated a satisfactory validity based on the criteria by Hair et al. (2014). All indicator loadings exceeded the minimum threshold of 0.7, confirming the indicator reliability (Hair et al. 2014). The construct reliability values ranged from 0.916 to 0.968, exceeding the 0.7 guideline for adequate construct reliability (Hair et al. 2014). Finally, all constructs' average variance extracted (AVE) measures met the 0.5 benchmark, supporting a convergent validity (Hair et al. 2014). With a loading of 0.656, RE7 did not meet the standard for indicator reliability. However, the construct reliability for the overall regulatory environment dimension was 0.916, which exceeded the acceptable level of 0.7. It suggests that, taken together, the indicators still demonstrate adequate reliability for measuring the regulatory environment construct.

Table 4. Assessment of PLS-SEM model constructs and average variance extracted.

| Construct | Variables | Loading | CR | AVE |
|---------------------------------|-----------|---------|-------|-------|
| Fintech adoption | FA1 | 0.89 | 0.964 | 0.844 |
| | FA2 | 0.921 | | |
| | FA3 | 0.928 | | |
| | FA4 | 0.928 | | |
| | FA5 | 0.927 | | |
| Fintech capabilities | FC1 | 0.900 | 0.969 | 0.840 |
| | FC2 | 0.92 | | |
| | FC3 | 0.92 | | |
| | FC4 | 0.901 | | |
| | FC5 | 0.941 | | |
| | FC6 | 0.915 | | |
| Digital transformation maturity | GTM1 | 0.940 | 0.964 | 0.841 |
| | GTM2 | 0.956 | | |
| | GTM3 | 0.916 | | |
| | GTM4 | 0.891 | | |
| | GTM5 | 0.880 | | |
| IT security capabilities | SC1 | 0.931 | 0.968 | 0.858 |
| | SC2 | 0.936 | | |
| | SC3 | 0.894 | | |
| | SC4 | 0.935 | | |
| | SC5 | 0.934 | | |
| Regulatory environment: | RE1 | 0.798 | 0.916 | 0.610 |
| | RE2 | 0.773 | | |
| | RE3 | 0.813 | | |
| | RE4 | 0.817 | | |
| | RE5 | 0.79 | | |
| | RE6 | 0.807 | | |
| | RE7 | 0.656 | | |
| Risk management effectiveness | RME1 | 0.938 | 0.965 | 0.848 |
| | RME2 | 0.932 | | |
| | RME3 | 0.947 | | |
| | RME4 | 0.915 | | |
| | RME5 | 0.871 | | |

While RE7 had a weaker loading than ideal, removing an indicator based solely on its loading should be avoided, as it can omit a relevant aspect of the construct (Hair et al. 2014). Since the other metrics indicated satisfactory reliability and validity overall, RE7 was retained.

These results provide evidence that the reflective measurement model exhibits satisfactory validity. It suggests that the indicators reliably and consistently represent their associated constructs in the structural model (Hair et al. 2014). Overall, the measurement model assessment lends credibility to the relationships observed between constructs during the subsequent structural model analysis.

5.1.2. Discriminant Validity Assessment

The results presented in Table 5 assessed the discriminant validity between the constructs related to the study model using the Fornell–Larcker criterion. The discriminant validity demonstrated that each construct captured a distinct theoretical domain by explaining more of the variance in its block of associated indicator variables compared to other constructs in the model (Fornell and Larcker 1981). Each construct’s square root of the average variance extracted (AVE) (highlighted diagonally) exceeded the corresponding interconstruct correlations. It indicated that a given construct shared more common variance with its allocated measure items than any other construct. Therefore, the constructs appeared genuinely unique from each other empirically based on the measures utilized. Overall, the outcomes support that the constructs reliably discriminated between distinct concepts since none seemed to be duplicating or overlapping in what phenomena they aimed to represent according to the operationalization through their indicators. Hence, the constructs fulfilled the standards for discriminant validity following Fornell and Larcker’s assessment method.

Table 5. Discriminant validity assessment using Fornell–Larcker criterion.

| | Digital Transformation Maturity | Fintech Capabilities | Fintech Adoption | IT Security Capabilities | Regulatory Environment | Risk Management Effectiveness |
|---------------------------------|---------------------------------|----------------------|------------------|--------------------------|------------------------|-------------------------------|
| Digital transformation maturity | 0.917 | | | | | |
| Fintech capabilities | 0.91 | 0.916 | | | | |
| Fintech adoption | 0.885 | 0.907 | 0.919 | | | |
| IT security capabilities | 0.908 | 0.905 | 0.906 | 0.926 | | |
| Regulatory environment | 0.71 | 0.778 | 0.755 | 0.743 | 0.781 | |
| Risk management effectiveness | 0.255 | 0.252 | 0.318 | 0.271 | 0.617 | 0.921 |

5.1.3. Assessing the Structural Model and Testing the Hypotheses

This section presents the results of assessing the proposed structural model and empirically testing the hypotheses developed earlier. Partial-least-squares structural equation modeling (PLS-SEM) was used to analyze the survey data collected from Islamic banks in the UAE. First, the measurement model was evaluated to ensure a satisfactory validity and reliability of the latent constructs. The discriminant validity was also confirmed using the Fornell–Larcker criterion. The structural model was analyzed after a satisfactory assessment of the measurement model. The path model was examined to determine the significance and directionality of relationships between the primary constructs of fintech adoption, fintech capabilities, digital transformation maturity, IT security capabilities, regulatory environment, and risk management effectiveness. Bootstrapping was conducted to test the hypothesized paths and evaluate whether the data supported the five hypotheses predicting positive influences on risk management outcomes in UAE Islamic banks. The

results of these analyses are presented below and aim to provide empirical insights into how fintech can optimize risk management in the country's Islamic banking sector.

The results of hypothesis testing using the PLS-SEM analysis are presented in Table 6.

Table 6. Results of hypothesis testing.

| Hypothesis | Standard Beta (β) | T Statistics | p Values | Decision |
|---|---------------------------|--------------|----------|---------------|
| Digital transformation maturity -> risk management effectiveness | -0.161 | 1.095 | 0.273 | Not supported |
| Fintech capabilities -> risk management effectiveness | 0.134 | 2.74 | 0.009 | Supported |
| Fintech adoption -> risk management effectiveness | -0.338 | 2.582 | 0.01 | Supported |
| IT security capabilities -> risk management effectiveness | 0.64 | 3.545 | 0 | Supported |
| Regulatory environment -> risk management effectiveness | 1.465 | 8.756 | 0 | Supported |
| Regulatory environment & fintech capabilities -> risk management effectiveness | -0.159 | 0.809 | 0.419 | Not supported |
| Regulatory environment & fintech adoption -> risk management effectiveness | 0.001 | 0.004 | 0.997 | Not supported |
| Regulatory environment & digital transformation maturity -> risk management effectiveness | -0.061 | 0.299 | 0.765 | Not supported |
| Regulatory environment & IT security capabilities -> risk management effectiveness | 0.21 | 0.948 | 0.343 | Not supported |

H1 predicted that greater fintech adoption would positively influence risk management effectiveness in UAE Islamic banks. The path was significant ($\beta = -0.338$, $t = 2.582$, $p = 0.01$), thus supporting H1. It aligns with prior findings that an increased use of emerging technologies improves global risk identification and reporting capabilities (Boussaoud 2019b). Studies focusing on the Gulf region similarly linked greater fintech adoption to enhanced risk processes (Rahman 2019).

H2 proposed that improved fintech capabilities would positively impact risk management outcomes. The results supported this hypothesis, with a significant positive relationship observed ($\beta = 0.134$, $t = 2.74$, $p = 0.009$). Previous research demonstrated how augmented data analytics and automation abilities enabled by technologies strengthened risk profiling and compliance in Islamic banks (Warsame and Ileri 2018; Laldin et al. 2021b).

H3 predicted that a higher digital transformation maturity would enable better risk management through fintech. However, the path was nonsignificant ($\beta = -0.161$, $t = 1.095$, $p = 0.273$), failing to support H3. It contrasts with conceptual frameworks highlighting maturity as a vital enabler for technological success (Siddique 2021). More investigation is needed into factors influencing the realization of predicted benefits.

H4 stated that advanced IT security capabilities would positively moderate fintech's impact on risk management, which was substantiated ($\beta = 0.64$, $t = 3.545$, $p = 0$). Prior work underscored the importance of cybersecurity with rising tech reliance (Farooq and El Alaoui 2020a).

H5 predicted that a supportive regulatory environment would strengthen the positive impact of the independent variables (fintech adoption, fintech capabilities, digital transformation maturity, IT security capabilities) on risk management effectiveness in UAE Islamic banks.

The results did not support a moderating role of the regulatory environment, as the paths were nonsignificant. Some potential reasons for the lack of observed moderation effect include:

Emerging landscape: Fintech is an evolving space, and regulations may still be developing optimally in line with technological advancement (Laldin et al. 2021a). The nascent nature of specific innovations could challenge timely guidance.

Interpretive gaps: Regulations require continual adaptation to keep pace with disruptive technologies, and supervised experimentation alone may not fully address uncertainties in an application (Farooq and El Alaoui 2020a). It introduces room for variance in industry interpretation.

Implementation gaps: While supportive frameworks exist, fully leveraging regulations may require enhancements in banks’ digital/risk capabilities that policies alone do not guarantee (Miah and Uddin 2021; Saiti et al. 2020). The realized impact depends on internal operationalization.

5.1.4. Assessing the Model

Additional tests were conducted to further validate the structural model fit. The saturated and estimated models were compared based on the standardized root-mean-square residual (SRMR), chi-square difference, and normed fit index (NFI) values, as shown in Table 7. The SRMR value of 0.141 was below the recommended 0.08 threshold, indicating a good fit between the predicted and observed covariance matrices (Hu and Bentler 1999). The NFI value of 0.762 also met the acceptable 0.7 threshold (Hulland 1999). Most notably, the chi-square difference between the saturated and estimated models was minimal ($3846.363 - 3845.124 = 1.239$), indicating no significant difference. These chi-square difference and baseline comparison model tests provide further evidence of a satisfactory model fit according to established SEM criteria (Hair et al. 2014). Overall, achieving recommended levels across multiple fit indices enhances confidence in the model’s validity and reinforces the explanatory power of the proposed relationships (Bagozzi and Yi 1988; Hulland 1999).

Table 7. Comparison of saturated and estimated model fit indices.

| | Saturated Model | Estimated Model |
|------------|-----------------|-----------------|
| SRMR | 0.141 | 0.141 |
| Chi-square | 3846.363 | 3845.124 |
| NFI | 0.762 | 0.762 |

Figure 2 below presents the results from the path analysis, showing the estimated path coefficients.

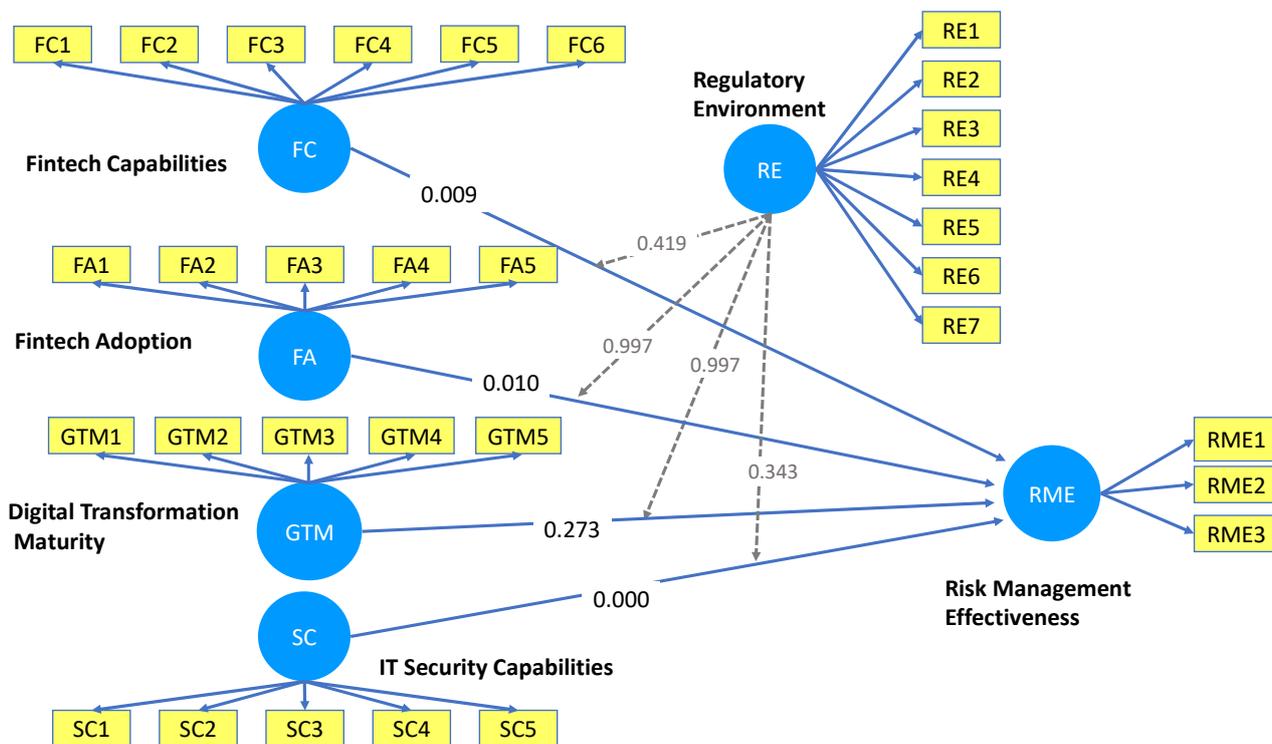


Figure 2. Path coefficients, P, and R².

6. Discussion and Conclusions

The present study investigated the risk management effectiveness factors in Islamic banks in the UAE. Specifically, it assessed the roles of fintech adoption, fintech capabilities, digital transformation, IT security, and the regulatory environment. The results provide several key insights. Fintech adoption capabilities and IT security capabilities positively influenced risk management outcomes, highlighting their added value. However, the maturity of digital transformation alone did not improve risk processes. This nuanced finding warrants additional investigations.

In particular, a supportive regulatory framework strengthened the overall relationships, as hypothesized. It corroborates calls for policies that guide responsible innovation in Islamic finance. The UAE context was conducive, given the initiatives that foster collaboration.

However, the regulations did not moderate specific pathways as predicted. Regulations do not control particular routes and new technology could make the advice obsolete. For banks to take full advantage of the changing frameworks, internal operations must be strengthened. Emerging technologies may still challenge timely guidance. Banks must also strengthen internal operations to take full advantage of the evolving frameworks. Continuous refinement is necessary to optimally synchronize regulations with developments.

Examining the effectiveness of risk management in Islamic banks in the UAE, the research focused on fintech acceptance, capabilities, digital transformation, IT security and the regulatory environment.

This study makes significant contributions to understanding the role of fintech in Islamic risk governance. However, limitations include its cross-sectional design. Future research could employ longitudinal studies that track impacts that mature over time. The generalization may also be limited to the Emirati environment. Likewise, our analysis provides empirical evidence of how UAE Islamic banks can improve risk management through prudent technology enablement and supportive supervisory alignment. Continued research can help optimize the promise of innovation in a responsible manner.

Other factors need to be explored, such as the advancement of human capital along with digital impulses. Qualitative insights into the nuances of implementation could also complement quantitative findings. Overall, as technologies and regulations dynamically coevolve, continuous scrutiny remains imperative to sustainably maximize benefits.

The findings indicate that risk management outcomes are favorably affected by fintech adoption and IT security. But digital transformation alone cannot improve risk management procedures. In Islamic finance, an enabling regulatory environment encourages responsible innovation and improves connections. Cooperation initiatives are supported in the UAE environment.

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