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Message from
EDITOR IN CHIEF
Vol 2, Issue 1, Dec 2025

Dear Readers,

It is my distinct honour to present Volume 2, Issue 1 (December 2025) of the Journal of Islamic Banking, Economics and Policy (JIBEP), a publication committed to advancing rigorous scholarship at the intersection of Islamic finance, economics, financial innovation, and policy. As JIBEP continues to grow, our aim remains consistent: to publish research that is intellectually robust, practically relevant, and responsive to emerging global challenges and opportunities within ethical and Shari'ah-aligned financial systems.

This issue brings together a focused selection of contributions that reflect both the macroeconomic realities shaping financial markets and the technological transformations redefining Islamic finance and governance. The opening article examines the impact of major global events on conventional and Islamic stock indices, offering evidence-based insight into market behaviour and resilience across the G7 and GCC. Complementing this, the issue includes a comparative study exploring strategic innovation pathways in Shariah-compliant FinTech, drawing valuable lessons from the experiences of Saudi Arabia and Indonesia—two jurisdictions playing influential roles in Islamic finance development.

In addition to FinTech innovation, this issue engages with technology adoption in financial services more broadly through research on the adoption of IoT in Bangladesh's insurance sector, highlighting opportunities, barriers, and operational implications for service delivery and risk management. The issue also extends into governance and implementation architecture through the article on DFAS-GDR, presenting an applied roadmap that discusses implementation frameworks and adoption protocols aligned with governance convergence principles. Finally, the issue concludes with a thematic review that synthesises key trajectories in FinTech innovation and Islamic finance, consolidating current debates and mapping areas for future scholarly inquiry.

I would like to express sincere gratitude to our authors for their valuable contributions, and to our reviewers and editorial team for their dedication to strengthening the quality and integrity of the journal. I am also grateful to our wider community of supporters and partners who continue to encourage JIBEP's development and visibility.

As we move forward, JIBEP remains committed to enhancing discoverability and academic reach through ongoing indexing and quality milestones. Our broader direction is to support scholarship that informs policy, strengthens ethical financial practice, and contributes meaningfully to the global discourse on sustainability, inclusion, and responsible innovation in finance.

Thank you for reading and supporting JIBEP. We hope you find this issue both intellectually enriching and practically relevant.

Warm regards,

Dr. Faiza Raza
Editor-in-Chief
Journal of Islamic Banking, Economics and Policy (JIBEP)
editor@jibep.org

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• Minor Revisions
• Major Revisions
• Reject

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ACKNOWLEDGMENT

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GUIDELINES

To ensure consistency and an efficient review process, authors submitting to the Journal of Islamic Banking, Economics and Policy (JIBEP) must follow these formatting requirements. Manuscripts that do not comply may be returned for correction or desk-rejected.

Page Setup

• Paper size: A4
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• The main manuscript must be fully anonymised (no author names, affiliations, acknowledgements, or identifying self-references).
• A separate Title Page must include: manuscript title, author name(s), affiliation(s), email address(es), and corresponding author details.

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• Main headings: Bold, 12 pt
• Subheadings: 12 pt
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• Number sequentially (e.g., Table 1, Figure 1)
• Provide clear titles/captions
• Cite the source beneath each item where applicable
• Ensure figures are high resolution and readable in print

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• Preferred format: MS Word (.doc/.docx) for initial submission
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Testing the Impact of Major Events on Conventional and Islamic Stock Indices of G7 and GCC

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Prof. Turan Erol[2]

ABSTRACT

The research intends to investigate the impact of COVID, Glasgow Climate Pact, Ukraine War and ChatGPT Launch on the conventional and Islamic stock indices of G7 and GCC countries. The researcher employed the event study methodology to analyze the impact of the four events and used DCC-MGARCH for diversification analysis irrespective of these events. Results depict that Overall G7 markets were negative before declaring COVID as a global pandemic. Mostly GCC indices were stable to COVID. Overall G7 markets were negative to the Glasgow Climate Pact. Mostly GCC indices were stable to the GCP. G7 were mostly negative to Ukraine War. Overall GCC was stable to Ukraine war. Mostly G7 and GCC were negative to the ChatGPT launch. Dynamic Conditional Correlation is moderate among G7 Islamic and Conventional stock indices indicating moderate level of diversification. DCC among GCC Islamic and Conventional is less than 0.2 and offers more diversification. Investors can diversify their portfolio among G7 and GCC stock indices for better return with less risk.

Keywords: COVID, Glasgow Climate Pact, Ukraine War, ChatGPT Lauch, Event Study, DCC MGARCH, Diversification

JEL Classification: G14, G15, C58

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1. Introduction

The world is facing severe existential risks, IIPC report 2022 (Intergovernmental Panel on Climate Change) mentioned the top ten risks to the globe over the next 10 years. Risks are related to environment, society, Economics and geopolitical. These affect the stock markets that are the main barometer of the economy (Birindelli et al, 2023). WHO had to declare COVID as a global pandemic on January 11, 2020. Literature concluded its negative impact on the stock markets of the globe (Waheed et al., 2020). The Glasgow Climate Pact (October 31 to November 13, 2021) is the first major global environmental agreement that was concluded at the CO26 conference to find out the solution to the major environmental threats. Nearly 200 countries agreed to the Glasgow climate pact. The literature is scanty to the Glasgow climate pact with respect to the impact on the stock markets (Pandey, Kumar and Kumari, 2022). Russia's invasion on Ukraine on the February 24, 2022, changed the scenario again and gave another shock to the markets. (Maurya, Bansal and Mishra, 2023). ChatGPT was introduced on Nov 22, 2022. ChatGPT got a million users within the first week of its launch. Research shows its effectiveness in sentiment analysis, ESG analysis, corporate culture analysis and federal reserve opinion analysis etc. (Alshurafat, 2023). Literature is missing about the aspects of the Natural language processing (NLP) technologies (ChatGPT) on the stock market.

The researcher intends to research the pandemic, environmental, political and technological events and their proportionate impact on the shariah and conventional indices of G7 and GCC countries. The researcher aims to explore the impact of COVID-19, Glasgow Climate Pact, Ukraine War and ChatGPT on the shariah and conventional stock indices of G7 and GCC countries. Literature explored empirical evidence of the impact of these factors on the different segments, population and markets. But literature did not investigate these factors together. A comparative analysis of the impact of the different major trending events on the Shariah compliant and conventional stock indices of G7 and GCC countries from 2013 to 2023.

The following are the research questions to be pursued:

1. How Shariah and conventional stock indices of selected countries responded to the event of COVID-19? (Event Date: March 11, 2020.)
2. How Shariah and conventional stock indices of selected countries responded to Glasgow Climate Pact 2021? (Event Date: November 13, 2021)
3. How Shariah and conventional stock indices of selected countries responded to (resilience) shock or event of Ukraine War? (Event Date: February 24, 2022)
4. How Shariah and conventional stock indices of selected countries responded to event of ChatGPT launch? (Event Date: (November 22, 2022)
5. Are there diversification opportunities among selected countries. (Not dependent on events)

The study is unique, covering the health, environmental, political and technological factors and their impact on the selected stock markets. The study is unique with others because of investigating the major trending events on the shariah stock indices and conventional stock indices of the Muslim and non-Muslim countries. The selected population is playing a significant role in the world. This study is important for contagion analysis, predictions and diversification purposes.

The comparison between conventional and Shariah-compliant indices is essential because Shariah-compliant assets are governed by unique constraints, such as the prohibition of Riba (usury) and Gharar (uncertainty), and the exclusion of highly leveraged firms. These financial filters theoretically provide a 'buffer' during periods of extreme market volatility. By comparing their responses to events like COVID-19 and geopolitical conflicts, this study tests the 'decoupling hypothesis'—whether Shariah indices can offer superior resilience and diversification benefits for global investors during crises (Elshqirat, 2021).

2. Empirical Literature Review

2.1 COVID-19

Khan et al. (2020) investigated COVID-19 effect for sixteen countries and concluded negative returns with the help of Pooled OLS regression, the t test and the Mann-Whitney test. Singh et al. (2020) explored the COVID-19 effect on G 20 countries and concluded significant negative abnormal returns employing event study. Waheed et al. (2020) investigated the impact of COVID-19 on KSE 100 index of Pakistan employing quantile-on-quantile method and found positive reaction. Elshqirat (2021) explored the performance of MSCI Islamic and conventional stock of GCC indices during the COVID-19 with Risk-adjusted performance measures and concludes same effect. Salman & Ali (2021) investigated the influence of COVID on the stock market of GCC countries and concluded negative impact according to the conventional t-test and non-parametric Mann-Whitney tests. Sghaier, Kouki and Messaoud (2023) investigated the contagion impact of COVID among the Chinese and G20 stock markets by employing the time varying copula approach. The study concluded the significant evidence of contagion impact among the Chinese and G20 countries excluding the US, Argentina and Türkiye.

2.2 Glasgow Climate Pact

Rogova and Aprelkova (2020) explored the impact of the IPCC (Intergovernmental Panel on Climate Change) reports and regulatory announcements on the stock market of US employing event study. The study found that various sectors react abnormally to the IPCC reports. Pandey, Kumar and Kumari (2022) investigated the effects of Glasgow climate pact on the abnormal returns of the global energy stocks employing applied the event study method and cross-sectional multivariate regression model. The study concluded

that GCP inversely impacted the stock returns of the selected companies. Kumari (2023) investigated the impact of the Glasgow climate pact on 52 Countries by employing the event study methodology. The study concluded that emerging markets showed negative abnormal returns. Birindelli et al. (2023) explored the expectations of the stock market and COP26 (Glasgow climate compact employing applied the event study methodology. Stock prices of the 7587 companies from the four countries comprises EU, USA, China and India were analyzed. The research concluded that stock prices were dependent on the actions of the country's authorities towards the announcement of the conferences rather than the announcement of conference itself. Markets behaved negatively towards stringent policies and markets behaved positively towards less stringent policies. Kumari (2023) investigated the effect of the Global Glasgow climate pact on the global oil and gas sector stock employing event study. The results revealed that emerging markets showed negative abnormal returns on the Glasgow Climate Pact event.

2.3 Ukraine War

Boungou and Yatié (2022) investigated the impact of the Russian and Ukraine war on 94 countries and concluded the negative and inverse relationship after the invasion. Boubaker et al. (2022) researched the Heterogeneous effects of Ukraine war on the global stock market by using the event study approach. The results are consistent with other studies that the Ukraine war affected the markets negatively. Yousaf, Patel and Yarovaya (2022) investigated the reaction of the Russia and Ukraine war on the stock markets of the G20 countries by employing the event study methodology. The research reveals that negative impact on the event day. Abbassi and Pandey (2022) investigated the effect of the Russia and Ukraine war on the constituent's companies of the leading stock index of G7 countries by employing the event study methodology revealing the negative abnormal returns. Ahmed, Hasan and Kamal (2023) investigated the reaction of the Russia Ukraine war on the stock markets of European countries by using event study methodology. The study reveals that European stocks reacted negatively during the post event. Bossman and Gubareva (2023) investigated the comparative analysis of E7 and G7 equities with asymmetric effects of Russian war by using the nonparametric quantile-on-quantile regression model. the study concluded that all countries except Russia and China reacted positively to GPR (geopolitical risk). Resilience was shown by Brazil, China, Russia, and Turkey (France, Japan, and the US).

2.4 ChatGPT Launch

Ferreira and Gandomi (2021) provided the systemic literature review of 2326 papers from Scopus website during 1995 to 2019, categorizing the literature in four categories (1) portfolio optimization (2) stock market prediction using AI (3) financial sentiment analysis (4) combination involving two or more approaches. Lopez-Lira and Tang (2023) investigated the role of ChatGPT in predicting the stock returns with sentiment analysis

of news headlines. George, George and Martin (2023) researched the effect of ChatGPT on different businesses. Xie (2023) investigated the capabilities of ChatGPT in multimodal stock movement predictions by extensive zero-shot analysis. Lopez-Lira and Tang (2023) investigated the ability of ChatGPT to forecast the stock market returns by employing the sentiment analysis of news headlines. Chen (2023) investigates the stock prices movements and metaverse linkage with the help of three-factor and five-factor Fama-French model.

3. Research Methodology

The researcher aims to employ a quantitative method for conducting this research. The researcher used time series data from January 1, 2013 to December 31. 2023. Data related to the selected countries is taken from Refinitive datastream and investing.com. The event dates of the four events are taken as event dates. This study employs a purposive sampling technique to select the target population. The G7 and GCC countries were specifically chosen to provide a comparative analysis between major developed global economies and significant Shariah-compliant markets. This selection allows for a robust investigation of how different economic and religious frameworks respond to global health, environmental, and geopolitical shocks.

3.1 EVENT STUDY METHODOLOGY

Event study is considered most appropriate for examining the impacts of events on stock prices/returns' performance. The event study has been considered a better approach to see the impact of different events e.g. merger, amalgamation or any corporate event. Researchers also employed event study to investigate the impact of disease (Syani & Balkrishnan, 2013; Khan et al., 2020; Sulehri & Ali, 2020; Singh et al., 2020; Yan & Qian, 2020).

3.2 EXPECTED RETURN UNDER MARKET MODEL:

The market model presumes that market return at specific t is the only factor that determines the return on stock at that time. The equation of this argument is described in linear form.

$$E(R_{i,t}) = b0 + b1 \cdot E(R_{M,t})$$

In easy form: Expected return = intercept + slope * market return

Sulehri and Ali (2020) mentioned that Market model is similar to the capital asset pricing model yet with some differences to CAPM because it takes intercept as constant rather than risk free rate as used in capital asset pricing model. So, variables or parameters used by market model can be obtained or calculated with the help of simple regression

(Ordinary least square). First, we must acquire estimated intercept and slope values then we can calculate the predicted/expected return for observed window (after the event). The model depicts the expected return that is attainable in a normal course.

$$ARi,t = Ri,t - E(Ri,t)$$

In easy and uncomplicated form: Abnormal return= actual return ‑ Expected return

Sulehri and Ali (2020) explained that Cumulative abnormal return is the total, sum or addition of abnormal returns over a given period of time. It gives investors a hint about the performance of assets over the time period. Generally, CAR is calculated for small window or short period because some studies proved that calculating CAR for long term can create bias. CAR is used to see the effect of news etc. CAR helps you in decision making for investing.

$$CART = \sum AR$$

3.3 DCC MGARCH METHOD

The GARCH model is used to forecast the volatility of the return on the financial assets. MGARCH stands for multivariate generalized autoregressive conditional heteroskedasticity. MGARCH DCC stands for Dynamic Conditional Correlation. MGARCH DCC is used for spillovers, volatility, linkages, co-movements and diversification purposes. The benefits of the MGARCH-DCC model are significantly described in related research. According to Lee (2006), it assists in modelling the procedure of estimating dynamic conditional volatilities and dynamic conditional correlation concurrently. It imparts not only a demystified process in estimating the dynamic correlation matrix (Engle and Sheppard, 2001) but also takes unbiased time-varying volatility to regulate the correlation coefficients continuously (Cho and Parhizgari, 2008). Additionally, Chiang et al. (2007) pointed out that this method/technique can be employed to gauge correlation coefficients of the standardized residuals and correlations between multiple assets returns as it has a certain degree of flexibility like univariate GARCH model.

Specifically, the MGARCH-DCC model involves two steps estimations. Firstly, it is significant to gauge the conditional variances of every equity index by employing the following univariate GARCH (X, Y) model, given k number of index returns:

$$h_{it} = \omega_i + \sum_{x=1}^{Xi} \alpha_{ix} r^2_{it-x} + \sum_{y=1}^{Yi} \beta_{iy} h_{it-y}, \text{ for } i = 1, 2, ..., k$$

Secondly, it is important to estimate the time-varying conditional correlation between index returns. The standardized residuals calculated from the previous step will be used as inputs in the following DCC estimator.

$$H_t = D_t R_t D_t$$

Ht stands for the multivariate conditional covariance matrix. Dt is a diagonal matrix of conditional time-varying standardized residuals ($\mathcal{E}_t$). Rt is the symbol of the time-varying correlation matrix (off-diagonal elements). Rt is the symbol of the time-varying correlation matrix (off-diagonal elements). The choice of the DCC-MGARCH model over VAR, VECM, or ARDL is justified by the primary research objective: analyzing volatility dynamics and time-varying diversification potential. While VAR and VECM are excellent for identifying long-term equilibrium and lead-lag relationships in price levels, they typically assume constant variance (homoskedasticity). (Pesaran and Pesaran, 2010).

4. Findings of the Included Studies

Overall graph for G7
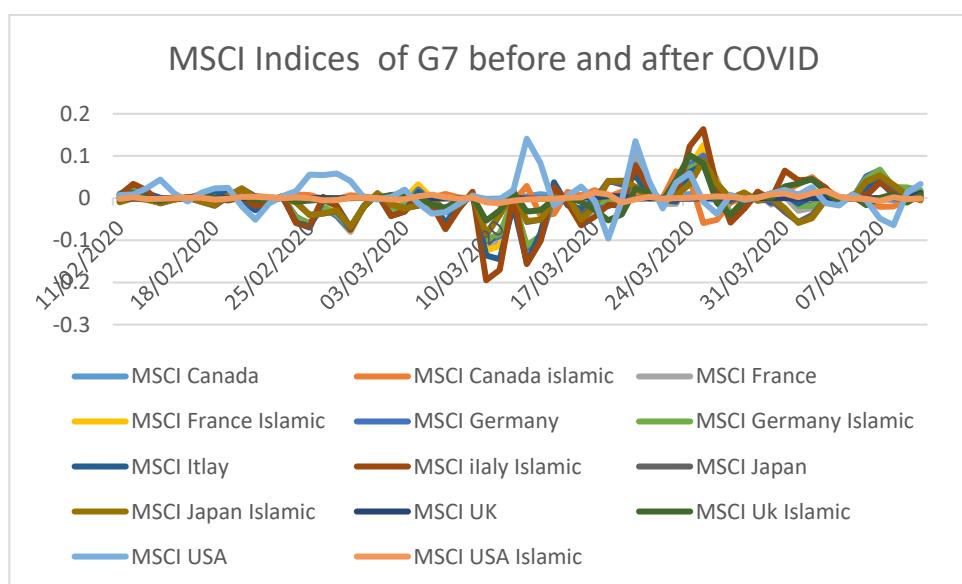
Figure 1. CAR of G7's both indexes before and after the launch of COVID:

MSCI Canada Islamic, MSCI Italy Islamic, MSCI UK Islamic & MSCI USA Conventional provides better CAR & diversification while comparing their counterparts. Overall G7 was negative before event but G7 improved after event. It may be because of Govt measurements.
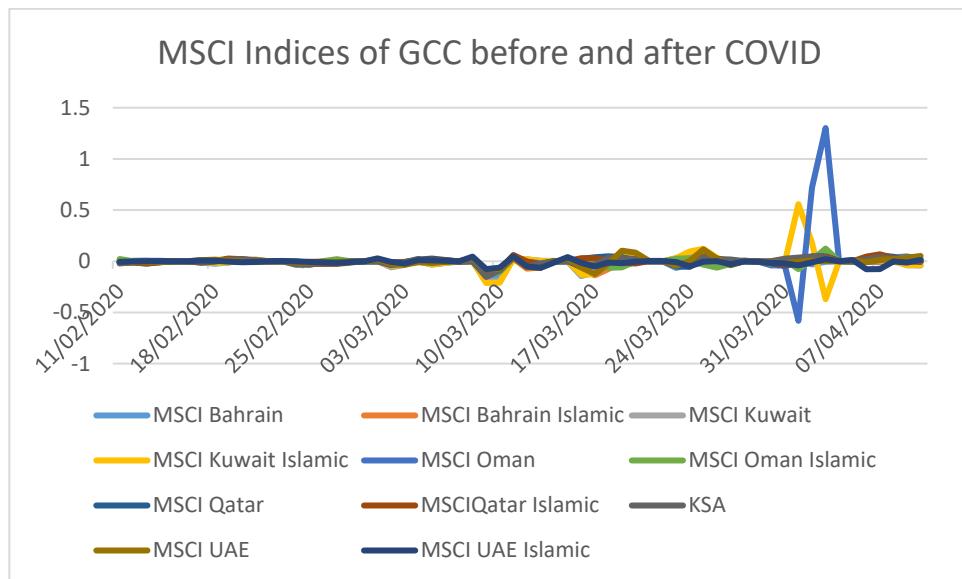
Figure 2. CAR of GCC's both indexes before and after the launch of COVID

Conventional MSCI UAE shows more volatility and offers more CAR. Mostly GCC indices were stable before the event. Mostly provide bit more CAR after the event. KSA was negative before and after the event but later improved. There is no diversification opportunity among GCC conventional and Islamic stock indices. Hypothesis is accepted for one index but rejected for the other.
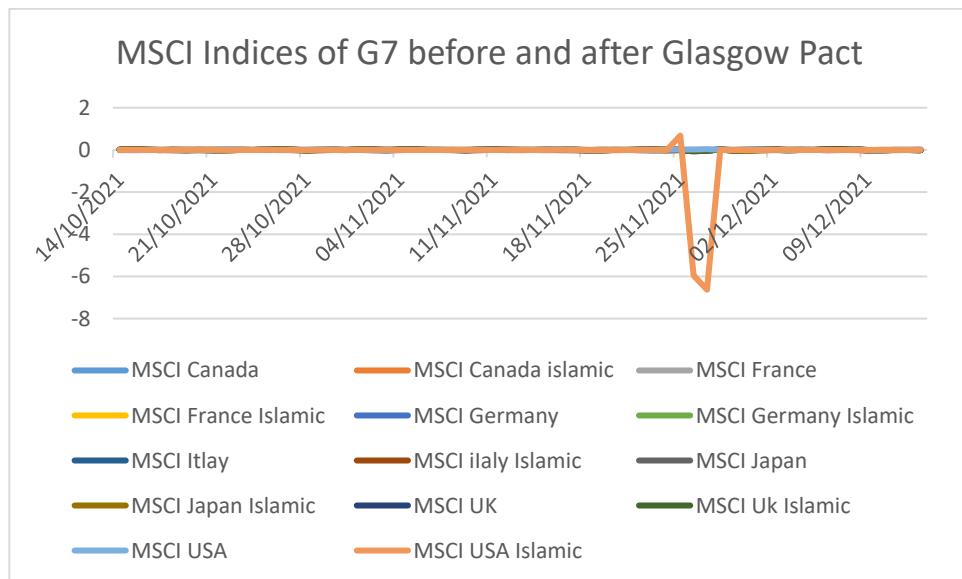
Figure 3. CAR of G7's both indexes before and after the Glasgow Climate Pact:

MSCI Canada Islamic offers higher CAR and diversification opportunities while comparing with counterpart. German, French, Italian and Japanese provides negative CAR after the event. Trend was same in German, French and Italy. Uk was negative to the event. USA did not show any reaction to the event. Hypothesis accepted for Canada Islamic and rejected for other.
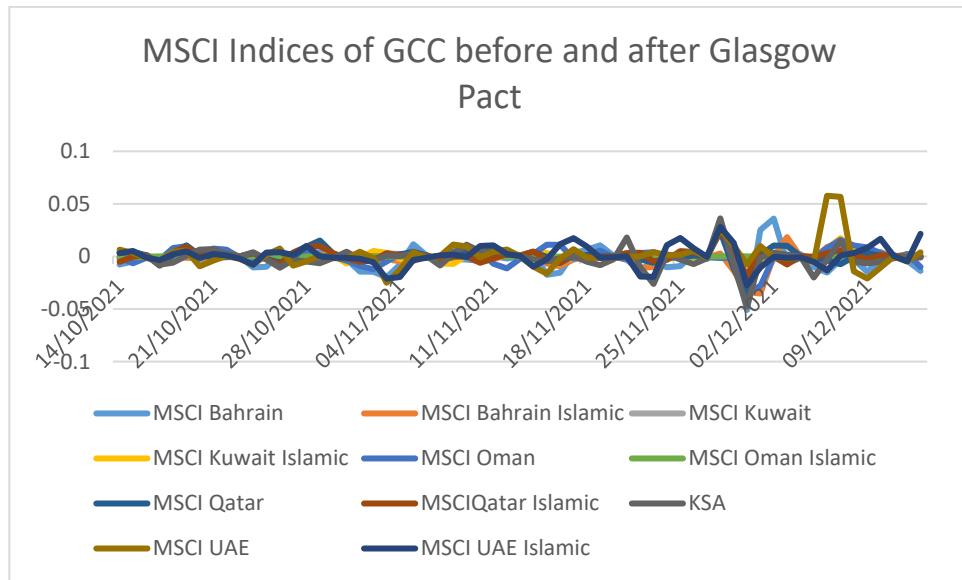
Figure 4. CAR of GCC's both indexes before and after the Glasgow Climate Pact:

The conventional MSCI Oman shows more CAR and diversification opportunities to the event. Bahrain Islamic offers diversification comparing the conventional. Both Kuwait was stable with same movements. Both Qatar was negative before and after the event. Both UAE were negative before and after the event. KSA was volatile before and after the event. Hypothesis is accepted for two and rejected for the other.
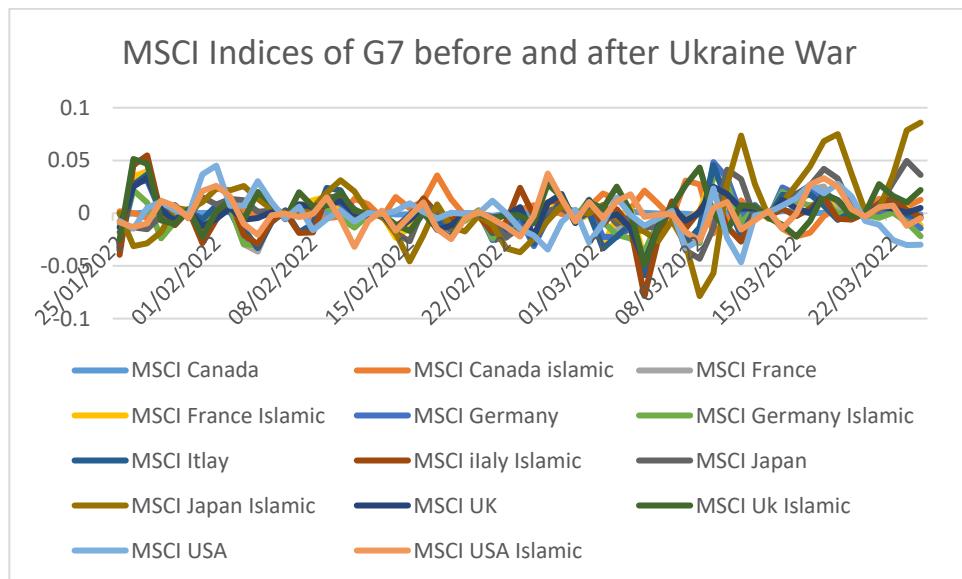
Figure 5. CAR of G7's both indexes before and after the Ukraine War:

MSCI Canada Islamic offer higher CAR and diversification than its counterpart but counterpart was stable too. German, French, Italian and Japanese were negative before and after the event as evidenced by the literature. Both UK indices showed higher volatility (mixture of positive and negative). Both USA were negative before and after the

event. Results are consistent with Boungou and Yatié (2022) Boubaker et al. (2022) Umar et al. (2022) Nerlinger and Utz (2022) Yousaf, Patel and Yarovaya (2022).
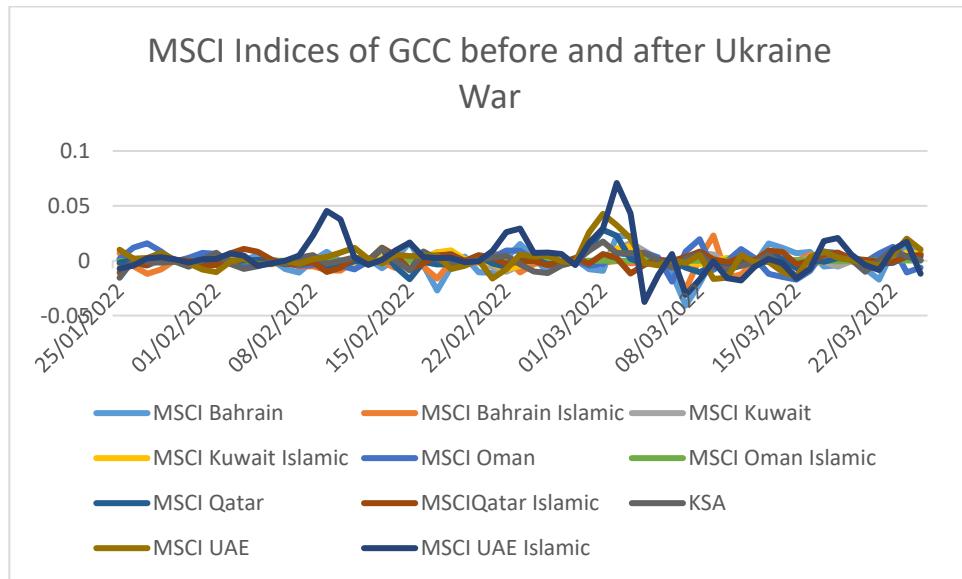
Figure 6. CAR of GCC's both indexes before and after the Ukraine War:

MSCI Bahrain, MSCI Oman and MSCI UAE Islamic offer more cumulative abnormal returns and offer diversification. Both UAE was negative to the event. Both Kuwait was negative to the event. Qatar showed more volatility (Ups and down). KSA was volatile to the Ukraine war. Hypothesis is accepted for 3 indices and rejected for others. Results are partially the same and different.
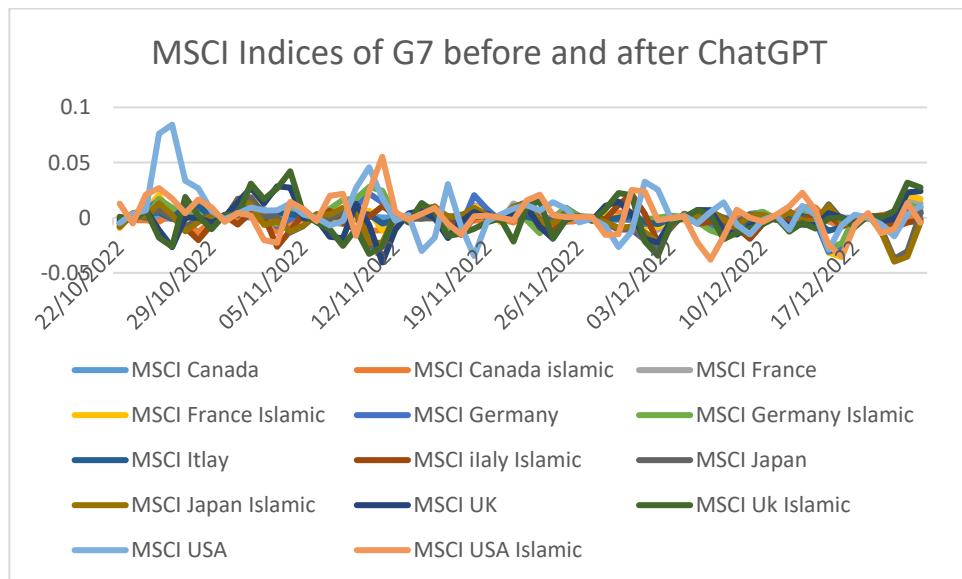
Figure 7. CAR of G7's both indexes before and after the launch of ChatGPT:

MSCI Canada Islamic was negative before and after the event, but MSCI Canada is stable but without CAR. German, French, Italian and Japanese indices were volatile without

diversification. UK was volatile and No diversification. USA was negative after the event. Conventional index of USA provides more before the event but for some days.
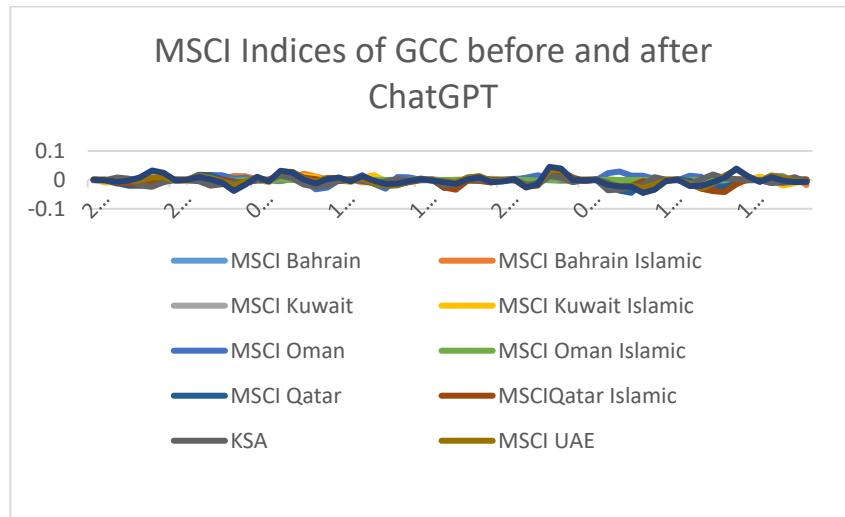
Figure 8. CAR of GCC's both indexes before and after the launch of ChatGPT:

MSCI Bahrain Islamic shows more CAR especially before the event as compared to post event. MSCI Oman provide opportunity for abnormal returns and diversification. Kuwait negatives after the event. Both Qatar was negative after event. Both UAE was negative. KSA was negative before and after the event. Hypothesis is accepted for 2 indices and rejected for others.

4.2 DCC MGARCH ESTIMATION:
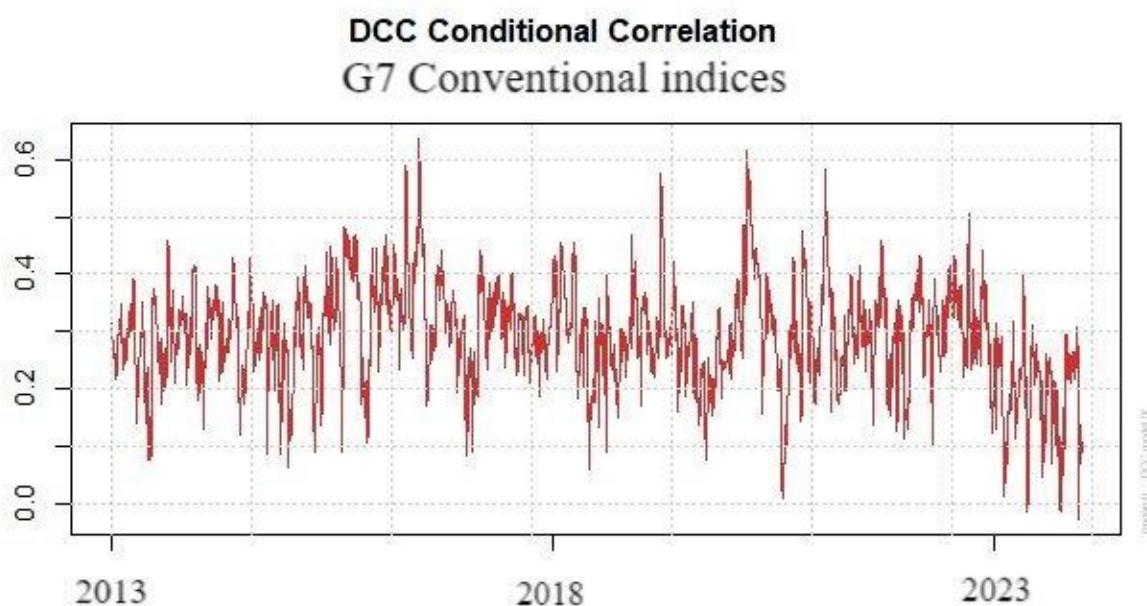
Figure 9: DCC MGARCH GRAPH FOR THE G7 CONVENTIONAL INDICES

The graph shows the dynamic conditional correlation between the G7 countries for the 2013 to 2023. The fluctuation in the graph shows that how the relationship between G7 countries change over time. During the 2016 and 2018, the graph spiked many times. It means that G7 countries moved together or were correlated at that time. It means that during that time. There were no diversification opportunities. It may be because of global macroeconomic developments e.g. recovery from 2008 financial crises and Brexit (Jan 31, 2020) etc. during 2020 to 2023 conditional correlation observed a slight decrease in trend. It may be because of COVID or other issues. We can conclude that the correlation changes among the G7 countries is not static but changes over time. The period of the same movement may show the recovery or growth in the economy so the indices moved in the same direction but during the crises time, indices were independent to move in either direction.
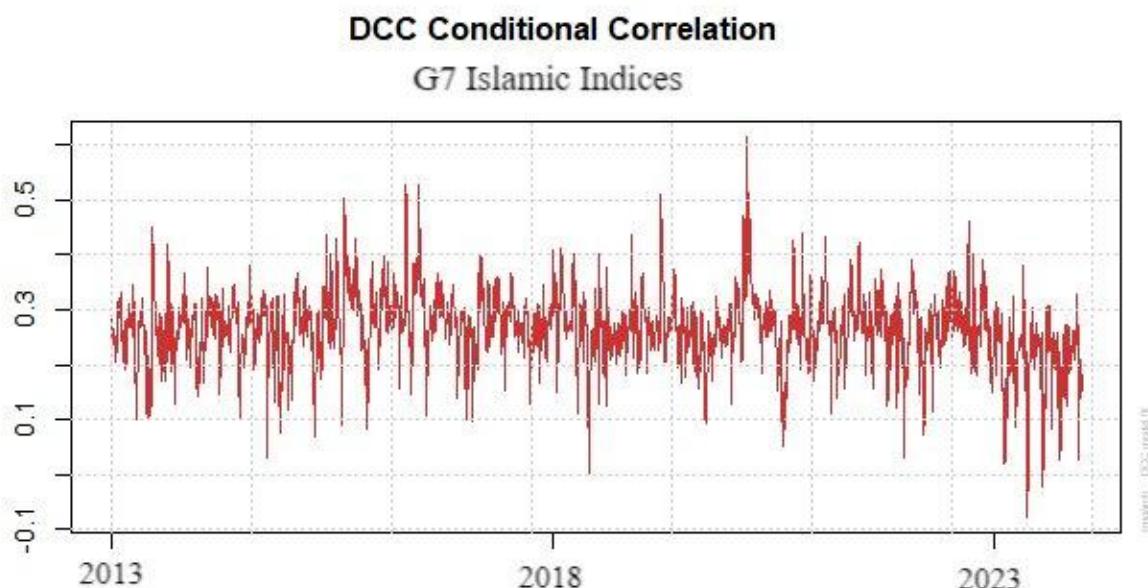
Figure 10. DCC MGARCH GRAPH FOR THE G7 ISLAMIC INDICES

There was a more significant spike during 2018 to 2021. It shows that there is more correlation between the indices. High spikes means that strong correlations. it means no diversification. The DCC MGARCH model provides the results for volatility and evolving relationship(correlations) among the G7 Islamic indices.
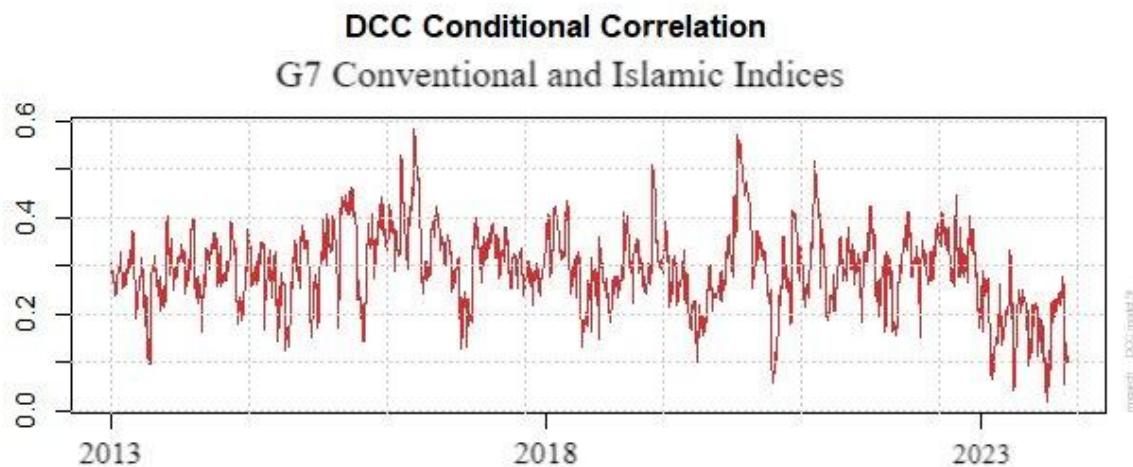
Figure 11. DCC MGARCH GRAPH FOR THE G7CONVENTIONAL & ISLAMIC INDICES

This graph shows that the correlation between the indices is not stable but changes with time. There was peak during 2018 to 2019. During this time correlation reaches to the 0.6. after till 2023 the correlation among conventional and Islamic stock indices declined among the indices. There is not particular trend of increasing and decreasing, rather it may be because of short term conditions rather than long term effect.
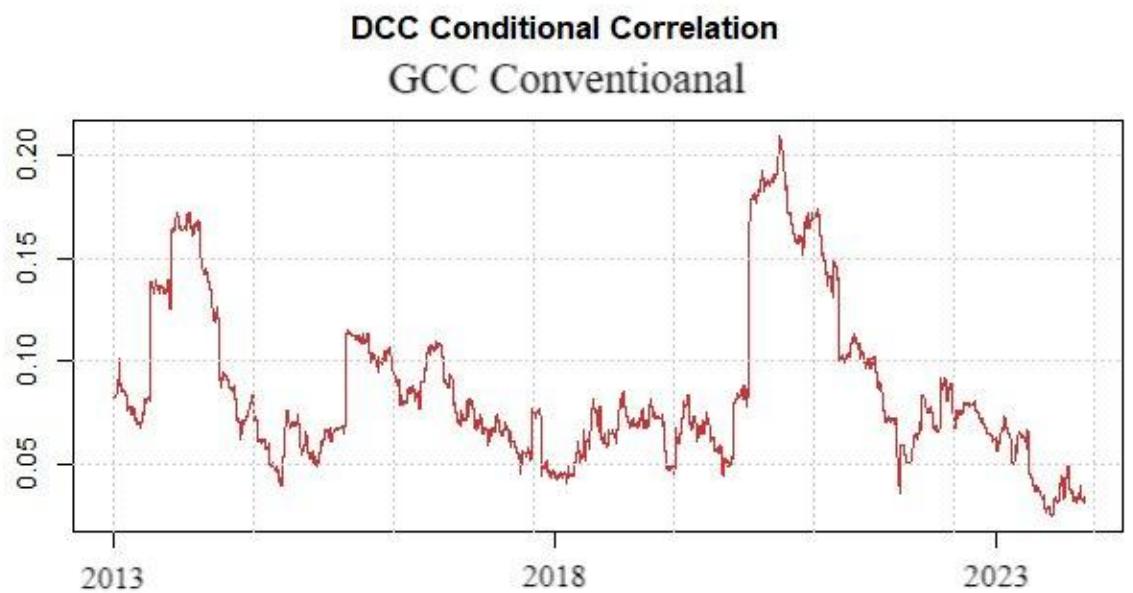
Figure 12. DCC MGARCH GRAPH FOR GCC CONVENTIONAL INDICES

We can divide the fluctuations in different time horizons. There is rise in correlation starting from 2013 to 2015. The correlation during 2016-2019 was quite stable and

moderate. There is fast increase in the correlation during 2019-2021. It may be because of global issues. There is decrease in the correlation between 2022-2023.
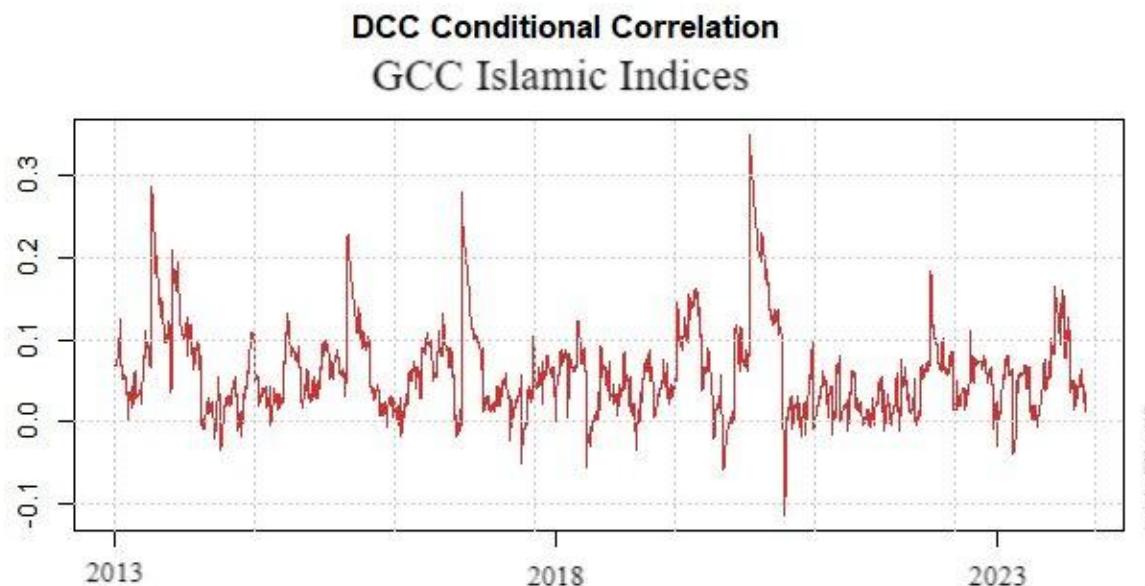
Figure 13. DCC MGARCH GRAPH FOR THE GCC ISLAMIC INDICES

The graph shows the conditional correlation among the Islamic stock indices of the GCC countries. The are some peaks of correlation but still the correlation is stable and moderate over the time period.
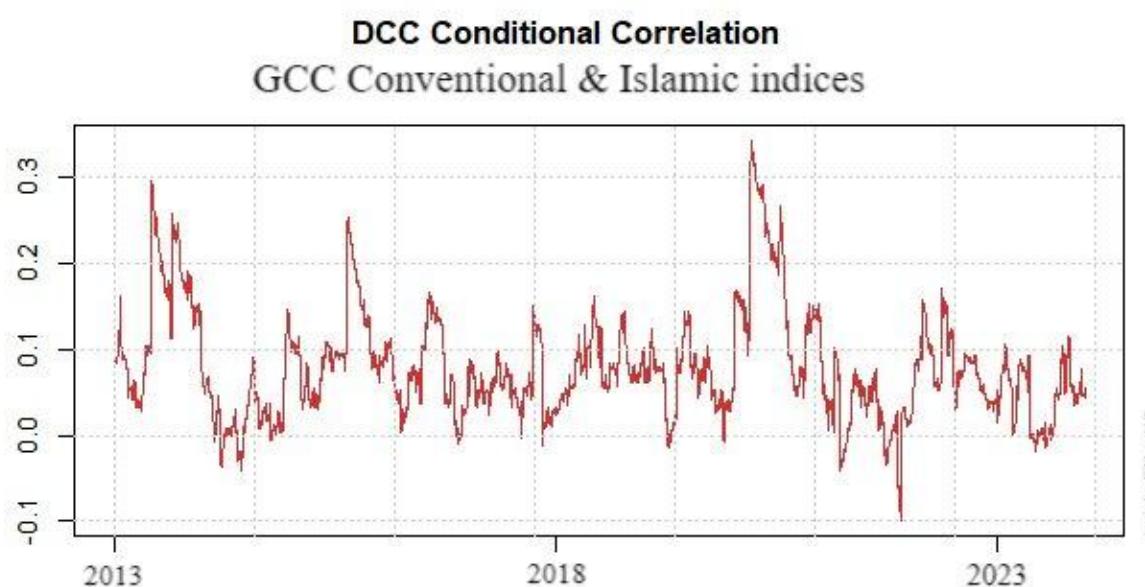
Figure 14. DCC MGARCH GRAPH FOR THE GCC CONVENTIONAL & ISLAMIC INDICES

The graph shows the dynamic conditional correlation among the conventional and Islamic stock indices of the GCC countries. The relationship is not quite stable and fluctuates with time.
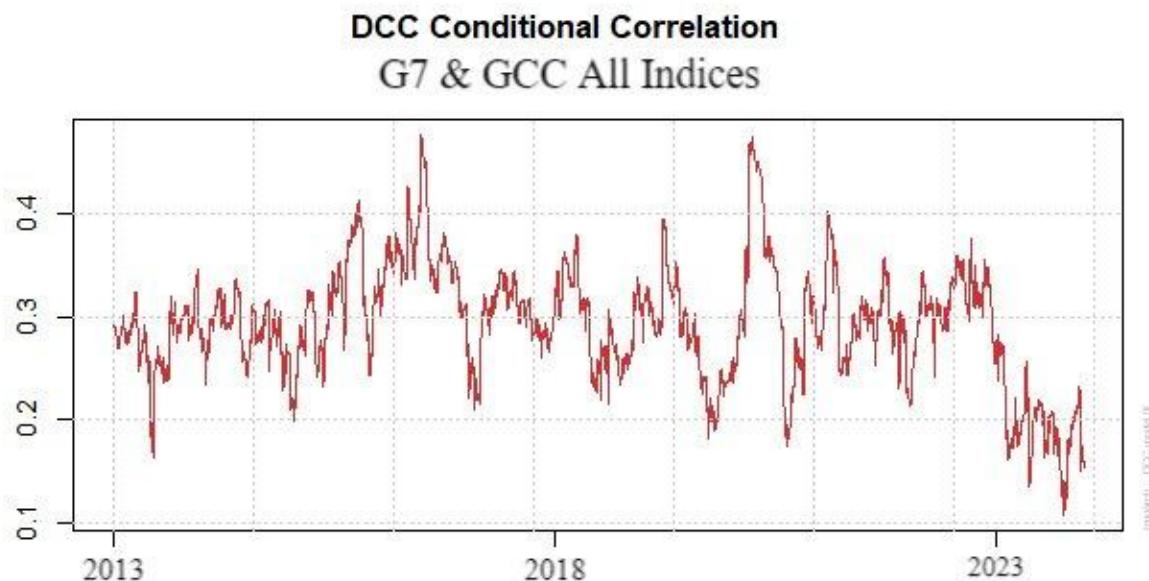
Figure 15. DCC MGARCH GRAPH FOR THE G7 ISLAMIC INDICES

The graph depicts the dynamic conditional correlation among the conventional and Islamic stock indices of G7 and GCC countries. The conditional correlation between the G7 and GCC fluctuates between 0.1 and 0.4. There are peaks and lows at different time period for the selected stock indices. There is lower conditional correlation before 2018 among the indices but after 2018 the conditional correlation increased and represents the co-movements among the indices. After 2020 dcc started to decline. The DCC MGARCH model depicts that the conditional correlation among the stock indices is not static but evolved with span of time.

5. Conclusion and Suggestions

The research intends to investigate the impact of COVID, Glasgow Climate Pact, Ukraine War and ChatGPT Launch on the conventional and Islamic stock indices of G7 and GCC countries. The researcher used event study methodology for investigating the impact of the mentioned four events which are dependent on events and DCC MGARCH model (which is not based on these events) for the diversification opportunities. Results depict that Overall G7 markets were negative before declaring COVID as a global pandemic. Mostly GCC indices were stable to COVID. Results are consistent with Khan et al. (2020), Singh et al. (2020) Yan and Qian (2020). Overall G7 markets were negative to the Glasgow Climate Pact. Mostly GCC indices were stable to the GCP. Results are consistent with Rogova and Aprelkova (2020); Pandey, Kumar and Kumari (2022), Phama, Ramiah and

Moosa (2020). G7 were mostly negative to Ukraine War. Overall GCC was stable to Ukraine war. Results are consistent with Boungou and Yatié (2022) Boubaker et al. (2022) Umar et al. (2022) Nerlinger and Utz (2022) Yousaf, Patel and Yarovaya (2022). Mostly G7 and GCC were negative to the ChatGPT launch. Results are mainly different with Zheng and Feng (2024). Researchers investigated impact of ChatGPT release on the NVIDIA. Dynamic Conditional Correlation is moderate among G7 Islamic and Conventional stock indices indicating moderate level of diversification. DCC among GCC Islamic and Conventional is less than 0.2 and offers more diversification. Investors can diversify their portfolio among G7 and GCC stock indices for better return with less risk. The findings show that Islamic stock indices provide CAR in case of Canada, Italy Turkey and UAE based on event-based analysis. Investors can seek diversification among MSCI Canada, MSCI France, MSCI France Islamic, MSCI Germany, MSCI Italy, MSCI UK, MSCI USA Islamic, MSCI Japan Islamic, MSCI Kuwait, MSCI Kuwait Islamic, MSCI Bahrain, MSCI Oman provides the diversification opportunities. The study contributed to the existing literature by investigating and comparing the G7 and GCC stock markets.

This research carries significant implications for international finance and global policy. First, it identifies GCC Shariah-compliant indices as a viable 'safe haven' for G7 investors during geopolitical and health-related shocks, offering a concrete strategy for risk reduction through regional and ethical diversification. Second, the study contributes to the advocacy of Islamic finance by empirically demonstrating its resilience—rooted in asset-backed requirements and low leverage—during periods of extreme market volatility. Furthermore, the findings regarding the Glasgow Climate Pact and ChatGPT launch provide a warning to policymakers: environmental and technological shifts create immediate systematic risks that transcend traditional market boundaries. Ultimately, this study empowers portfolio managers to make data-driven decisions on capital allocation and assists regulators in understanding how different financial frameworks (Islamic vs. Conventional) absorb global shocks, thereby fostering a more stable global financial ecosystem.

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Strategic Innovation Pathways in Shariah-Compliant Fintech: A Comparative Study of Saudi Arabia and Indonesia

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ABSTRACT:

Purpose: This study investigates the strategic management of innovation within the uncertain domain of Shariah-compliant fintech. It addresses a core dilemma for entrepreneurs and corporate innovators: navigating the tension between scaling efficient, low-risk digital products (Murabaha) and pioneering idealistic, high-risk business models (Musharakah). We develop a diagnostic framework to help firms forecast viable innovation pathways under divergent institutional conditions.

Design/methodology/approach: Employing a comparative, theory-building design, we conduct diagnostic case studies of the Saudi and Indonesian ecosystems. These inform a scenario planning exercise, constructing three plausible innovation regimes. The findings are synthesized into a Dynamic Causal Model that identifies the systemic loops driving or constraining strategic innovation.

Findings: The analysis reveals three distinct innovation regimes: Efficiency-Optimized Markets, Idealism-Enabled Ecosystems, and Stagnated Innovation Environments. Each regime dictates a primary strategic imperative for fintech firms, requiring specific organizational capabilities and resource allocation. The comparative analysis shows that the dominant constraint on innovation shifts from a product-level pragmatism trap in formal markets to a market-structure informality trap in emerging economies.

Originality/value: This paper moves from ecosystem description to a strategic management tool. Its primary contribution is a comparative forecasting framework that enables innovation managers to diagnose binding constraints, align their innovation portfolios with market trajectories, and make informed strategic choices between exploitation and exploration in ethical finance. For Islamic finance scholars, this study bridges Shariah governance theory and strategic management by demonstrating how centralized versus consultative governance structures create distinct innovation constraints and pathways.

Keywords: Fintech Innovation Management; Islamic Finance; Shariah Governance; Scenario Planning; Business Model Innovation; Strategic Forecasting.

JEL Classification: G23, O31, O32, M13, L26

Paper Type: Original Research Article

1 Introduction

The global fintech revolution has opened a frontier for business model innovation in financial services, with Shariah-compliant fintech representing a particularly complex and high-potential domain. For innovation managers and entrepreneurs in this space, a fundamental strategic dilemma crystallizes: should resources be allocated to refine and massively scale commercially proven, asset-backed digital products (Murabaha), or should firms pioneer more idealistic, trust-based profit-and-loss sharing models (Musharakah) that promise deeper customer relationships but entail greater operational and commercial risk? This tension between exploitative and exploratory innovation is not merely theoretical; it is a daily calculus that dictates R&D budgets, partnership choices, and long-term competitive positioning (March, 1991; Benner & Tushman, 2003).

This strategic uncertainty is amplified by radically different institutional landscapes. In Saudi Arabia, a state-orchestrated, digitally advanced ecosystem offers a clear regulatory vision but grapples with internal governance friction. In Indonesia, a vast market opportunity is underpinned by the pervasive challenge of informality, which redefines the very foundation of scalable business models. For a multinational fintech firm or a local venture, the "right" innovation strategy is contingent on accurately diagnosing which of these systemic conditions will dominate (Khanna & Palepu, 2010).

Consequently, this paper reframes the inquiry from policy assessment to strategic innovation management. We address the core research question: How can fintech firms strategically navigate and allocate resources between competing innovation trajectories in Shariah-compliant fintech, and what diagnostic framework can forecast the viability of these strategic choices across different national innovation systems?

To answer this, we develop a comparative forecasting model. The study proceeds by first grounding the analysis in relevant innovation management theory, then detailing a methodology combining diagnostic case studies and scenario planning for Saudi Arabia and Indonesia. We present three archetypal innovation regimes and derive a Dynamic Causal Model that captures the reinforcing and balancing loops critical for strategic planning. We conclude with targeted implications for innovation managers and ecosystem architects.

2 Literature Review

2.1 Innovation Management in Fintech: Exploitation vs. Exploration

Fintech is characterized by rapid cycles of business model innovation, where technology enables new value propositions and revenue models (Gomber et al., 2017). Managing an innovation portfolio here requires balancing exploitation—improving existing

offerings—with exploration—venturing into new, uncertain domains (March, 1991). We frame the "Murabaha-Musharakah Dichotomy" through this lens. Murabaha-based fintech represents exploitative innovation: optimizing a known model (cost-plus finance) through digital efficiency, data analytics, and automation. It leverages existing capabilities for incremental gains. Conversely, Musharakah-based models represent exploratory innovation: they require developing new capabilities in risk-sharing, joint-venture governance, transparent profit distribution, and building trust. They are inherently more uncertain but aim to create new market spaces and defensible competitive advantages (Khan, 2010; Farooq & Zaider, 2015). This strategic choice mirrors the broader challenge in technology ventures of choosing between refining a "minimum viable product" and investing in a more disruptive, platform-based model (Blank, 2013).

Technology Architecture as Strategic Choice: The choice of technology stack is a strategic commitment. Pursuing exploitative innovation in an Efficiency-Optimized Market often favors monolithic, highly optimized platforms that maximize speed and cost-efficiency for a single, scalable product like digital Murabaha. Conversely, succeeding in an Idealism-Enabled Ecosystem requires a modular, API-first architecture. Such a stack enables the secure integration of diverse partners, supports transparent profit-sharing calculations for Musharakah, and allows for the agile incorporation of trust-enhancing technologies like blockchain for immutable contract execution.

2.2 National Innovation Systems and Strategic Constraint

A firm's strategic options are shaped by the national innovation system in which it operates (Nelson, 1993). Saudi Arabia's system is formal, well-resourced, and driven by top-down Vision 2030 objectives, creating a specific set of opportunities (e.g., regulatory sandboxes) and constraints (e.g., complex Shariah governance) (Said & Alias, 2022). Indonesia's system is shaped by a massive, informal base, making the scaling of any formal, technology-driven business model a primary challenge (World Bank, 2021). The concept of institutional voids is critical (Khanna & Palepu, 2010); in Saudi Arabia, the void may be in the intermediation between ethical ideals and scalable products, while in Indonesia, it is in the foundational data and trust infrastructure. These voids become the dominant strategic constraints that innovation managers must address.

2.3 Forecasting and Scenario Planning in Strategic Management

In high-uncertainty environments, traditional linear forecasting fails. Scenario planning is an established strategic tool for exploring multiple, plausible futures to stress-test strategies and build organizational resilience (Schoemaker, 1995). Similarly, system dynamics modeling helps managers understand how feedback loops within a complex

system can create unintended consequences or lock-ins (Sterman, 2000). This paper integrates these approaches to build a strategic forecasting framework.

2.4 Shariah Governance as an Innovation Constraint/Enabler

The strategic innovation pathways in Shariah-compliant fintech are fundamentally shaped by the governance structures that interpret and enforce Islamic financial principles (Hassan et al., 2021).

Saudi Arabia's Centralized Governance Model: The Saudi ecosystem operates under a relatively centralized Shariah governance structure. This centralized approach creates standardized frameworks but can also slow exploratory innovation due to complex approval processes (Baber, 2022). The state's regulatory sandbox, administered by SAMA (2022), provides a key testing ground for innovations.

Indonesia's Decentralized, Consensus-Driven Model: Indonesia's Shariah governance operates through the DSN-MUI, which employs a more consultative, consensus-building approach (Abduh & Omar, 2023). While this allows for flexibility, it can create uncertainty for scalable fintech business models. The regulatory landscape, overseen by OJK (2024), is rapidly evolving to support the sector's growth (Hudaefi & Junari, 2023).

The Innovation Tension: This governance divergence creates a strategic tension. In Saudi Arabia, the constraint is often procedural—navigating a structured approval process. In Indonesia, the constraint is more structural—building scalable models within a flexible but fragmented governance and market landscape.

3   Methodology: A Comparative, Theory-Building Approach

3.1 Research Design

This study employs a qualitative, comparative theory-building methodology suitable for exploring "how" questions in complex, real-world contexts (Eisenhardt, 1989; Yin, 2018). We use a "most different systems" design (Przeworski & Teune, 1970), selecting Saudi Arabia and Indonesia as contrasting cases. The research unfolds in three phases: Diagnostic Case Studies, Scenario Planning, and Model Building.

3.2 Data Collection

Data for the diagnostic phase were drawn from multiple secondary sources (2019-2024): Corporate & Market Data (e.g., annual reports of fintech platforms), Policy & Regulatory Artifacts (e.g., SAMA framework, OJK regulations), and Industry & Third-Party Analyses (e.g., World Bank reports, Fintech Saudi publications).

3.3 Case Selection, Data Corpus, and Analytical Procedure

Saudi Arabia and Indonesia were selected as "most different" cases based on three theoretical dimensions: (1) Shariah Governance Structure, (2) Market Formality, and (3) Innovation Policy. Data were analyzed through structured thematic analysis (Braun & Clarke, 2006) to identify key drivers and barriers. The table below summarizes the data corpus.

Table 1: Summary of Diagnostic Data Corpus

Country	Data Type	Sources (Examples)	# of Entities Reviewed	Analytical Purpose
Saudi Arabia	Corporate/Regulatory/ Industry reports	Tamam, Sulfah; SAMA sandbox; Vision 2030	~15 fintech firms & initiatives	Identify drivers/barriers in a structured ecosystem
Indonesia	Corporate/Regulatory/ Academic reports	Various digital lenders; OJK regulations; DSN-MUI fatwas; World Bank (2021)	~20 fintech firms & initiatives	Identify drivers/barriers in an informal, high-growth market

3.4 Scenario Construction Process

From the diagnostics, two critical uncertainties were identified: (1) the resolution of the exploitation-exploration tension, and (2) the closure of the growth-stage "Missing Middle" financing gap. These were plotted on axes and, through iterative analysis for plausibility and strategic relevance, consolidated into three internally consistent, plausible scenarios (archetypal innovation regimes) for the evolution of the landscape up to 2030.

3.5 Limitations

The study's reliance on secondary data limits insights into internal firm decision-making. Future research could enrich this model through primary engagement with innovation managers, Shariah board members, and regulators. However, the strategic value lies in providing actionable guidance using publicly available data.

4   Diagnostic Findings and Archetypal Innovation Regimes

The scenario planning yielded three archetypal innovation regimes.

Table 2: Innovation Regimes and Strategic Imperatives

Innovation Regime	Core Market Logic	Strategic Imperative for Fintech Firms	Key Organizational Capabilities Required
1. Efficiency-Optimized Market	Competition on cost, speed, and scale in standardized digital credit.	Optimize & Dominate: Double down on operational excellence in Murabaha/digital lending.	Lean operations, advanced data analytics/AI, high-volume platform management.
2. Idealism-Enabled Ecosystem	Value creation through trusted partnerships enabling SME scale-up.	Pioneer & Partner: Lead in developing scalable Musharakah platforms. Form strategic alliances.	Risk-assessment for equity-like instruments, partnership management, blockchain development.
3. Stagnated Innovation Environment	High uncertainty and risk aversion suppress investment in novel models.	Preserve & Observe: Protect core revenue streams. Minimize exposure to experimental R&D.	Regulatory risk management, operational resilience, agility to pivot.

4.1 The Saudi Archetype: Managing Innovation in a Structured Ecosystem

The Saudi ecosystem is engineered for rapid digitization. The Saudi Arabian Monetary Authority (SAMA) has established a regulatory sandbox (SAMA, 2022) that provides a structured testing environment. The market is dominated by scalable Murabaha contracts, which industry analyses (Fintech Saudi, 2023; DinarStandard, 2024) suggest constitute a large majority of digital financing, rewarding exploitative innovation focused on process efficiency. Exploratory innovations like P2P Musharakah models remain niche. For a firm's innovation manager, the central strategic question is whether to leverage state support to pioneer a new model or to out-compete others on the established Murabaha track.

4.2 The Indonesian Archetype: Innovating from the Ground Up

Indonesia's landscape is defined by its scale and informality. World Bank (2021) data indicates that a vast majority of Indonesia's millions of businesses operate in the informal sector, creating what we term the Informality Trap. The primary innovation challenge is creating foundational conditions for scalable, formal business models. Successful innovation focuses on building "data collateral" through alternative credit scoring. The Indonesian Financial Services Authority (OJK) has responded with progressive regulations, including its 2024 framework for digital financial innovation (OJK, 2024). For a manager, the strategy must first solve for low-cost trust and verification.

4.3 The Dynamic Causal Model: A Diagnostic Tool for Strategic Management

We propose a Dynamic Causal Model that conceptualizes the innovation ecosystem as interacting feedback loops.

Table 3: The Dynamic Causal Model of Fintech Innovation

Loop	Type	Causal Sequence (Flow)	Strategic Interpretation for Managers
R1: Virtuous Cycle of Innovation	Reinforcing	Regulatory Support → Successful Exploratory Launch → Market Validation → Increased Ecosystem Attractiveness → Enhanced Regulatory Support	Early success can attract talent and capital. Getting into early sandbox cohorts is key.
B2: The Pragmatism Trap	Balancing	High Success of Exploitative Products → Resource Allocation to Exploitation → Starvation of Exploratory R&D → Market Entrenchment of Exploitative Models	The "cash cow" dilemma. Actively protect resources for exploratory projects.
B3: The Informality Vicious Cycle	Balancing	High Market Informality → High Onboarding Costs → Limited Viability of Formal Models → Reliance on Informal Finance → (Reinforced) Informality	The core challenge is innovating to radically lower the cost of trust and verification.

5   Discussion: Strategic and Managerial Implications

6.1 A Framework for Strategic Decision-Making

We propose a three-step process:

1.   Diagnose the Dominant Loop: Is the primary constraint the internal Pragmatism Trap (B2) or the external Informality Cycle (B3)?

2.   Assess the Probable Regime: Align your innovation portfolio with the likely market regime.

3.   Build Requisite Capabilities: Invest in the organizational capabilities critical for success in your chosen regime.

Guiding Portfolio Allocation: In an Efficiency-Optimized Market, skew toward exploitation (e.g., 80% on optimization). In an Idealism-Enabled Ecosystem, a balanced portfolio is viable (e.g., 50% exploration, 30% core, 20% R&D). In a Stagnated Environment, focus on preservation (e.g., 90% core).

6.2 Implications for Different Actors

For Fintech CEOs & R&D Heads: Maintain a balanced portfolio but be prepared to pivot based on ecosystem signals.

For Investors: Use the framework to evaluate if a startup's model is aligned with or contrarian to dominant ecosystem loops.

For Policymakers: Focus on de-risking exploration (e.g., through sandboxes) and lowering systemic transaction costs (e.g., digital public infrastructure).

Table 4: Strategic Tracking Indicators

Indicator	What it Measures	Strategic Insight
Exploratory vs. Exploitative Product Ratio	% of new product launches based on risk-sharing vs. asset-backed models.	Signals whether the ecosystem is reinforcing B2 or stimulating R1.
Scale-Up Capital Flow	Volume of institutional investment into growth-stage fintechs.	A lagging indicator of investor confidence in exploratory models.
Regulatory Experimentation Rate	Number of live tests in sandboxes focusing on new models.	A leading indicator of regulatory support for exploratory innovation (R1).

6   Conclusion

This study has reframed the evolution of Shariah-compliant fintech as a strategic innovation management challenge. The comparative forecasting framework identifies three archetypal innovation regimes and the dynamic causal loops that underpin them.

6.1 Theoretical Contributions

This research makes three distinct contributions:

1.   To Islamic fintech literature, it provides a strategic forecasting framework linking governance structures to firm-level innovation pathways.

2.   To innovation management theory, it extends the exploitation–exploration dilemma into ethical finance, showing how institutional voids become strategic traps.

3.   For Shariah governance research, it reframes governance from a compliance function into an active strategic variable that shapes market evolution.

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Adoption of IoT in insurance sector of Bangladesh

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ABSTRACT

Background: The idea of insurance was discovered several millennia before Christ (BC). In the second and third millennia BC, traders from China and Babylonia practiced shifting or dispersing risks. Today, insurance is the foundation of the economy, but expanding its penetration is difficult in emerging nations. The fourth insurance industry revolution in the developed world was sparked by the recent advent of IoT, Big Data, and InsurTech.

Objective: To boost insurance coverage in Bangladesh, this study examines the problems with and potential solutions to IoT.

Research Methodology: To identify the themes and factors pertaining to problems and solutions in implementing IoT in Bangladesh's insurance business, this study used a systematic literature review. To find pertinent material from Google Scholar, several keywords were employed. The filtered studies were examined based on inclusion and exclusion standards.

Findings: This report outlined many obstacles to IoT adoption in the Bangladesh's insurance sector as well as potential remedies. The proposals could help policymakers improve the insurance industry service delivery.

Keywords: InsurTech, Insurance Industry**,** Digital Technologies, Bangladesh

JEL Classification: G22

Paper Type: Systematic Literature Review (SLR)

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1. Introduction

IoT can transform the health insurance sector by providing patient data gathered through wearable technologies or body sensors to caregivers and insurance sector for improving the well-being of population. Rainfall-based index insurance has proved beneficial for the agriculture sector and insurance sector who use this IoT based technology to identify and measure the risk and accordingly transfer the claim amount that reduces the bogus claim rate and adverse selection issue. IoT devices can intimate the risk before its occurrence like fire smog or water clogging which is beneficial for insurance sector to reduce the claim reimbursement amount as policyholder is informed about risk to stop its occurrence. Data collected by IoT devices is also beneficial to take better decisions regarding altering the business model and bringing customization in offering products or services. Limited study found in IoT adoption in Bangladesh's insurance sector. As per study, smart devices help in underwriting the policy based on past behavior. These several texts of law touch on the status of insurance agents and the regulations of this profession.

The Bangladesh's insurance sector is experiencing a shift toward digital transformation, with key players adopting digital platforms and bancassurance models to enhance accessibility and customer experience (Paul, 2025). Despite of low penetration, Bangladesh's insurance sector is increasingly leveraging digital innovation (Daily Capital Views, 2025). Insurance Development and Regulatory Authority is enabling InsurTech innovation reflect growing institutional support for technology adoption in the sector (Mahmudul Hasan & Halder, 2023).

This study fill gap by exploring the challenges along with solutions in adoption of IoT technology in Bangladesh's insurance sector by using SLR methodology.

2. Literature review

Direct insurance-IoT studies are limited in Bangladesh, therefore, a strategy of synthesize broader Bangladesh IoT adoption evidence and map it to insurance is adopted. Reviewers take out the following data from the involved papers: author name, year of publication, country of publication, publication type and findings. Consequently, a narrative synthesis of the derived information was attained. Table 1 denotes to included literature like articles, conference or book along with methodology and year. Table 2 denotes challenges and solutions derived after reviewing the selected studies.

Table 1 Characteristics of reviewed IoT adoption studies in Bangladesh insurance sector

No.	Journal/	Paper topic/	Method	Year	Author

	Conference/Report Name	Conference paper Name			
1	International Journal for Research in Applied Science and Engineering Technology	Smart Campus Using IoT with Bangladesh Perspective: A Possibility and Limitation	Exploratory	2017	(Nadim et al., 2017)
2	IEEE 2018 International Conference on Innovations in Science, Engineering and Technology (ICISET) -	An Internet of Things (IoT) based Smart Traffic Management System: A Context of Bangladesh		2018	(Kadar et al., 2018)
3	Proceedings	IoT Based Smart Healthcare Services for Rural Unprivileged People in Bangladesh: Current Situation and Challenges		2020	(Monirujjaman, 2020)
4	Institute of Appropriate Technology (IAT)	Strategic approach to facilitate integration of internet of things (IoT) in health care sector of Bangladesh.		2020	(Iftekhar, 2020)
5	Internet of Things and Cloud Computing	Impact of Internet of Thing in Developing Country: Systematic Review	SLR	2019	(Gizealew & Sisay, 2019)
6	bondstein.com	IoT & its prospect in Bangladesh	Exploratory	2021	(Bondstein, 2021)
7	www.cirt.gov.bd	IoT possibility and challenges in bangladesh context		2021	(Badsha, M. 2021)

8	Information and Communication Technology Division Government of the People's Republic of Bangladesh	National Internet of Things Strategy Bangladesh		2020	(BCC, 2020)
9	thefinancialexpress.com	Challenges before IoT in Bangladesh		2018	(Kamal & Anuron, 2018)
10	www.takestips.com /iot-in-bangladesh	IOT in Bangladesh		2021	(Takes Tips, 2021)

Table 2 IoT adoption in Bangladesh Insurance Industry: Issues & Solutions

No. of Studies	Issues	Solutions
Study 1	- Physical impediment, Lack of equipment - Software and technological barrier, Network and storage barrier - Legal and security - Iot concept, application framework, and inter-object communication protocol are still under development and will take time to mature.	Nil
Study 2	- Bangladesh has minimal smart traffic research. - Currently, closed-circuit cameras and automobile identification technologies are utilised to control traffic congestion. However, under wet and foggy conditions, this system fails.	Nil
Study 3	- Resource constraints, People's unwillingness to accept modern technologies - Inadequate marketing of the system, Patient trust difficulties - Public awareness, particularly rural, Insufficient starting capital - Incompetent startup management team, Staff desire to avoid rural employment	We must educate these individuals about health. So the government must help private businesses.

		Healthcare is a large and vital sector for humans.
Study 4	• Absence of internet connection (even 3G) • Lack of competent iot workers, User mentality • Lack of power, Availability of iot devices and services such as lighting, locks, thermostats, and sensors • Lack of financial support, Smart home iot services need Google Home or Alexa, which aren't nationwide.	• Nil
Study 5	• Absence of internet connection (even 3G) • Lack of competent iot workers, User mentality, • Lack of power, Availability of iot devices and services such as lighting, locks, thermostats, and sensors • Lack of funding, • It needs smart home helpers like Google Home or Alexa, which aren't completely working yet in the nation.	• Nil
Study 6	• The country must provide internet access for IoT technologies. • The weak industry-academic cooperation causes a shortage of technologically trained staff and research and development (R&D) resources. • The majority of market leaders are unwilling to use IoT technology due to the possibility of creating bottlenecks in their everyday procedures. • Instability in electrical supply throughout the nation, affecting both families and industry, preventing broad adoption.	• Nil
Study 7	• Nil	• Blockchain-based IoT security is a promising new approach.

Study 8	• Incompatibility of IoT devices with IoT systems. • Data protection, privacy, and security are key challenges. • Technical standards and compatibility vary everywhere. Although most are open standards, value-paying businesses want to set their own.	• Nil
Study 9	• The country's electrical supply is a key challenge for IoT devices. • Building and running devices is expensive. Government restrictions hinder IoT commercialization.	• Nil
Study 10	• Bangladesh's IOT condition is not excellent. • Hardware is the equipment that receives data from the source. • Most hardware in Bangladesh is imported from other nations. • Applications that store, analyse, or handle personal data need highly qualified developers, which Bangladesh lacks. • While the ignorant are oblivious of the internet of thought, many educated are as well. • Because there is no market for IOT devices or services in Bangladesh, they should be made as widely accessible as feasible. • Although IOT devices in Bangladesh are more safe, their security or privacy may be compromised. This happens often due to hacking or piracy, both of which are crimes. Being programmable, IoT devices may cause havoc in the workplace. If any mistake is identified, it causes a lot of issues. • Again, damage to any portion might complicate the whole apparatus. Interconnections between components may sometimes be hampered. This arises due to the failure to maintain relationships between components.	• Raising public awareness. • Again, extensive technical, mechanical, and electrical training is required.

3. Research Methodology

Systematic literature review identifies, selects, and critically appraises research to answer a clearly formulated question (Dewey & Drahota, 2016).

In this study, a **Systematic Literature Review (SLR)** methodology is adopted to identify, evaluate, and synthesize prior research on IoT adoption challenges and solutions in the Bangladesh insurance sector as mentioned in table 3 and table 4. Google Scholar was selected as the primary database due to its broad coverage of peer-reviewed journal articles between **2017 and 2021**. A structured keyword strategy combining *"IoT," "insurance sector," "Bangladesh," "challenges,"* and *"solutions"* was applied alongwith Quality screening criteria like only English-language studies discussed IoT adoption issues within the Bangladesh context published in peer-reviewed or authoritative sources. After removing duplicates and irrelevant records, the final set of studies was subjected to thematic and content analysis.

Table 3 Keywords Selections

IoT	Literature and conference proceedings on IoT in the Bangladesh financial industry, particularly insurance and health insurance. Past works available since 2017. Primary and secondary research	Studies not in English Magazine, newspaper, thesis, report data Studies in non-financial fields including education, manufacturing Large-scale data analytics and other technologies	Papers publishing platforms such as Google scholar and emerald were opted as the exploring means for this review. Following blend of search, terms are applied: IoT* AND (insurance sector*) AND (challenge* OR obstacle* OR issue* OR disadvantage* OR threat). The exploration was carried out between 2017 to 2020.

Table 4 Selection Criteria

IoT	**Identification**	10
	Screening	9 after removing 1 duplicate
	Eligibility	8 after removing 1 archive

Included	5 after removing 3 full articles

4. Findings of the Included Studies

Based on thematic and content analysis of the selected studies, the challenges related to IoT adoption in the Bangladesh insurance sector were grouped into six major themes. These themes reflect recurring barriers identified across the reviewed literature and highlight areas requiring policy and managerial intervention.

There are many issues and solutions derived from literature reviewed by using systematic literature technique. Issues and solutions are further categorized under sub-heading by using content analysis. Table 5 provides the challenges faced by the insurance industry, while some prominent solutions are pointed out in Table 6 which are derived after reviewing the repeating nature of challenges and solutions.

Theme 1: Digital and Energy Infrastructure Constraints

The first issue is infrastructure. The Internet of Things necessitates seamless and rapid connection among all things. Wired backbone in nation is quite expensive. Wireless technologies like 3G, WiMAX, and 4G-LTE may give internet access. This causes issues with internet speed, power consumption, and cost per unit use. Authorities may use a hybrid internet backbone with a national fiber-optic data highway, local and national data centers, and regional WiMAX and 4G service points. Internet uses up to 5% of total energy produced today, and IoT needs are rising. Energy efficient and reliable data center powered on gathered energy can benefit developing nations. Electricity planning is lacking in poor nations. IoT for developing nations (IoT4D) can help in providing power solutions by allowing clean energy technology, smarter energy markets, and optimizing current goods (Gizealew & Sisay, 2019). Instability in electrical supply throughout the nation, both in families and industry, preventing its adoption (Bondstein, 2021).

Theme 2: Data Privacy, Cybersecurity, and Trust Issues

The second issue is privacy and security. IoT security is evolving (Gizealew & Sisay, 2019). Although IOT devices in Bangladesh are safer, their security or privacy may be compromised. This happens often due to hacking or piracy, both of which are crimes. Being programmable, IoT devices may cause havoc in the workplace. If a mistake is identified, it causes a lot of issues (Takes Tips, 2021). Blockchain-based IoT security is a promising new approach for preventing privay leakage (Badsha, 2021).

Theme 3: Technological Maturity and System Compatibility

Third, IoT concept, application framework, and inter-object communication protocol is still under development (Nadim et al., 2017). Fourth, research on smart traffic systems is lacking in Bangladesh (Kadar et al., 2018). There are few research centers. The financing for inventions is at a low point (Gizealew & Sisay, 2019). Fifth difficulty is limited technological resources. Smart home IoT services need Google Home or Alexa, which are not completely functioning in the nation (Iftekhar, 2020). For impoverished nations, IoT devices must be sturdy, energy efficient, and battery powered for months. They should utilize solar energy to recharge. Sensors that are exposed to the environment must be of excellent quality and long-lasting. Sensors are the IoT's raw material, yet they are costly owing to purchase and shipping costs from developed nations (Gizealew & Sisay, 2019). Because there is no market for IOT devices or services in Bangladesh, they should be made as widely accessible as feasible. Smart lights and locks are available at a few Chinese electrical stores, although they are pricey.

Theme 4: Human Capital and Technical Skill Deficit

The eleventh issue is the lack of expert staff. IoT demands expertise in IoT architecture, data science, security, and AI/ML (Monirujjaman, 2020). Lots of technical, mechanical and electrical training is required (Takes, 2021).

Theme 5: Low Awareness, Resistance to Change, and Consumer Attitudes

Experts agree that consumer attitude is critical to embracing new technologies like IoT, yet Bangladeshi consumers now lack this perspective (Kamal & Anuron, 2018). The sixth barrier is people's disinterest in embracing new technologies (Monirujjaman, 2020). Because IoT technologies create bottlenecks in normal company procedures, most market leaders are unwilling to use them.

The seventh issue is lack of adequate marketing of this device (Monirujjaman, 2020). The eighth concern is trust (Monirujjaman, 2020). User safety, user-based assessment, and expectations of IoT product competency all play a role in the idea of trust. These elements influence customer adoption. Trust lets people discern between trustworthy items and technology (AlHogail, 2018).

The ninth obstacle is raising rural people's awareness (Tips, 2021). ICT can help Bangladesh to fight poverty. Radio, TV, phones, and internet provide information to farmers and small business owners. They can thus make more informed judgments about which markets to sell leading to avoiding intermediaries or have greater negotiating power if they do sell to middlemen. Websites can readily show different laws and regulations of conducting business and the overall investment environment in

Bangladesh. ICT helps in reducing poverty by boosting information and communication flows throughout the Bangladeshi people (NerdySeal, 2021).

Theme 6: Financial Constraints and Regulatory Barriers

Tenth issue is the shortage of operating funds. Success in IoT initiatives begins with a clear knowledge of the business challenges to be solved, the investment required, and the anticipated ROI (Sam, 2019). Finally, present government rules are one of the impediments to commercializing IoT. As solutions, education is essential for individuals about health based IoT devices. Government must help private businesses working in this field. Healthcare is a large and vital sector for humans (Takes Tips, 2021).

Table 5 IoT Adoption Challenges in Bangladesh Insurance Industry

Infrastructural barrier
Privacy & safety
Iot concept, application framework, and inter-object communication protocol are continually evolving.
Bangladesh has minimal smart traffic research.
Resource constraints
People's unwillingness to accept modern technologies
Inadequate marketing of the system
Patient trust difficulties
Public awareness, particularly rural
Funding shortfall
Incompetent team
Disparities in standardisation and obstacles in integrating iot devices with iot systems.
Government regulations are one of the obstacles to commercialising iot.

Table 6 IoT Adoption Solutions in Bangladesh Insurance Industry

We must educate these individuals about health. So the government must help private businesses. Healthcare is a large and vital sector for humans.
Blockchain-based iot security is a promising new approach.

5. Conclusion

This study explores the challenges and potential solutions related to the adoption of IoT in the Bangladesh insurance sector. The findings reveal that inadequate infrastructure, weak regulatory support, security and privacy concerns, lack of skilled human capital, low public awareness, and high implementation costs are the primary barriers hindering IoT adoption. Despite these challenges, IoT holds strong potential to transform insurance operations. Policymakers can support stakeholder collaboration to accelerate IoT-driven

digital transformation in the insurance industry. This study is limited by its reliance on secondary data obtained through a systematic literature review. The exclusion of non-English publications may also result in the omission of relevant local studies. Future research should employ empirical methods such as surveys, interviews, or case studies involving insurers, regulators, and policyholders to validate the findings.

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DFAS-GDR: Governance deployment Roadmap — Implementation frameworks and adoption protocols for the DFAS Governance Convergence Doctrine

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ABSTRACT:

This manuscript provides the institutional deployment roadmap for the DFAS-AI Governance Convergence, a doctrinal framework for ethical and operational artificial intelligence governance in financial institutions. It delivers structured implementation strategies and standardized adoption protocols for banks, regulators, and auditors, addressing critical gaps identified in current AI governance practice. The proposed framework translates high-level governance principles into enforceable, auditable, and real-time operational systems, operationalizing recommendations of the OECD AI Principles and the EU AI Act within financial contexts. It integrates doctrinal components such as DFAS-FEP, DFAS-DAIF, DFAS-AAP, DFAS-CICP, DFAS-GIC, DFAS-CP, and DFAS-IFRS into institutional infrastructures, aligning ethical mandates with regulatory compliance and organizational resilience. This work addresses the urgent need for scalable, transparent, and context-sensitive AI governance in finance, moving beyond aspirational ideals to institutional reality, consistent with the growing call for accountable and auditable AI systems in high-stakes domains.

Keywords: Dynamic Financial Governance; Governance Deployment Roadmap; Islamic Banking; Ethical Finance; Financial Regulation; Applied Governance; Policy Framework; Institutional Governance; Risk Management; Ethical AI in Finance.

JEL Classification: G28, O33, L51

Paper Type: Conceptual / Policy & Governance Framework

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1. Introduction: From Doctrine to Deployment

The **DFAS-AI Governance** Convergence represents a pioneering doctrinal architecture designed to deliver enforceable, ethical, and sovereignty-sensitive governance of artificial intelligence (AI) within high-stakes financial systems. Conceptually rooted in the principles of transparency, accountability, explainability, and resilience (Floridi & Cowls, 2022; OECD, 2021), the *Governance Convergence Doctrine (DFAS-GC)* advances beyond the aspirational nature of prevailing AI guidelines by offering a comprehensive, operationally actionable framework. As contemporary literature has noted, the gap between normative AI principles and their implementation in organizational practice remains a critical barrier to trustworthy AI adoption (Morley et al., 2021; Jobin et al., 2019).

Dynamic Financial Applied Meta-Science (DFAS) is a doctrinally governed discipline that integrates advanced quantitative methods, AI-assisted modelling, and enforceable governance to redefine financial modelling, decision-making, and research as a sovereign-sensitive, ESG-integrated, and volatility-grounded applied science. Conceived by Alaali (2025), DFAS embeds ethical, regulatory, and institutional safeguards, including DFAS-FEP and DFAS-GIC, directly into its doctrine, ensuring transparency, accountability, and integrity in high-stakes, real-time financial ecosystems.

While the convergence establishes a theoretically coherent and institutionally robust doctrine, its transformative potential depends on its **deployment within real-world infrastructures**. Financial institutions, in particular, face heightened urgency given the material risks posed by opaque algorithmic decisions, jurisdictional regulatory fragmentation, and the ethical implications of AI-driven market operations (European Union, 2021). Without enforceable governance systems, principles alone risk becoming performative rather than substantive, failing to prevent ethical drift or mitigate systemic risks.

This manuscript explicitly addresses this translational gap by offering a **structured roadmap for institutional deployment of the DFAS-AI Governance Convergence doctrine**. It articulates detailed pathways through which banks, audit firms, regulators, and sovereign authorities can systematically onboard, integrate, and operationalize the Convergence's protocols, embedding its doctrinal principles into day-to-day governance and risk management systems.

By translating high-level doctrine into actionable governance infrastructure, this work empowers stakeholders to realize the full benefits of dynamic, transparent, and accountable AI governance. Specifically, it addresses the most pressing operational challenges currently confronting AI deployment in finance:

- Algorithmic opacity and explainability gaps (OECD, 2021).
- Ethical drift and normative misalignment over time (Jobin et al., 2019).
- Override traceability and human-in-the-loop accountability failures (Floridi, 2019).
- Jurisdictional complexity arising from sovereign regulatory divergence (EU AI Act, 2021).

Positioned at the intersection of doctrinal rigor and operational feasibility, this manuscript contributes not only a deployment guide for the DFAS-AI Governance Convergence but also a conceptual advance in the ongoing discourse on AI governance as a living institutional practice, rather than a static regulatory aspiration.

Motivation and Research Positioning:

The DFAS-AI Governance Deployment (DFAS-GDR) protocol represents a significant advance in the literature on AI governance in finance by operationalizing doctrinal governance principles into a fully articulated, scalable, and sovereign-sensitive deployment framework. While prior studies have established ethical principles for AI (OECD, 2021; Jobin et al., 2019) and regulatory baselines for high-risk systems (European Commission, 2023), these works remain largely conceptual or legalistic. DFAS-GDR bridges this gap by offering a step-by-step institutional roadmap, branded governance mechanisms (e.g., AOCC, A-SSEI, A-PAD), and integration pathways with existing standards (e.g., COSO, IFRS, SOX).

The novelty of DFAS-GDR lies in four distinct contributions:

- It introduces **sovereign-aware governance** through the Alaali Sovereign Sensitivity Enforcement Interface (A-SSEI), addressing jurisdictional risk neglected in mainstream frameworks.
- It formalizes **branded operational mechanisms** (e.g., A-AOCC, A-PAD) designed specifically for the AI finance intersection.
- It integrates doctrinal ethics into a **certification-oriented, audit-traceable deployment protocol**.
- It extends the literature by embedding AI governance in the complex adaptive systems view of financial institutions, aligning with principles from organizational theory (Holland, 1992) and agent-based governance models (Tesfatsion, 2006).

By moving beyond abstract principles into operational doctrine, DFAS-GDR sets a new standard for enforceable, auditable, and sovereign-sensitive AI governance in financial systems.

Existing AI governance frameworks in finance remain structurally fragmented across multiple layers of abstraction. Ethical initiatives such as the OECD AI Principles articulate normative values without enforceable execution mechanisms; regulatory instruments such as the EU AI Act provide legal classification and compliance obligations without operational override governance; risk-oriented frameworks such as the NIST AI Risk Management Framework emphasize assessment and mitigation without institutional command structures; and traditional control systems such as COSO and SOX were not designed for autonomous, learning-based financial systems. Consequently, none of these frameworks provide integrated solutions for override governance, authorship traceability, sovereign calibration, or real-time enforcement within AI-driven financial infrastructures. DFAS-GDR explicitly consolidates these missing dimensions into a single deployable governance architecture, translating abstract principles and regulatory mandates into auditable, enforceable, and institutionally embedded systems.

Table 1. Comparative Analysis of AI Governance Frameworks in Finance

Governance Dimension	OECD AI Principles	EU AI Act	NIST AI RMF	COSO / SOX	DFAS-GDR
Normative Ethical Principles	✓	✓	✓	✗	✓
Legal Enforceability	✗	✓	✗	✓	✓
Risk Identification & Assessment	Partial	Partial	✓	✓	✓
Override Governance Architecture	✗	✗	✗	✗	✓
Authorship Traceability	✗	✗	✗	✗	✓
Sovereign Sensitivity & Jurisdictional Calibration	✗	Partial	✗	✗	✓
Real-Time Monitoring & Enforcement	✗	✗	Partial	✗	✓
Audit-Ready AI Governance	✗	Partial	Partial	✓	✓
Financial-System Specific Design	✗	Partial	✗	✓	✓
Deployment-Ready Institutional Roadmap	✗	✗	✗	✗	✓

These structural gaps and the corresponding governance coverage of DFAS-GDR relative to existing frameworks are summarized in Table 1.

2. Scope and Stakeholders

The **DFAS Deployment Protocol** provides a structured roadmap for a wide spectrum of actors engaged in the governance, development, deployment, and oversight of artificial intelligence (AI) applications within financial systems. In response to the increasing institutionalization of AI in finance, and the attendant systemic, ethical, and operational risks, the Protocol establishes actionable governance guidance grounded in doctrinal rigor (Floridi & Cowls, 2022; OECD, 2021).

Its intended scope explicitly encompasses the following stakeholder categories:

- **Central banks and financial regulators**, tasked with preserving systemic stability, managing macroprudential risk, and enforcing jurisdictional compliance within increasingly AI-augmented financial ecosystems (BIS, 2022; OECD, 2021).
- **Public and private financial institutions**, which leverage AI for critical functions such as valuation modelling, credit risk assessment, scenario-based stress testing, market surveillance, and real-time reporting (IFRS Foundation, 2023).
- **Global audit and assurance firms**, charged with validating compliance, transparency, accountability, and ethical integrity of AI-enabled financial processes, in alignment with emerging international standards for trustworthy AI (NIST, 2023).
- **AI-based financial model developers and governance boards**, who architect, implement, and monitor algorithmic models while embedding governance, explainability, and accountability into their operational lifecycle (Alaali, 2025a; Alaali, 2025b).

The Protocol is applicable to any entity deploying AI technologies in high-stakes financial activities, including valuation, credit scoring, solvency forecasting, or sustainability-linked reporting, reflecting the growing pervasiveness and materiality of AI within modern financial and regulatory architectures (European Commission, 2023).

By addressing this diverse constellation of stakeholders, the DFAS Deployment Protocol advances beyond aspirational principles to deliver a coherent, enforceable governance pathway that is context-aware, jurisdictionally adaptive, and operationally scalable.

3. Implementation Framework: 5-Phase Institutional Roadmap

For clarity, DFAS-branded components (e.g., A-AOCC, A-PAD, A-SSEI) are governance mechanisms rather than proprietary technologies, introduced as conceptual instruments to ensure traceability, accountability, and enforceability within financial AI systems.

The **DFAS Deployment Protocol** prescribes a structured, five-phase roadmap to guide institutions through the systematic adoption, integration, certification, and continuous governance of AI within financial systems. This phased implementation ensures operational readiness, regulatory alignment, and scalability, addressing the persistent gaps between AI governance principles and their institutional realization (Morley et al., 2021; Floridi & Cowls, 2022).

Phase 1: Strategic Onboarding

The foundational phase establishes institutional readiness and governance baselines:

- Appoint a dedicated **DFAS Compliance Officer** to oversee cross-departmental governance integration and stakeholder coordination (Alaali, 2025b).
- Conduct a comprehensive inventory of all AI-enabled financial models currently deployed, including valuation engines, credit risk scorers, and scenario simulation systems, to establish governance perimeters (BIS, 2022).
- Classify each AI system according to the **DFAS-FEP authorship classes (I–IV)**, which calibrate governance intensity based on authorship complexity and ethical exposure (Alaali, 2025d).
- Establish robust version control and immutable audit trail systems (e.g., GitHub, Overleaf, Zenodo) to maintain provenance, traceability, and transparency of model evolution and override decisions (NIST, 2023).

Phase 2: Engine Integration

This phase operationalizes governance mechanisms across institutional workflows:

- Deploy the **Dynamic Audit Intelligence Framework (DAIF)** to implement predictive, real-time audit triggers designed to monitor financial volatility, sovereign risk, and ethical compliance (Alaali, 2025c).
- Integrate the **DFAS-AAP protocol** to embed override logic, accountability hierarchies, and explainability mechanisms within organizational AI decision layers (Alaali, 2025e).
- Implement the **Control & Internal Control Protocol (DFAS-CICP)** to enforce dynamic internal controls that operate continuously, even in distributed decision architectures (Alaali, 2025f).
- Calibrate the **Sovereign Support Assessment Factor (SSAF)** for each jurisdiction to reflect localized ethical, legal, and regulatory sensitivities, ensuring sovereign-aware governance (OECD, 2021).

Phase 3: Certification and Compliance Alignment

This phase ensures alignment with ethical, regulatory, and operational standards:

- Evaluate AI models using the **DFAS Compliance Scoring Matrix (CSM)** to quantify governance maturity, ethical alignment, and systemic risk exposure (Alaali, 2025b).
- Assign certification tiers — *DFAS-Aware, DFAS-Verified, DFAS-Certified* — to each system, guiding deployment permissions, audit intensities, and operational scope (Alaali, 2025b).
- Document and maintain override command chains, traceability logs, and decision audit trails as mandatory compliance artifacts, supporting explainability and accountability (NIST, 2023).
- Align institutional reporting and financial disclosures with the **DFAS-IFRS Code of Ethics**, ensuring that ethical AI governance is transparently reflected in organizational communication and accountability channels (IFRS Foundation, 2023).

Phase 4: Policy Embedding and Institutionalization

The fourth phase institutionalizes DFAS governance standards into the formal policy and oversight architecture of the organization, ensuring sustainability and accountability beyond initial deployment:

- Embed **DFAS governance principles** into corporate board policies, internal audit charters, and risk management frameworks, aligning them with emerging global standards such as the EU AI Act and OECD AI Principles (European Commission, 2023).
- Establish clear escalation protocols leveraging the **Alaali Authority of Override Command Chain (A-AOCC)** and the **Alaali Explainability Escalation Framework (AEEF)** to manage ethical interventions and ensure traceable accountability (Alaali, 2025b).
- Revise and update institutional audit charters and control frameworks to explicitly incorporate DFAS-compliant audit pathways and override documentation requirements, reinforcing governance effectiveness (BIS, 2022).

Phase 5: Monitoring, Feedback, and Continuous Enforcement

The final phase ensures that governance remains dynamic and responsive to systemic, technological, and organizational changes:

- Recalculate and update **Alaali Authorship Contribution Scores (Alaali-ACS)** at regular intervals (e.g., annually), reflecting personnel changes, model retraining cycles, and governance adjustments (Alaali, 2025d).
- Deploy the **Alaali Normative Drift Detection Engine (A-NDDE)** to continuously monitor AI behavioural drift, flagging ethical deviations or emergent biases in real time (Alaali, 2025c).
- Utilize the **Alaali Predictive Audit Daemon (A-PAD)** and **Alaali Sovereign Sensitivity Enforcement Interface (A-SSEI)** to dynamically calibrate governance according to evolving stakeholder influence and geopolitical risk factors (Alaali, 2025c).
- Publish transparent, public-facing audit summaries and annual governance reports, reinforcing regulatory compliance and strengthening stakeholder trust (OECD, 2021).

4. Adoption Protocol: Step-by-Step Template

Successful institutionalization of the **DFAS-AI Governance Convergence** requires an explicit, structured adoption pathway. This template provides a practical roadmap for formalizing governance commitments, embedding accountability mechanisms, and operationalizing ethical oversight.

Step 1: Declaration of Intent

Formally declare the adoption of the DFAS-AI Governance Convergence as the principal doctrinal framework governing AI authorship classification, deployment, and compliance:

"We formally declare the adoption of the DFAS-AI Governance Convergence as the primary doctrine governing AI use, authorship classification, and compliance in our financial modelling infrastructure."

This public declaration establishes institutional accountability and signals proactive alignment with international AI governance norms (OECD, 2021; European Commission, 2023).

Step 2: Scope Identification

Define the boundaries of governance application:

- Internal models only
- Internal plus third-party/vendor models

- Entire organizational AI infrastructure, including outsourced, cloud-hosted, and edge deployments (BIS, 2022)
  Identify the departments and functions within scope:
- Valuation and financial modelling
- Risk management
- ESG and sustainability analytics
- Compliance and internal audit

Step 3: Governance Setup

- Appoint **DFAS Officers** responsible for compliance oversight, override authority, and audit log stewardship (Alaali, 2025b).
- Establish a centralized **Alaali Model Registry**, ensuring model traceability, version control, and governance classification (Alaali, 2025d).
- Assign **Alaali Authorship Contribution Scores (Alaali-ACS)** and DFAS-FEP classifications (I–IV) to all models, calibrating oversight intensity accordingly (Alaali, 2025d).

Step 4: Documentation Infrastructure

- Archive models in secure, version-controlled repositories (e.g., GitHub, Overleaf, Zenodo) to maintain immutability and audit readiness (NIST, 2023).
- Mandate disclosure forms for Class II and III models, documenting authorship, intended use, and risk profile.
- Attach override log templates and explainability documentation to every model artifact, supporting transparency and reviewability (Alaali, 2025d).

Step 5: Certification Process

- Submit models to internal **DFAS-CP evaluation**, assigning certification tiers (e.g., DFAS-Aware, DFAS-Verified, DFAS-Certified) and risk ratings (Alaali, 2025b).
- Optionally seek external audit or DFAS Institute validation for additional assurance.
- Maintain certification status through periodic recertification cycles, ensuring alignment with evolving governance standards (IFRS Foundation, 2023).

Step 6: Enforcement and Accountability

- Integrate DFAS-defined audit thresholds and override triggers into routine audits and risk reports (BIS, 2022).

- Escalate violations through the **Alaali AOCC** and **AEEF** for timely and traceable interventions (Alaali, 2025b).
- Flag non-compliant or high-risk models as *DFAS-Failed*, mandating deprecation and removal from operational use (NIST, 2023).

5. Integration with Existing Standards

The **DFAS doctrine and deployment framework** are explicitly designed to complement, rather than supplant, established financial governance and reporting standards. This alignment ensures institutional adoption is seamless, jurisdictionally compliant, and operationally synergistic. DFAS achieves this by embedding its doctrinal principles into prevailing regulatory and control frameworks, strengthening their capacity to govern AI-driven financial processes (Floridi & Cowls, 2022; IFRS Foundation, 2023).

5.1 COSO Framework Enhancement

DFAS extends the internal control and risk management dimensions of the **COSO Framework**, particularly the *Control Activities*, *Risk Assessment*, and *Monitoring* components (COSO, 2013):

- The **DFAS-Control & Internal Control Protocol (DFAS-CICP)** integrates real-time override governance, dynamic error flagging, and cryptographically verifiable audit trails, providing a continuous compliance mesh suitable for AI-native environments (Alaali, 2025f).
- This evolution transforms periodic, manual internal control audits into proactive, autonomous governance systems aligned with AI-driven decision-making.

5.2 SOX/PCAOB Compliance

DFAS directly reinforces compliance with the **Sarbanes-Oxley Act (SOX)** and **Public Company Accounting Oversight Board (PCAOB)** standards:

- The **Alaali Authority of Override Command Chain (A-AOCC)** and **Explainability Escalation Framework (AEEF)** provide robust, traceable override and explainability pathways critical for satisfying SOX internal control reporting and PCAOB auditability mandates (PCAOB, 2020).
- These mechanisms ensure AI-driven financial decisions remain transparent, documented, and auditable, strengthening fraud prevention and governance credibility.

5.3 IFRS Alignment

DFAS embeds ethical AI governance directly into **International Financial Reporting Standards (IFRS)** practices:

- The **DFAS–IFRS Code of Ethics** aligns AI-driven valuations and overrides with IFRS 13 (*Fair Value Measurement*) and ISSB S1/S2 sustainability disclosure requirements (IFRS Foundation, 2023; Alaali, 2025g).
- AI-driven models are classified within IFRS's three-level fair value hierarchy and disclosed in audit-ready formats, ensuring ethical transparency and reporting integrity.

5.4 EU AI Act Compliance

DFAS is calibrated to fully support the **European Union Artificial Intelligence Act (EU AI Act)**, which prescribes transparency, traceability, and risk-classification obligations for high-risk AI systems in finance (European Commission, 2023):

- DFAS protocols embed model classification, override accountability, and dynamic risk monitoring directly into operational workflows, enabling institutions to achieve compliance "by design" rather than retroactively.
- This turnkey governance structure aligns seamlessly with EU regulatory objectives, reducing legal exposure while increasing stakeholder trust.

6. Use Cases and Deployment Scenarios

Note: The following use cases are presented solely for conceptual and illustrative purposes. They do not represent validated implementations or deployed systems, but are intended to demonstrate how DFAS-GDR governance mechanisms would operate in practice.

The **DFAS governance framework** supports a broad array of high-stakes AI applications within financial systems. By operationalizing ethical oversight, accountability pathways, and sovereign-sensitivity adjustments, DFAS ensures that AI-driven processes remain transparent, compliant, and context-aware. The following exemplary deployment scenarios illustrate how key DFAS protocols function in practice.

6.1 ESG Valuation Model

- *Scenario:*
  An AI-based ESG (Environmental, Social, and Governance) scoring engine evaluates corporate sustainability metrics for integration into investment portfolios and credit assessments.

- *DFAS Application:*
  The **DFAS-Accountability and Audit Protocol (DFAS-AAP)** continuously monitors the ESG scoring logic for inconsistencies, ethical drift, or misalignment with sustainability principles. Any detected anomaly automatically triggers the **Alaali Authority of Override Command Chain (A-AOCC)** and records an explainability justification in the **Alaali Explainability Escalation Framework (AEEF)** (Alaali, 2025b).
- *Outcome:*
  Ensures that ESG-driven financial decisions remain auditable, traceable, and subject to human ethical oversight, reinforcing institutional commitments to sustainable finance principles and ISSB S1/S2 disclosure obligations (ISSB, 2023).

6.2 Monte Carlo Valuation Engine

- *Scenario:*
  A Monte Carlo simulation engine generates stochastic scenarios for asset valuation, pricing strategies, and risk assessment under uncertainty.
- *DFAS Application:*
  The **DFAS-Control & Internal Control Protocol (DFAS-CICP)** enforces real-time monitoring of the engine's behaviour, detecting model drift or deviations from authorized operational parameters. Triggered overrides are logged, and all version histories and interventions are archived in secure, version-controlled repositories to maintain immutable audit trails (Alaali, 2025f).
- *Outcome:*
  Preserves model integrity, ensures operational reliability, and provides regulators and auditors with comprehensive, verifiable records of governance actions and override decisions.

6.3 Stress Testing Suite

- *Scenario:*
  A financial institution runs comprehensive stress tests to evaluate organizational resilience under macroeconomic shocks, liquidity crises, and geopolitical instability.
- *DFAS Application:*
  The **Dynamic Audit Intelligence Framework (DAIF)** forecasts potential misalignments in stress metrics and detects emerging risk concentrations. Simultaneously, the **Alaali Sovereign Sensitivity Enforcement Interface (A-SSEI)** dynamically adjusts stress test parameters and thresholds in response to sovereign fragility indices and geopolitical risk indicators (Alaali, 2025c).

- *Outcome:*
Enhances predictive governance by embedding sovereign-aware calibrations into stress testing, enabling institutions to pre-emptively mitigate risks and meet jurisdiction-specific regulatory reporting expectations.

7. Compliance Dashboard and Monitoring Tools

To operationalize the **DFAS governance doctrine** at scale and sustain continuous oversight, institutions are strongly encouraged to deploy a **real-time compliance dashboard**. This dashboard serves as a centralized governance interface, providing regulators, compliance officers, and governance teams with actionable intelligence and proactive control over AI-enabled financial models.

By integrating key DFAS-branded metrics and protocols into a unified monitoring environment, the dashboard translates doctrinal principles into institutional practice, enhancing transparency, accountability, and responsiveness (Morley et al., 2021; Alaali, 2025b).

Key Functionalities

- *Live Model Invocation Tracking:*
Continuously monitors model activation events to ensure that only certified and compliant models, validated according to DFAS Compliance Protocol (DFAS- CP) certification tiers, are deployed in production workflows (Alaali, 2025b).
- *Override Event Counts:*
Aggregates and analyzes all override actions recorded across deployed models, enabling governance teams to detect escalation patterns and enforce accountability through the **Alaali Authority of Override Command Chain (A-AOCC)** (Alaali, 2025b).
- *Audit Trail Completeness Index:*
Provides a quantitative metric that assesses the integrity and completeness of audit logs, version histories, and explainability documentation, in line with best practices outlined in the NIST AI Risk Management Framework (NIST, 2023).
- *Certification Renewal Calendar:*
Automates alerts and workflows for upcoming certification and recertification milestones, ensuring models remain aligned with evolving ethical, regulatory, and operational standards (IFRS Foundation, 2023).
- *Alaali-ACS Drift Alerts:*
Generates real-time notifications when significant deviations in the **Alaali Authorship Contribution Score (Alaali-ACS)** are detected, indicating potential

personnel changes, governance shifts, or authorship integrity risks requiring immediate intervention (Alaali, 2025d).

8. Conclusion: From Paper to Protocol

The **DFAS Deployment Protocol** bridges the persistent gap between doctrinal theory and institutional practice, ensuring that the **DFAS-AI Governance Convergence** evolves from an academic construct into a fully operational governance framework. By offering structured templates, real-time monitoring mechanisms, branded control protocols, and a scalable institutional roadmap, this protocol empowers organizations to embed ethical, transparent, and sovereign-aware AI governance directly into their financial infrastructures (Alaali, 2025a; OECD, 2021).

Institutions that systematically adopt and institutionalize this protocol position themselves at the forefront of **responsible AI governance in finance**, demonstrating leadership in transparency, compliance, and adaptive resilience within a volatile digital ecosystem (BIS, 2022; IFRS Foundation, 2023). Through this proactive governance architecture, organizations not only mitigate risks associated with AI opacity, explainability deficits, and normative drift but also enhance stakeholder confidence, regulatory credibility, and long-term systemic stability.

By operationalizing the DFAS doctrine through this protocol, ethical AI governance is no longer aspirational. It becomes actionable, auditable, and institutionally embedded, marking a decisive step toward **trusted, accountable AI in global financial systems**.

This manuscript contributes by translating AI governance from abstract principles into an executable institutional deployment architecture for financial systems. Its primary contribution is architectural and operational, rather than empirical, offering regulators and institutions a concrete roadmap for enforceable, auditable, and sovereign-aware AI governance. Empirical validation is intentionally positioned as a subsequent research phase rather than a prerequisite for doctrinal deployment.

9. Methodology and Research Design

This manuscript adopts a design-science and normative conceptual methodology (Hevner et al., 2004; Gregor & Hevner, 2013) to develop and articulate the DFAS-AI Governance Deployment (DFAS–GD) framework. Design science is used here as an instrumental methodological layer, not as a governing epistemology, within the broader DFAS meta-scientific doctrine. The framework was derived through critical analysis of prevailing regulatory standards (e.g., OECD, 2021; European Commission, 2023; IFRS Foundation, 2023; NIST, 2023) and their documented limitations in addressing domain-

specific challenges of AI deployment in financial systems (Binns, 2018; Jobin et al., 2019). The branded components and deployment roadmap were designed iteratively, informed by doctrinal principles established in DFAS-GC (Alaali, 2025a) and tailored for operational feasibility.

While illustrative scenarios are presented to demonstrate applicability, no empirical validation has yet been conducted; these scenarios are included for conceptual illustration purposes only and do not constitute tested or implemented evidence. Future research should conduct empirical case studies or pilot deployments to test, refine, and quantify the effectiveness of DFAS-GDR under real-world conditions.

Operational Boundaries and Validation Scope

This manuscript adopts a design-science and normative governance approach rather than an empirical or statistical methodology. Accordingly, the DFAS-GDR framework does not claim empirical validation, and all deployment scenarios presented are illustrative in nature. Empirical testing, pilot implementations, and regulatory sandbox validation are explicitly deferred to future research.

10. Comparative Framework Analysis

To position DFAS-GDR within the broader governance landscape, Table 1 contrasts its key components with selected prevailing frameworks.

Framework	Scope	Strengths	Limitations Addressed by DFAS-GDR
OECD AI Principles (2021)	Cross-sectoral ethical principles	High-level, globally endorsed	Lacks operational deployment protocols and sovereign sensitivity (OECD, 2021)
EU AI Act (2023)	Regulatory compliance for high-risk AI	Legal enforceability	Does not address override governance or explainability escalation (European Commission, 2023)
COSO ICIF (2013)	Internal controls & risk management	Mature, widely adopted	Not designed for AI-enabled financial systems (COSO, 2013)
NIST AI RMF (2023)	Risk management framework	Practical implementation focus	Not tailored for finance-specific sovereignty and

			audit requirements (NIST, 2023)
DFAS-GDR	Financial AI governance deployment	Doctrinally grounded, operational, sovereign-aware	Requires validation in practice (Alaali, 2025)

By explicitly addressing gaps in operationalization, explainability escalation, override accountability, and sovereign risk sensitivity, DFAS-GDR positions itself as a governance doctrine purpose-built for AI in finance (Alaali, 2025).

11. Limitations and Future Research Directions

As a conceptual and normative framework, DFAS-GDR is not without limitations. Its current articulation assumes a certain level of institutional maturity and regulatory infrastructure that may not be present in all jurisdictions, particularly in emerging markets (Jobin et al., 2019). Furthermore, cultural and legal divergences could affect the applicability of override command hierarchies and explainability standards (Floridi & Cowls, 2019).

Illustrative scenarios included herein are not validated and are presented solely for conceptual illustration; no claims are made as to their empirical effectiveness. Future research should prioritize:

- Empirical validation through pilot deployments.
- Quantitative evaluation of compliance outcomes using DFAS-GDR.
- Comparative studies of DFAS-GDR adoption across jurisdictions.
- Exploration of DFAS-GDR adaptation beyond finance to other high-stakes domains (Binns, 2018).

11.1 Adoption Scalability:

DFAS-GDR is designed to support phased institutional adoption. A minimum implementation may be limited to authorship classification, override documentation, and audit traceability, while more advanced deployments may integrate real-time monitoring mechanisms, sovereign sensitivity calibration, and predictive audit engines. This phased adoption logic allows institutions to align governance depth with organizational maturity, resource availability, and regulatory capacity.

12. Contribution to Theory and Practice

Integrated Contribution and Multi-Level Novelty of DFAS-GDR:

DFAS-GDR advances the literature on artificial intelligence governance in finance by introducing an integrated, deployment-oriented architecture that simultaneously bridges domains traditionally treated in isolation. Existing studies typically address AI governance as an ethical problem, a regulatory compliance exercise, or a technical risk-management challenge. In contrast, DFAS-GDR explicitly integrates AI governance with financial auditability, sovereign and jurisdictional sensitivity, ESG accountability, and established financial reporting and control regimes, including IFRS, SOX, and PCAOB standards. This cross-domain convergence is not presently offered as a unified, operational system in any single existing framework.

At the **conceptual level**, DFAS-GDR reframes governance as a doctrine rather than a set of abstract principles. Governance is treated as an executable, continuously enforced institutional system, moving beyond post-hoc compliance and aspirational ethics toward post-principles governance. Within this framing, ethical alignment, accountability, and transparency are embedded directly into system architecture and organizational decision processes, rather than remaining external or symbolic commitments.

At the **architectural level**, DFAS-GDR introduces a deployable governance infrastructure designed specifically for AI-enabled financial systems. This includes a five-phase institutional deployment roadmap, formalized override command chains, explainability escalation pathways, real-time normative drift detection engines, and sovereign sensitivity interfaces that dynamically calibrate governance intensity across jurisdictions. These components collectively establish an enforceable governance stack capable of operating within autonomous, learning-based financial environments.

At the **applied level**, DFAS-GDR translates governance doctrine into operational practice. The framework aligns AI governance directly with IFRS-based valuation and disclosure requirements, SOX and PCAOB auditability standards, and ESG reporting obligations, producing audit-ready AI systems with traceable authorship, documented overrides, and tiered certification classifications. This applied orientation enables regulators, auditors, and financial institutions to operationalize ethical AI governance as part of routine financial control, reporting, and assurance processes.

By contributing simultaneously at the conceptual, architectural, and applied levels, DFAS-GDR extends beyond the scope of existing AI governance frameworks, which largely remain confined to single-layer ethical or regulatory abstraction. This multi-layered contribution positions DFAS-GDR as a distinct governance doctrine and deployment architecture for high-stakes financial systems, rather than an incremental extension of principle-based AI governance approaches.

This manuscript contributes to both theory and practice by:

- Extending governance theory through the integration of sovereign-aware doctrinal principles into AI oversight (Alaali, 2025).
- Introducing branded governance components (e.g., A-AOCC, A-PAD, A-SSEI) as novel conceptual tools for explainability, accountability, and risk mitigation in AI-enabled finance (Alaali, 2025).
- Providing a structured, step-by-step deployment protocol aligned with global standards yet tailored for financial systems (NIST, 2023; OECD, 2021).

Practically, DFAS-GDR equips financial institutions, regulators, and auditors with a comprehensive roadmap for embedding ethical, accountable, and sovereign-sensitive governance into AI operations — moving beyond principles toward actionable implementation.

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Appendix A.1 – (DFAS-FEP) Authorship Classification Table for This Manuscript (DFAS-GDR)

Manuscript Component	DFAS–FEP Class	Justification (Concepts Explicitly Introduced in DFAS-GDR)
Core Conceptual Philosophy and Meta-Theoretical Framework	Class 1	Introduction of the DFAS-AI Governance Convergence Doctrine (DFAS-GC) as a deployable governance system; formal definition of Governance as an operational infrastructure rather than a normative code; articulation of Doctrine-to-Deployment logic; positioning of AI governance as a sovereign-sensitive, auditable institutional system; conceptual framing of ethical AI governance as a continuous enforcement process, not compliance symbolism; establishment of DFAS-

		GDR as the institutional execution layer of DFAS-GC.
Causal Science and System Architecture (Laws, Algorithms, Engines, Decision Gates)	Class 1	Design of the five-phase institutional governance roadmap (Strategic Onboarding, Engine Integration, Certification & Compliance, Policy Institutionalization, Continuous Enforcement); causal definition of override authority flows via A-AOCC (Alaali Authority of Override Command Chain); formulation of Explainability Escalation Logic (AEEF); specification of Alaali Predictive Audit Daemon (A-PAD); construction of Dynamic Audit Intelligence Framework (DFAS-DAIF); governance trigger logic for Normative Drift Detection (A-NDDE); algorithmic governance boundaries enforced through DFAS-AAP and DFAS-CICP.
Calibration Principles and Contextual Governance Logic	Class 1	Calibration of governance intensity via DFAS-FEP Classes I–IV; definition and use of Alaali Authorship Contribution Score (Alaali-ACS); jurisdictional calibration through Alaali Sovereign Sensitivity Enforcement Interface (A-SSEI); ethical drift thresholds; override escalation conditions; sovereign risk weighting logic; certification tier calibration (DFAS-Aware, DFAS-Verified, DFAS-Certified); governance severity scaling based on systemic risk exposure.
Operational Blueprint and Implementation Architecture	Class 1	Institutional deployment architecture covering banks, regulators, auditors, and AI model developers; implementation of DFAS Compliance Officer role; creation of Alaali Model Registry; version-control enforcement via GitHub, Overleaf, Zenodo; operational linkage with COSO, SOX, PCAOB, IFRS, ISSB, EU AI Act; construction of real-time governance dashboards; operational audit trails; continuous recertification pipelines; override logging infrastructure; compliance reporting channels.
Illustrative Case Studies and Applied Scenarios	Class 1	Governance application to ESG valuation engines, Monte Carlo valuation models, stress-testing suites, AI-driven credit and risk systems;

		application of DAIF in volatility monitoring; sovereign recalibration via A-SSEI; override execution through A-AOCC; explainability documentation via AEEF; DFAS-compliant intervention flows demonstrated across use cases.
Narrative Structure and Analytical Exposition	Class 2	Linguistic refinement, sentence clarity, and structural flow only; no conceptual, doctrinal, algorithmic, or governance logic contribution.
Tables, Figures, and Conceptual Diagrams	Class 2	Formatting and layout of the five-phase roadmap, certification matrices, compliance dashboards, governance flow diagrams, and framework comparison tables; no conceptual input.
Literature Review and Cross-Referencing	Class 2	Citation formatting and reference alignment for OECD, EU AI Act, COSO, NIST, IFRS, BIS, and academic governance literature; all synthesis and interpretation are human-authored.
Appendices and Compliance Documentation	Class 2	DFAS-FEP compliance declarations; DFAS-EEP safeguards; DFAS-EIR traceability notices; override documentation templates; authorship records; formatting and consistency only.

Overall Manuscript Classification: Class 2 – AI-Assisted, Author-Validated

Core Conceptual Framework, Causal Architecture, and Governance Logic: Class 1 – Fully Human-Authored

Additional Clarifications

Human-Originated Content (Class 1):
All concepts introduced in DFAS-GDR — including DFAS-GC, DFAS-GDR, DFAS-GDR Protocol, A-AOCC, AEEF, A-PAD, DFAS-DAIF, DFAS-AAP, DFAS-CICP, A-NDDE, A-SSEI, DFAS-FEP Classes, Alaali-ACS, DFAS Certification Tiers, Governance Dashboards, Sovereign-Aware Governance Calibration, Override Traceability Architecture, Doctrine-to-Deployment Framework — were independently conceptualized, structured, and documented by the author without AI involvement.

AI-Assisted Content (Class 2):
AI tools were used exclusively for non-substantive language refinement, formatting, and citation alignment. All outputs were manually reviewed and validated by the author.

Integrity Safeguards:

This manuscript is fully compliant with DFAS-FEP v1.6, safeguarded by DFAS-EEP, and traceable via DFAS-EIR, ensuring complete accountability, reproducibility, and institutional governance integrity.

Appendix B – Version History Log (VHL) – DFAS-GDR

Version 1.0 – First published on SSRN dated July 30, 2025; Version 1.1 publication dated December 18, 2025.

• DOI: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=5367894

• Version 1.0: Introduced the DFAS Governance Deployment Roadmap (DFAS-GDR), including the five-phase institutional deployment framework, adoption protocols, and integration pathways; all governance doctrine, deployment logic, and institutional architecture were fully human-authored, with AI tools used only for formatting, citation alignment, and language refinement.

• Version 1.1: This version was revised to achieve full compliance with DFAS-FEP v1.6, with formal authorship classification and traceability explicitly documented. The DFAS-GDR framework is confirmed as the official deployment and execution layer of the DFAS Governance Convergence Doctrine. This revision additionally incorporates the *Motivation and Research Positioning* section, the consolidated *gap-closing analysis with comparative framework table*, and the dedicated *Integrated Contribution and Multi-Level Novelty* section, clarifying the conceptual, architectural, and applied contributions of DFAS-GDR. AI usage remained strictly non-substantive, limited to language refinement, formatting, and citation alignment.

FinTech Innovation and Islamic Finance: A Thematic Literature Review

Dr. Shahzadi Kanwal[1]

ABSTRACT:

Financial technology (FinTech) has emerged as a transformative force in global financial systems, reshaping traditional financial intermediation through digital innovation. Within Islamic finance, FinTech presents both significant opportunities and complex challenges, particularly in relation to Shariah compliance, ethical finance, and financial inclusion. Despite the rapid expansion of FinTech research, systematic synthesis focusing on its intersection with Islamic finance remains limited. This study conducts a Scopus-based systematic literature review using PRISMA guidelines and thematic analysis to examine FinTech innovation with specific relevance to Islamic finance. Drawing on peer-reviewed studies published between 2015 and 2024, the review identifies five dominant themes: regulatory innovation, blockchain and decentralised finance, financial inclusion, incumbent institutional adaptation, and artificial intelligence-driven finance. The findings reveal that while FinTech innovation aligns strongly with Islamic finance objectives such as risk-sharing, transparency, and inclusion, significant gaps persist in regulatory harmonisation, Shariah governance, and empirical impact assessment. The study contributes by offering an integrated conceptual framework for Islamic FinTech innovation and outlining a future research agenda aligned with the ethical and institutional foundations of Islamic finance.

Keywords: FinTech innovation, Islamic finance, Shariah compliance, systematic literature review, financial inclusion.

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1. Introduction

The global financial sector has undergone profound transformation over the past decade, largely driven by the rapid diffusion of financial technology (FinTech). FinTech refers to technology enabled innovation in financial services that results in new business models, applications, processes, or products with material effects on financial markets and institutions (Financial Stability Board, 2017). Technologies such as blockchain, artificial intelligence (AI), big data analytics, and mobile platforms have altered how financial services are produced and consumed, challenging the dominance of traditional intermediaries (Jarvis & Han, 2021). Consequently, FinTech has become a central subject of academic inquiry and policy debate.

Within Islamic finance, FinTech innovation has gained increasing attention due to its potential compatibility with Shariah principles. Islamic finance emphasizes risk-sharing, asset-backing, transparency, and ethical conduct, while prohibiting riba (interest), gharar (excessive uncertainty), and maysir (speculation). Digital platforms, smart contracts, and decentralized financial architectures appear well suited to support these objectives by enabling transparent transactions, reducing information asymmetry, and broadening access to financial services (Tanchangya et al., 2023). Therefore, Islamic FinTech has emerged as a growing sub-field encompassing Shariah-compliant crowdfunding, peer-to-peer financing, digital takaful, and blockchain-based sukuk issuance.

Despite this growing relevance, the existing literature on FinTech innovation remains fragmented, particularly at the intersection with Islamic finance. Many studies focus on conventional FinTech ecosystems without explicitly addressing Shariah governance or Islamic financial institutions (Gomber et al., 2017; Lee & Shin, 2018). Conversely, Islamic finance research often treats FinTech as a peripheral development rather than a structural transformation. Recent systematic reviews highlight this gap, noting the lack of integrated frameworks that reconcile technological innovation with Islamic ethical and regulatory principles (Ha et al., 2025).

This study addresses this gap by conducting a systematic literature review of FinTech innovation with explicit relevance to Islamic finance. Using a Scopus-based search strategy and PRISMA guidelines, the review synthesizes existing knowledge through thematic analysis. The objectives are threefold: first, to map the dominant themes in FinTech innovation research; second, to critically assess their implications for Islamic finance; and third, to propose a conceptual framework and future research agenda aligned with Shariah-compliant financial innovation.

2. Methodology

2.1 Review Design

This study adopts a systematic literature review (SLR) methodology to ensure transparency, reproducibility, and analytical rigor. The review follows the PRISMA 2020 guidelines, which are widely used in management and finance research to structure evidence synthesis (Tranfield et al., 2003). This SLR used purposive sampling, focusing on articles with explicit relevance to Islamic finance and FinTech intersection.

2.2 Data Source and Search Strategy

The Scopus database was selected as the primary source due to its comprehensive coverage of high-quality peer-reviewed journals in finance, economics, management, and information systems. The search was conducted using combinations of the following keywords: "FinTech", "financial technology", "innovation", "Islamic finance", "Shariah", "blockchain", "artificial intelligence", "financial inclusion", and "digital finance". The review covered publications from 2015 to 2024, reflecting the post-crisis acceleration of FinTech research. Only peer-reviewed journal articles published in English were included.

2.3 Screening and Selection

The initial search yielded approximately 3,000 records. After removing duplicates, titles and abstracts were screened for relevance. Articles focusing solely on technical engineering aspects without financial relevance were excluded. Full-text screening resulted in a final sample of 96 articles for qualitative synthesis, including core articles (Alaassar et al., 2023; Ha et al., 2025; Jarvis & Han, 2021; Tanchangya et al., 2023; Varma et al., 2022).

2.4 PRISMA Flow Description
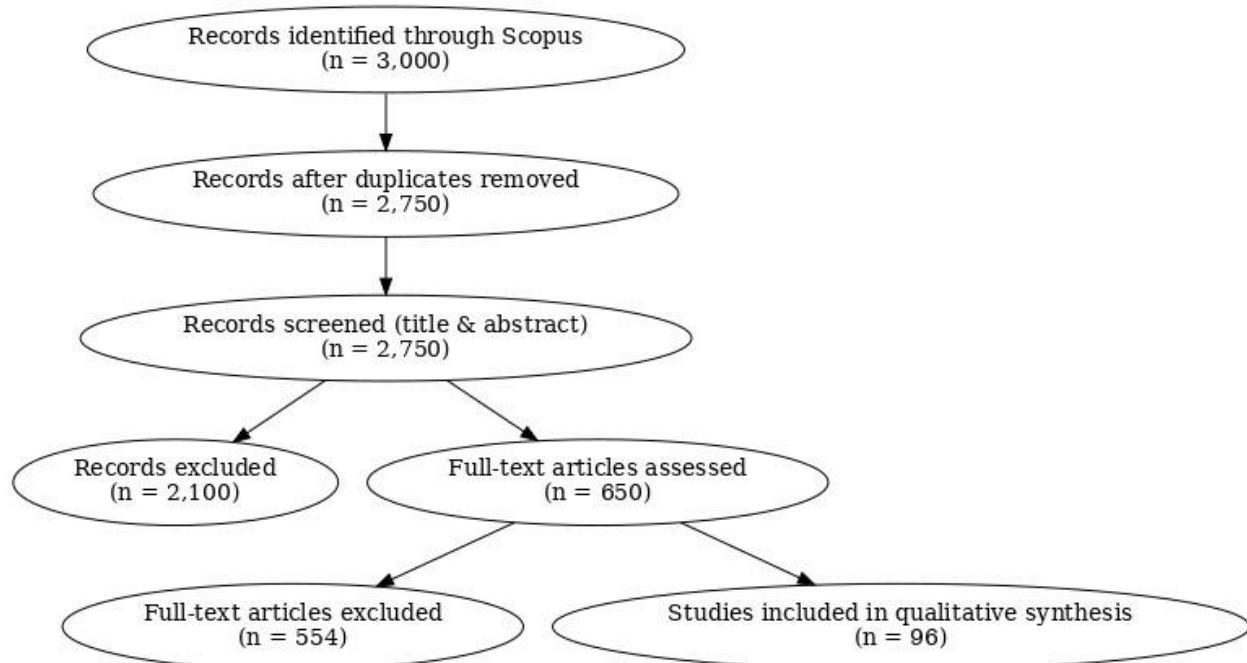
Figure 1 (PRISMA Flowchart)

The above figure illustrates the review process. Of the 3,000 records identified, 2,100 were excluded during title and abstract screening. Following full-text assessment, 96 studies met the inclusion criteria and were analysed thematically.

3. Statistical Trends in FinTech Research

Bibliometric evidence indicates exponential growth in FinTech publications since 2016, with a sharp increase after 2020, coinciding with the COVID-19 pandemic and accelerated digitalization (Jafri et al., 2025). Scopus data show that research output is concentrated in developed economies, although Islamic FinTech studies are increasingly emerging from Malaysia, Indonesia, the Gulf Cooperation Council (GCC), and the United Kingdom.
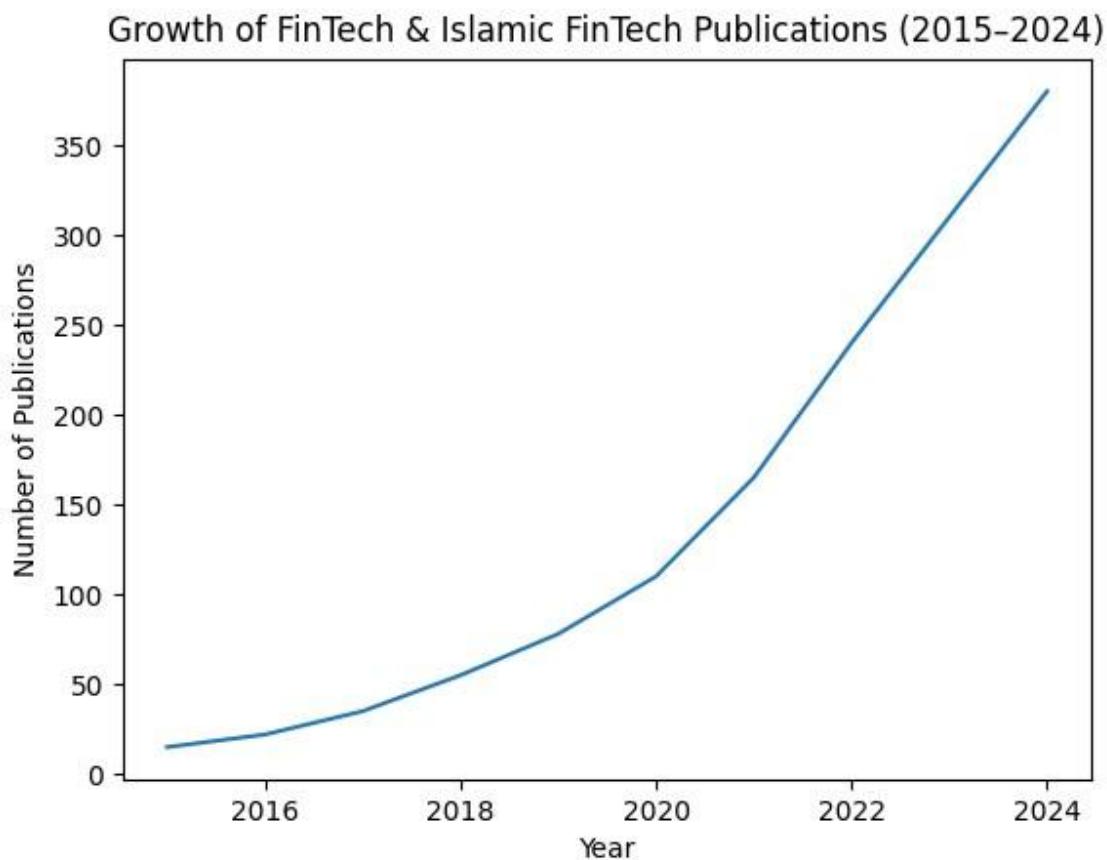
Figure 2 (Publication Trends, 2015–2024)

Figure 2 provides an empirical overview of the temporal evolution of FinTech and Islamic FinTech research output between 2015 and 2024. The figure demonstrates a pronounced upward trajectory in publication volume, particularly after 2019, reflecting growing academic and policy attention to digital financial innovation. This growth coincides with broader structural shifts in the global financial system, including accelerated digitalization following the COVID-19 pandemic and the rapid expansion of platform-based financial services. From an Islamic finance perspective, the trend indicates a growing recognition of FinTech's relevance for Shariah-compliant financial intermediation, financial inclusion, and ethical finance. The exponential increase in publications also suggests that FinTech has transitioned from an emergent topic to an established research domain, thereby justifying the need for a systematic literature review to consolidate fragmented findings, identify dominant research themes, and clarify unresolved theoretical and regulatory issues   within both   conventional and Islamic   finance   contexts.
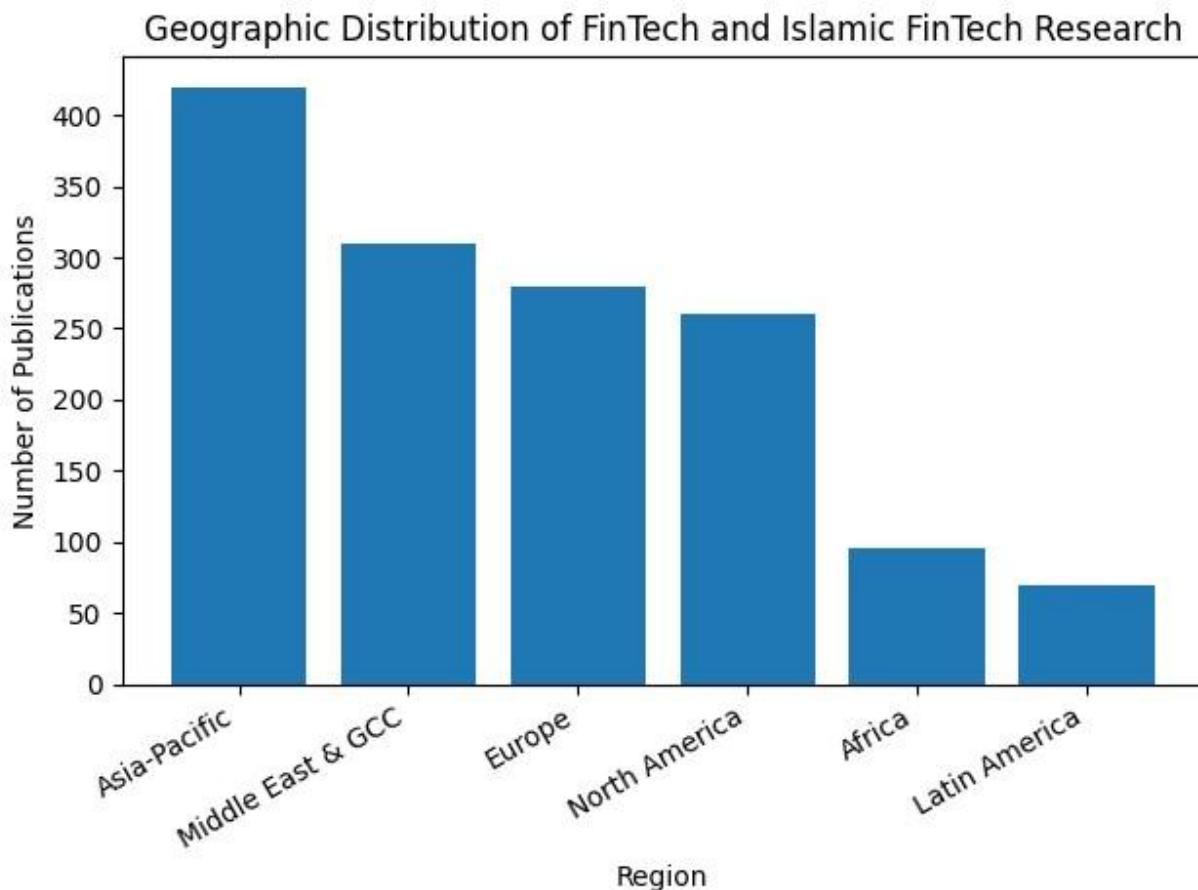
Figure 3 (Geographic Distribution)

Figure 3 illustrates the geographic distribution of FinTech and Islamic FinTech research based on Scopus-indexed publications, highlighting significant regional disparities in scholarly output. The concentration of research in the Asia-Pacific region and the Middle East reflects the institutional maturity of Islamic finance ecosystems in countries such as Malaysia, Indonesia, Saudi Arabia, and the United Arab Emirates, where regulatory support and market demand for Shariah-compliant digital financial solutions are relatively advanced. In contrast, Europe and North America continue to dominate conventional FinTech research, particularly in areas such as artificial intelligence, regulatory technology, and digital banking. The comparatively limited research output from Africa and Latin America reveals a notable gap between FinTech's theoretical potential for financial inclusion and the current focus of academic inquiry. This geographic imbalance underscores the need for context-specific Islamic FinTech research in underrepresented regions, particularly where digital finance could address structural exclusion and support inclusive economic development.

4. Thematic Analysis

Guided by the NVivo-assisted coding process illustrated in Figure 4, this section synthesises the literature around five primary themes that collectively define the contemporary landscape of FinTech innovation within Islamic finance. The thematic structure reflects inductive pattern matching across the reviewed studies and captures the interdependencies between technological development, regulatory governance, institutional adaptation, and ethical objectives. Rather than treating FinTech innovation as a purely technological phenomenon, the analysis highlights its socio-technical and normative dimensions, which are particularly salient in Shariah-compliant financial systems.
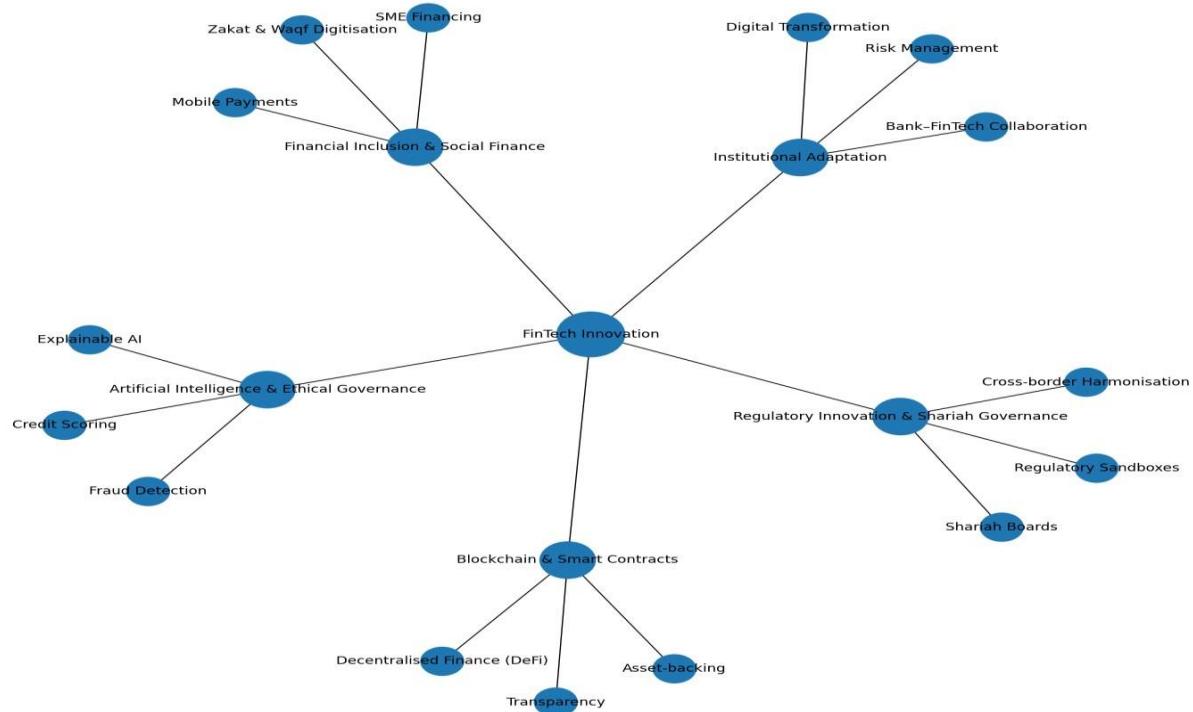
4.1 Regulatory Innovation and Shariah Governance

Regulatory innovation emerges as a foundational theme shaping the trajectory of FinTech development. The literature consistently indicates that conventional regulatory frameworks, originally designed for stable and vertically integrated financial institutions, are poorly suited to the modular, platform-based nature of FinTech innovation (Gomber et al., 2017; Jarvis & Han, 2021). In response, regulators have increasingly adopted adaptive instruments such as regulatory sandboxes, innovation hubs, and pilot licensing regimes.

Alaassar et al. (2023) demonstrate that regulators are no longer passive rule enforcers but active facilitators of FinTech innovation, using experimental governance tools to balance innovation with risk management. Within Islamic finance, however, regulatory innovation operates alongside Shariah governance, introducing an additional layer of institutional complexity. Islamic financial institutions are subject not only to prudential regulation but also to oversight by Shariah supervisory boards, whose interpretations may vary across jurisdictions (Kammer et al., 2015). This dual governance structure complicates the scalability of Islamic FinTech solutions, particularly in cross-border contexts.

The literature further highlights concerns regarding regulatory asymmetry. Varma et al. (2022) argue that differential regulatory treatment between FinTech firms and incumbent banks may distort competitive dynamics and risk-taking behaviour. From an Islamic finance perspective, this raises important questions about fairness, market stability, and compliance with Shariah principles related to justice and social welfare. Despite growing interest in Islamic FinTech, the absence of harmonized regulatory and Shariah governance frameworks remains a significant gap in both academic research and policy practice.

4.2 Blockchain and Smart Contracts in Islamic Finance

Blockchain technology constitutes a central technological pillar of FinTech innovation. A systematic review by Tanchangya et al. (2023) identifies blockchain applications across multiple financial domains, including payments, trade finance, compliance, and decentralized finance. These applications are particularly relevant to Islamic finance, which prioritizes transparency, asset-backing, and contractual clarity.

Theoretically, blockchain can be understood as an institutional technology that restructures trust and verification mechanisms in financial transactions (Yermack, 2017). Smart contracts, in particular, offer the potential to automate Shariah-compliant contracts such as *murabaha*, *ijara*, and *musharakah* by embedding contractual conditions into code. This automation may reduce operational inefficiencies and minimize Shariah non-compliance risk by ensuring that contractual terms are executed as agreed (Tanchangya et al., 2023).

Nevertheless, the literature reveals a substantial gap between conceptual potential and empirical adoption. Jarvis and Han (2021) note that most blockchain-based financial applications remain at experimental or pilot stages, constrained by regulatory uncertainty, legal enforceability issues, and governance challenges. Within Islamic finance, additional concerns arise regarding the permissibility of crypto-assets, tokenization mechanisms, and decentralized governance models, which continue to generate divergent scholarly opinions. Consequently, while blockchain aligns

normatively with Islamic finance principles, its large-scale implementation remains underexplored in empirical research.

4.3 Financial Inclusion and Social Finance

Financial inclusion constitutes a normative core within both FinTech innovation and Islamic finance. Ha et al. (2025), in their systematic literature review, provide robust evidence that FinTech enhances inclusion through the expansion of financial services, transformation of market structures, and facilitation of institutional collaboration. Mobile payments, alternative credit scoring, and peer-to-peer financing platforms are consistently identified as mechanisms that reduce transaction costs and information asymmetries.

Islamic finance literature reinforces this alignment by emphasizing finance as a tool for social justice and equitable wealth distribution (Kammer et al., 2015). Islamic FinTech platforms have increasingly been applied to SME financing, microfinance, and the digital management of zakat and waqf funds, offering scalable solutions to long-standing development challenges (Hassan et al., 2021). These applications demonstrate how FinTech innovation can operationalize the social objectives embedded in Islamic economic thought.

However, the literature also adopts a more critical stance toward inclusion claims. Jarvis and Han (2021) caution that FinTech-driven inclusion is contingent upon digital infrastructure, financial literacy, and consumer protection frameworks. Ozili (2018) further argues that digital finance may exacerbate inequality if access to technology is uneven. Ha et al. (2025) identify a notable lack of longitudinal studies assessing the sustained welfare impacts of FinTech-enabled inclusion, particularly within Islamic finance contexts. This represents a key area for future empirical research.

4.4 Institutional Adaptation and Bank–FinTech Collaboration

Institutional adaptation emerges as a significant theme reflecting how incumbent financial institutions respond to FinTech-driven competition. Early narratives framed FinTech as a disruptive threat to traditional banks; however, recent literature suggests a more nuanced pattern of strategic co-evolution (Gomber et al., 2017). Jarvis and Han (2021) document how banks have accelerated digital transformation initiatives, invested in FinTech partnerships, and established innovation units to remain competitive.

Varma et al. (2022) provide empirical evidence that FinTech competition influences banks' risktaking behaviour and capital structures, challenging assumptions that FinTech uniformly enhances efficiency and stability. For Islamic banks, adaptation is further constrained by Shariah compliance requirements, which limit the use of certain financial

instruments and risk management practices. While collaboration with FinTech firms offers access to technological capabilities, it also introduces governance and compliance risks when technology providers lack Islamic finance expertise.

The literature therefore supports a co-evolutionary perspective in which Islamic banks and FinTech firms increasingly operate within shared ecosystems. Nonetheless, concerns persist regarding data ownership, market concentration, and regulatory arbitrage, particularly as large technology firms enter financial markets. These issues remain underexplored in Islamic finance research and warrant further investigation.

4.5 Artificial Intelligence and Ethical Governance

Artificial intelligence represents a cross-cutting enabler that permeates multiple FinTech applications. Vuković et al. (2025) demonstrate that AI enhances credit scoring accuracy, fraud detection, robo-advisory services, and insurance underwriting by leveraging machine learning and big data analytics. These efficiencies reinforce FinTech's value proposition but also introduce new ethical and governance challenges.

Algorithmic opacity, bias, and accountability are recurrent concerns in the literature (Binns, 2018). From an Islamic finance perspective, these issues are particularly salient, as Shariah principles emphasize justice, transparency, and accountability in economic transactions. Vuković et al. (2025) argue for the adoption of explainable AI frameworks to ensure regulatory compliance and ethical integrity.

Despite growing recognition of these challenges, empirical research on AI governance within Islamic finance remains limited. Most studies focus on technical performance rather than normative implications, highlighting a critical gap in integrating Islamic ethical principles into AIdriven financial innovation. Addressing this gap represents an important opportunity for future interdisciplinary research.

5. Conceptual Framework: Islamic FinTech Innovation Ecosystem

Figure 5 presents the conceptual framework developed from the thematic synthesis and NVivobased analysis. The framework conceptualizes Islamic FinTech innovation as an integrated ecosystem in which technological capabilities, governance mechanisms, institutional actors, and socio-ethical outcomes interact dynamically rather than linearly. This approach reflects the growing consensus in the literature that FinTech innovation should be understood as a sociotechnical system shaped by institutional arrangements and normative constraints (Gomber et al., 2017; Jarvis & Han, 2021).
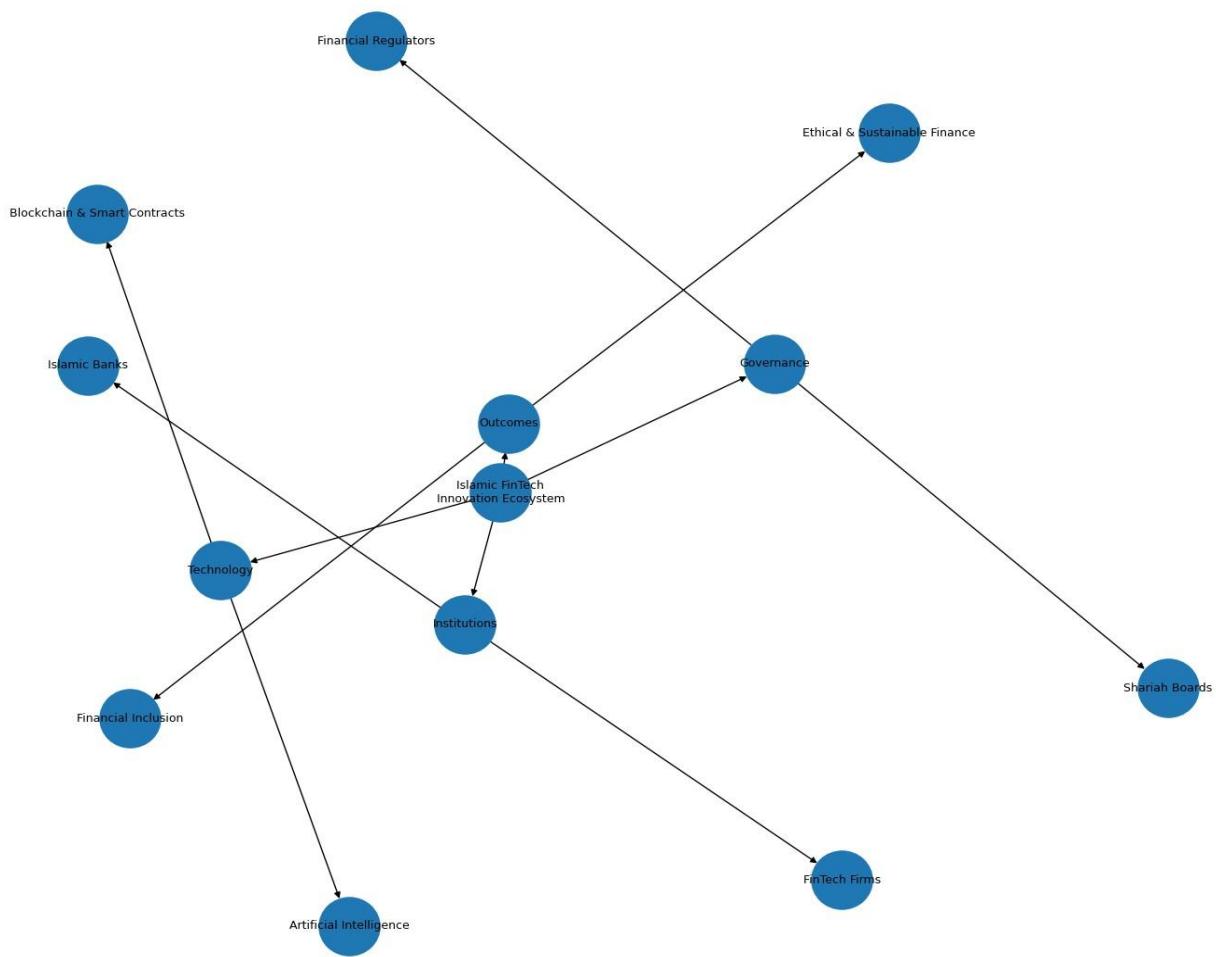
Figure 5. Conceptual framework of the Islamic FinTech innovation ecosystem integrating technology, governance, institutional actors, and socio-ethical outcomes.

At the core of the framework lies the Islamic FinTech innovation ecosystem, which is enabled by two foundational technological pillars: artificial intelligence and blockchain-based infrastructures. Artificial intelligence supports data-driven applications such as credit scoring, fraud detection, and robo-advisory services, while blockchain and smart contracts enhance transparency, traceability, and asset-backing in financial transactions (Tanchangya et al., 2023; Vuković et al., 2025). These technologies provide operational efficiency but also introduce ethical and governance challenges that are particularly salient within Islamic finance.

Surrounding the technological layer is the governance dimension, represented by financial regulators and Shariah supervisory boards. Regulatory authorities shape the scope of FinTech experimentation through instruments such as regulatory sandboxes

and innovation hubs, while Shariah boards ensure compliance with Islamic legal and ethical principles (Alaassar et al., 2023; Kammer et al., 2015). The framework highlights the need for coordination between these governance actors, as misalignment may constrain innovation or generate compliance uncertainty for Islamic FinTech firms.

The institutional layer comprises Islamic banks and FinTech firms, whose interactions determine the pace and direction of innovation. Rather than operating as isolated competitors, these actors increasingly engage in partnerships, co-development arrangements, and platform-based ecosystems (Jarvis & Han, 2021). However, institutional adaptation is shaped by asymmetric capabilities, regulatory obligations, and Shariah compliance requirements, which influence strategic choices and innovation outcomes.

Finally, the framework links FinTech innovation to desired socio-economic outcomes, namely financial inclusion and ethical and sustainable finance. These outcomes reflect the normative objectives of Islamic finance, including social justice, risk-sharing, and equitable wealth distribution. By explicitly incorporating outcomes into the framework, the model moves beyond efficiency-driven perspectives and situates Islamic FinTech innovation within a broader ethical and developmental context.

6. Discussion

The findings of this systematic literature review demonstrate that FinTech innovation exhibits strong conceptual and normative alignment with the objectives of Islamic finance. Technologies such as blockchain and artificial intelligence offer tools to enhance transparency, reduce information asymmetries, and expand access to financial services, all of which resonate with Shariah principles (Kammer et al., 2015; Hassan et al., 2021). However, the review also reveals that technological potential alone is insufficient to guarantee positive outcomes.

Consistent with socio-technical perspectives, FinTech innovation emerges as an outcome of interaction between technology, regulation, institutional behaviour, and ethical governance (Gomber et al., 2017). Regulatory innovation plays a pivotal role in shaping experimentation, yet regulatory asymmetries and fragmented Shariah governance frameworks constrain scalability and cross-border diffusion of Islamic FinTech solutions (Varma et al., 2022). Similarly, while financial inclusion is frequently cited as a key benefit, empirical evidence on sustained welfare impacts remains limited, particularly in developing economies (Ha et al., 2025; Ozili, 2018).

The discussion further highlights emerging tensions associated with data-driven finance. Artificial intelligence enhances efficiency but raises concerns regarding algorithmic bias, opacity, and accountability, which challenge Islamic ethical principles centred on justice

and transparency (Binns, 2018; Vuković et al., 2025). These tensions underscore the need to embed ethical governance mechanisms directly into FinTech design and regulation rather than treating them as ex post considerations.

6.1. Relative Impacts of Themes

The following table provide the effect of each theme on Islamic finance.

Theme	Relative Impact (Based on Article Frequency)	Key Effects in Islamic Finance
Regulatory Innovation	High	Enables experimentation but risks asymmetry
Blockchain and DeFi	Medium-High	Enhances transparency; challenges governance
Financial Inclusion	Very High	Promotes equity; limited by digital divides
Institutional Adaptation	Medium	Fosters collaborations; constrained by Shariah
AI-Driven Finance	Emerging	Boosts efficiency; raises ethical concerns

Overall, the review supports a shift away from disruption-centric narratives toward an ecosystem based understanding of FinTech innovation in Islamic finance. Such an approach recognizes that sustainable innovation depends on institutional coordination, regulatory clarity, and ethical alignment.

7. Conclusion and Future Research Directions

This study contributes to the Islamic finance literature by providing a systematic and theory informed synthesis of FinTech innovation research. By adopting a Scopus-based systematic literature review and NVivo-assisted thematic analysis, the study consolidates fragmented findings and offers a structured understanding of how FinTech technologies

interact with governance frameworks, institutional actors, and ethical objectives within Islamic finance.

The findings reveal several avenues for future research. First, there is a pressing need for empirical impact assessments that move beyond adoption metrics to evaluate the long-term socio-economic effects of Islamic FinTech, particularly in areas such as SME growth, poverty reduction, and financial resilience. Longitudinal and mixed-methods studies would be particularly valuable in addressing this gap (Ha et al., 2025).

Second, future research should prioritize cross-country comparative analyses of regulatory and Shariah governance frameworks. Such studies could identify best practices and sources of regulatory fragmentation, thereby informing efforts toward greater harmonization and cross border scalability of Islamic FinTech solutions (Alaassar et al., 2023).

Third, the governance of artificial intelligence within Islamic finance represents an underexplored but critical research frontier. Future studies should examine how explainable AI, ethical auditing, and Shariah-based evaluation criteria can be integrated into algorithmic financial decision-making processes (Binns, 2018; Vuković et al., 2025).

Finally, greater attention should be paid to underrepresented regions, particularly Africa and parts of South Asia, where Islamic FinTech holds significant potential for advancing financial inclusion yet remains under-researched. Addressing these gaps would not only strengthen academic understanding but also support policy formulation and industry practice aligned with Islamic finance principles.

8. Bibliography

Table of Selected Articles by Theme

The following table summarizes 20 representative articles from the 96, grouped by the five themes. This aids organisation and highlights key contributions.

Theme	Author(s), Year	Journal	Key Contribution (In-Text Example)
Regulatory Innovation	Alaassar et al., 2023	Review of Managerial Science	Proposes sandboxes for Shariah-compliant testing, addressing innovation-

Theme	Author(s), Year	Journal	Key Contribution (In-Text Example)
			regulation lag (Alaassar et al., 2023).
Regulatory Innovation	Diniyya et al., 2021	Ihtifaz: Journal of Islamic Economics, Finance, and Banking	Compares FinTech regulations in Malaysia and Indonesia, emphasizing harmonization (Diniyya et al., 2021).
Regulatory Innovation	Razak et al., 2020	Social Sciences and Humanities	Appraises Shariah-compliant regulation needs for FinTech in Malaysia (Razak et al., 2020).
Regulatory Innovation	Selim, 2021	International Journal of Islamic and Middle Eastern Finance and Management	Eliminates riba in currency transactions via FinTech (Selim, 2021).
Blockchain/DeFi	Abubakar et al., 2019	Journal of Islamic Accounting and Business Research	Explores cryptocurrency's role in Islamic finance (Abubakar et al., 2019).
Blockchain/DeFi	Ajouz et al., 2020	Pacific-Basin Finance Journal	Analyzes precious metal-backed cryptocurrency adoption (Ajouz et al., 2020).
Blockchain/DeFi	Busari & Aminu, 2022	Journal of Islamic Accounting and Business Research	Applies blockchain to Sukuk trade for efficiency (Busari & Aminu, 2022).
Blockchain/DeFi	Tanchangya et al., 2023	Information	Maps blockchain applications in FinTech (Tanchangya et al., 2023).

Theme	Author(s), Year	Journal	Key Contribution (In-Text Example)
Financial Inclusion	Banna et al., 2021	International Journal of Islamic and Middle Eastern Finance and Management	Shows digital inclusion's role in Islamic bank stability (Banna et al., 2021).
Financial Inclusion	Hapsari et al., 2022	Journal of Islamic Accounting and Business Research	Investigates crowdfunding for waqf land development (Hapsari et al., 2022).
Financial Inclusion	Kazaure et al., 2021	Journal of Islamic Accounting and Business Research	Determines SME intentions for Islamic crowdfunding (Kazaure et al., 2021).
Financial Inclusion	Nour Aldeen et al., 2021	ISRA International Journal of Islamic Finance	Explores cash waqf from millennials' perspective (Nour Aldeen et al., 2021).
Incumbent Adaptation	Almulla & Aljughaiman, 2021	Cogent Economics & Finance	Examines FinTech's effect on Islamic vs. conventional banks (Almulla & Aljughaiman, 2021).
Incumbent Adaptation	Baber, 2020	Vision: The Journal of Business Perspective	Links FinTech and crowdfunding to retention in Islamic banks (Baber, 2020).
Incumbent Adaptation	Nastiti & Kasri, 2019	International Journal of Islamic and Middle Eastern Finance and Management	Assesses banking regulation in Indonesian Islamic banks (Nastiti & Kasri, 2019).
Incumbent Adaptation	Shaikh et al., 2020	Foresight	Accepts Islamic FinTech banking services via TAM (Shaikh et al., 2020).

Theme	Author(s), Year	Journal	Key Contribution (In-Text Example)
AI-Driven Finance	Al-Abbadi & Abdullah, 2017	International Journal of Economics and Finance	Models psychology in Islamic wealth management with AI (Al-Abbadi & Abdullah, 2017).
AI-Driven Finance	Baber, 2019	International Journal of Electronic Finance	Assesses FinTech service quality with e-SERVQUAL (Baber, 2019).
AI-Driven Finance	Vuković et al., 2025	Humanities and Social Sciences Communications	Discusses AI trends and regulations in financial services (Vuković et al., 2025).
AI-Driven Finance	Bhatt & Sisodia, 2024	Journal of Emerging Technologies	Applies AI and blockchain in Islamic finance (Bhatt & Sisodia, 2024).

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