

## Does Financial Innovation Mediate Risk in Islamic Banking? Evidence from Algeria

**ABSTRACT** - As Islamic banks face increasingly complex financial environments, particularly in regulatory settings like Algeria, Islamic financial engineering emerges as a critical tool for managing the risks tied to Sharia-compliant financing instruments. This study develops a comprehensive model examining the dimensions of Islamic financial engineering (IFE) and their impact on the risks of Islamic financing Formulas, with financial innovation acting as a mediating variable. A descriptive and quantitative research approach was adopted. Data were collected via 150 questionnaires distributed to Islamic banking professionals in Algeria (Al-Baraka Bank, Al-Salam Bank, and Islamic windows) and analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) via SmartPLS software. The results reveal that IFE does not have a significant direct impact on mitigating the risks of Islamic financing Formulas. Instead, its influence is fully and significantly mediated by financial innovation. These findings emphasize that IFE frameworks must be supported by robust financial innovation capabilities to effectively mitigate risks in Islamic banking. Consequently, Islamic banks are encouraged to enhance product innovation and develop professional competencies to improve risk management efficiency and overall banking performance.

**ABSTRAK** - *Apakah Inovasi Keuangan Memediasi Risiko dalam Perbankan Syariah? Bukti dari Aljazair.* Dalam menghadapi kompleksitas sistem keuangan modern, terutama di negara dengan tantangan regulasi seperti Aljazair, rekayasa keuangan Islam menjadi instrumen penting dalam mengelola risiko pada pembiayaan berbasis syariah. Penelitian ini bertujuan untuk mengembangkan model yang mengkaji dimensi rekayasa keuangan Islam (IFE) dan pengaruhnya terhadap risiko format pembiayaan Islam, dengan inovasi keuangan sebagai variabel mediasi. Pendekatan deskriptif dan kuantitatif digunakan dalam studi ini. Data dikumpulkan melalui 150 kuesioner yang disebarkan kepada praktisi perbankan Islam di Aljazair (Bank Al-Baraka, Bank Al-Salam, dan unit perbankan syariah) dan dianalisis menggunakan pemodelan persamaan struktural berbasis Partial Least Squares (PLS-SEM) melalui perangkat lunak SmartPLS. Hasil penelitian menunjukkan bahwa rekayasa keuangan Islam tidak memiliki pengaruh langsung yang signifikan terhadap mitigasi risiko pembiayaan Islam. Sebaliknya, pengaruh tersebut dimediasi secara penuh (full mediation) dan signifikan oleh inovasi keuangan. Temuan ini menegaskan bahwa kerangka rekayasa keuangan Islam harus didukung oleh kapasitas inovasi keuangan yang kuat agar dapat menjadi instrumen mitigasi risiko yang efektif. Oleh karena itu, bank syariah didorong untuk meningkatkan inovasi produk dan mengembangkan kompetensi profesional guna mengoptimalkan efisiensi manajemen risiko dan kinerja perbankan secara keseluruhan.

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## INTRODUCTION

In recent years, Islamic banking has experienced substantial transformation driven by technological progress and increasing market complexity. Beyond improvements in service delivery, digital transformation has altered the way Islamic banks design financial products, manage liquidity, and address various operational risks. This transformation has become particularly significant in emerging Islamic financial systems, where institutional constraints and regulatory limitations continue to shape banking practices. Within this evolving landscape, Islamic financial engineering (IFE) has emerged as a strategic framework that enables Islamic banks to structure Sharia-compliant financial solutions capable of responding to dynamic market conditions (Ali, 1996).

At the same time, the expansion of financial activities and digital integration has introduced new layers of risk. Islamic banks must navigate not only risks associated with Sharia-compliant financing contracts but also broader financial and operational risks encountered in contemporary banking systems. Ensuring stability under such conditions requires the development of mechanisms that remain consistent with Islamic legal principles while addressing increasingly complex financial exposures (Nasser, 2015; Sari et al., 2024). In this regard, Islamic financial engineering offers structured approaches for managing risk while preserving compliance with Sharia norms (Humta, 2025).

Despite its conceptual importance, the practical application of Islamic financial engineering remains uneven, particularly in contexts such as Algeria. Islamic banks in this environment face persistent liquidity challenges, regulatory constraints, and limited institutional capacity to fully operationalize engineering-based financial solutions (Ibrahim, 2024). While classical contracts such as *Murābahah* and *Ijārah* continue to form the backbone of Islamic financing, their adaptability to contemporary risk conditions is often limited (Al-Jabouri, 2021).

Financial innovation has been identified as a key mechanism that enhances the ability of Islamic banks to diversify products, improve liquidity management, and adapt to evolving market demands (Kotby, 1990). However, the extent to which financial innovation effectively translates the theoretical constructs of Islamic financial engineering into practical risk management tools remains insufficiently understood, particularly in emerging markets.

Existing studies provide valuable insights into the relationship between Islamic financial engineering, innovation, and risk management, although their findings vary across contexts. For instance, Omari (2018) identified a link between financial engineering practices and risk exposure in Islamic banking, particularly in terms of credit and liquidity risks. In the Algerian context, Frendi (2024) highlighted institutional and regulatory barriers that constrain the implementation of Islamic financial engineering tools. Similarly, Bounkab (2016) found that while IFE contributes to risk management, its application is largely confined to traditional sales-based contracts.

Recent research has expanded the scope to incorporate the role of financial technology and systemic resilience. Hammadi et al. (2024) demonstrated that fintech adoption can reshape risk management practices in Islamic banks, while Al-Nimer (2024) showed that innovation capacity plays a mediating role between strategic risk integration and organizational performance.

Additionally, Rizwan et al. (2022) and Mzoughi (2023) emphasized the resilience of Islamic financial systems, particularly during periods of financial instability.

Although prior studies acknowledge the importance of Islamic financial engineering and financial innovation, limited empirical research has examined how these factors interact at the level of financing contracts. In particular, little is known about the mediating role of financial innovation in linking Islamic financial engineering to the risks associated with Islamic financing instruments. This gap is especially evident in the Algerian banking context, where empirical investigations remain scarce and often focus on isolated aspects of risk or innovation rather than their integrated effects.

This study seeks to examine the relationship between Islamic financial engineering and the risks of Islamic financing formulas in Algerian Islamic banks, with financial innovation considered as a mediating variable. Specifically, the study investigates the impact of Islamic financial engineering and its dimensions—namely named contracts, composite contracts, and Islamic financial derivatives—on financing risks, while also assessing the extent to which financial innovation influences this relationship.

This research contributes to the literature by offering a more integrated perspective on Islamic financial engineering and risk management. It extends existing theoretical discussions by emphasizing the role of financial innovation as a linking mechanism between engineering frameworks and practical outcomes. From a methodological standpoint, the study introduces a structural modeling approach to analyze complex mediation relationships. In practical terms, the findings are relevant for Islamic banking institutions operating in emerging markets, where enhancing innovation capabilities may support more effective risk management practices while maintaining compliance with Sharia principles (Dawaba, 2024; Yassamine, 2024).

The remainder of this paper is organized as follows. Section 2 reviews the relevant literature on Islamic financial engineering, financial innovation, and risk management. Section 3 outlines the research methodology. Section 4 presents the empirical results, followed by a discussion in Section 5. The final section concludes the study and identifies directions for future research.

## LITERATURE REVIEW

### Concept and Role of Islamic Financial Engineering

Islamic financial engineering (IFE) is an evolving discipline that seeks to design, structure, and implement financial instruments that adhere to Sharia principles while meeting modern economic and market needs. It bridges classical jurisprudence and contemporary finance by adapting legitimate contractual forms into innovative mechanisms for risk management and product development (Naharudi et al., 2025). As financial systems become more complex, Islamic financial engineering provides Islamic banks with flexible frameworks to manage liquidity, improve profitability, and mitigate financing risks within ethical boundaries.

According to Al Jabouri (2021), IFE plays a strategic role in ensuring the competitiveness and sustainability of Islamic banks. It enables institutions to enhance existing Sharia-compliant contracts such as *Murābahah*, *Ijārah*, *Salam*, and *Mushārahah*, and to develop hybrid or composite contracts suited to contemporary financing structures (Musa et al., 2022). These

innovations not only expand product offerings but also harmonize returns, liquidity, and risk in ways consistent with Islamic law. Financial engineering thus serves as both a creative and stabilizing mechanism in Islamic finance, ensuring compliance while promoting operational efficiency.

Financial innovation complements Islamic financial engineering by translating theoretical contract designs into practical tools that enhance financial performance and risk management. As Kotby (1990) explains, innovation strengthens Islamic banks' ability to mobilize deposits, diversify products, and introduce new instruments for hedging and liquidity management. In this sense, innovation functions as a mediating process that operationalizes Islamic financial engineering, enabling banks to adapt to changing financial environments while remaining compliant with Sharia principles.

Benamara (2020) and Nasser (2015) argue that financial innovation should not be understood merely as product creation but as an institutional capability that fosters continuous adaptation and resilience. This mediating role of innovation becomes especially significant in emerging Islamic banking markets, where technological, regulatory, and human resource constraints can limit the full application of Islamic financial engineering. Liyanage (2025) reinforces this view by showing that banks equipped with dedicated innovation units can transform engineering frameworks into tangible, risk-reducing mechanisms. Thus, innovation acts as a conduit linking financial engineering with effective risk management.

The literature identifies three major dimensions of Islamic financial engineering: Named contracts (*al-'uqūd al-musammā*), composite contracts (*'uqūd murakkabah*), and Islamic financial derivatives. Named contracts such as Murābahah, Salam, Istisnā', and Ijārah constitute the foundation of Islamic finance. However, as Frendi (2024) notes, these contracts often display rigidity when applied to modern risk management contexts, limiting their capacity for diversification. Composite contracts, by contrast, combine multiple contractual elements to address specific financial objectives—such as mitigating liquidity risk or reducing default exposure—and have proven effective in practical applications (Bounkab, 2016).

Islamic financial derivatives represent a more recent and debated dimension of IFE. While these instruments offer potential solutions for hedging and managing price fluctuations, their permissibility remains controversial due to differing interpretations of Sharia compliance. Poitras (2002) cautions that derivatives must be carefully structured to avoid speculative behavior while still fulfilling their risk management functions. Collectively, these dimensions illustrate that Islamic financial engineering encompasses a spectrum of instruments that vary in flexibility, purpose, and level of Sharia scrutiny.

### **Islamic Financial Engineering and Risk Management**

Empirical research on the role of Islamic financial engineering in risk management has produced diverse findings. Omari (2018) examined Dubai Islamic Bank and found that Islamic financial engineering significantly influenced the management of credit and liquidity risks, demonstrating that engineered contracts can improve risk responsiveness. In Algeria, Frendi (2024) explored the adoption of financial engineering tools and observed that institutional and regulatory barriers constrain their implementation. Similarly, Bounkab (2016) reported that while IFE contributes

to risk mitigation in Algerian Islamic banks, its application is largely limited to sales-based instruments such as *Murābahah* and *Ijārah*, rather than equity-based contracts.

In Sudan, Badjie (2019) revealed that Islamic financial engineering has considerable potential to manage banking risks but remains underutilized due to weak institutional support, limited human capital, and the absence of specialized innovation departments. These findings collectively emphasize that while IFE offers a comprehensive framework for managing Islamic financing risks, its practical effectiveness depends on internal capacities and regulatory environments.

Recent research has shifted toward understanding how financial technology (fintech) and digital transformation interact with Islamic financial engineering to strengthen risk management practices. Hammadi et al. (2024) analyzed the adoption of fintech in UAE Islamic banks and found that digital tools can both mitigate and reshape risk exposure, although regulatory structures do not always moderate these effects as expected. Similarly, Kifle and Olonisakin (2023) investigated the role of IFE during financial crises in Sudan, concluding that despite the availability of risk-mitigating instruments, their potential remains underexploited due to institutional inertia and lack of strategic innovation.

Further evidence supports the growing importance of innovation capacity. Al-Nimer (2024) demonstrated that innovation mediates the relationship between strategic risk integration and environmental, social, and governance (ESG) performance in Jordanian banks, suggesting that innovation enhances both financial resilience and sustainability. Rizwan (2022) examined systemic risk in dual-banking systems and found that Islamic banks exhibit lower spillover effects and greater resilience during financial shocks compared to conventional banks. Similarly, Mzoughi (2023) analyzed market behavior during the COVID-19 pandemic and showed that portfolios containing Islamic financial instruments engineered for stability outperformed conventional counterparts, confirming the resilience of Islamic financial structures under stress conditions.

### **The Algerian Context**

In Algeria, financial innovation and Islamic financial engineering remain relatively nascent but strategically significant. Dawaba (2024) and Yassamine (2024) noted that in a context characterized by regulatory evolution and limited financial sophistication, innovation operates as both a technological and institutional phenomenon. Digital tools enable the practical implementation of Islamic financial engineering, shifting it from a theoretical framework to an operational practice capable of managing liquidity and credit risks effectively. Despite these developments, there is limited empirical research examining the mediating role of financial innovation between IFE and risk exposure in Algerian Islamic banks.

This gap highlights the need for integrated analytical frameworks that capture how financial innovation influences the relationship between Islamic financial engineering and risk management. Theoretically, prior studies recognize IFE's relevance but rarely model its interaction with innovation explicitly. Methodologically, earlier research often relies on descriptive or regression-based analyses, leaving room for more robust techniques such as Structural Equation Modeling (SEM) to test mediation effects. Practically, Algerian Islamic

banks have yet to institutionalize financial innovation as part of their engineering strategies, constraining their ability to manage risks comprehensively.

In summary, the literature demonstrates that Islamic financial engineering plays a critical role in managing the risks of Sharia-compliant financing structures through innovative contract design and product development. However, its effectiveness depends heavily on the presence of financial innovation, which acts as a catalyst translating theoretical constructs into operational tools. While significant progress has been made in other jurisdictions such as the UAE, Sudan, and Jordan, empirical evidence from Algeria remains limited. This study contributes to bridging this gap by empirically testing a structural model that explores the impact of Islamic financial engineering on the risks of Islamic financing Formulas, with financial innovation positioned as a mediating variable.

### **Hypotheses Development**

Building on the preceding discussion, this study conceptualizes Islamic financial engineering as a strategic capability that influences the management of financing risks through the intermediary role of financial innovation. The framework assumes that Islamic financial engineering provides the structural foundation for designing Sharia-compliant financial instruments, while financial innovation enables their practical implementation.

#### *Islamic Financial Engineering and Financing Risk*

Islamic financial engineering introduces structured financial instruments designed to improve risk allocation and contract efficiency. Through the use of classical, composite, and derivative contracts, IFE has the potential to influence financing risk by improving liquidity management, reducing uncertainty, and enhancing contractual flexibility (Omari, 2018). However, the capacity of these instruments to directly affect risk outcomes remains uncertain, particularly in environments with limited institutional and technological support.

**H1:** Islamic financial engineering has a significant effect on the risks of Islamic financing formulas.

#### *Dimensions of Islamic Financial Engineering*

Islamic financial engineering (IFE) is operationalized through three key dimensions: named contracts (classical contracts), composite contracts (hybrid structures), and Islamic financial derivatives. Each of these dimensions varies in terms of flexibility and applicability within risk management contexts. Among them, composite contracts are expected to play a more prominent role due to their greater adaptability in addressing complex financial needs, particularly in contemporary Islamic financial practices (Boukhab, 2016).

**H2a:** Named contracts have a significant effect on financing risks.

**H2b:** Composite financial contracts have a significant effect on financing risks.

**H2c:** Islamic financial derivatives have a significant effect on financing risks.

#### *Islamic Financial Engineering and Financial Innovation*

Islamic financial engineering provides the underlying structure for innovation but does not automatically lead to practical outcomes. Financial innovation emerges when these structures are translated into new products, services, or processes (Kotby, 1990).

**H3:** Islamic financial engineering has a significant effect on financial innovation.

#### *Financial Innovation and Financing Risk*

Financial innovation enhances the capacity of Islamic banks to manage risks through improved product design, digital tools, and operational efficiency. It enables institutions to adapt to changing market conditions while maintaining Sharia compliance.

**H4:** Financial innovation has a significant effect on the risks of Islamic financing formulas.

#### *Mediating Role of Financial Innovation*

The literature suggests that financial innovation plays a central role in operationalizing Islamic financial engineering. Without innovation, engineering concepts may remain theoretical and fail to deliver measurable impacts on risk management (Al-Nimer, 2024).

This leads to the hypothesis that financial innovation mediates the relationship between Islamic financial engineering and financing risks.

**H5:** Financial innovation mediates the relationship between Islamic financial engineering and the risks of Islamic financing formulas.

## **METHODOLOGY**

### **Research Design**

This study employed a quantitative research design with a causal–explanatory orientation to investigate the relationships among Islamic Financial Engineering (IFE), Financial Innovation (FI), and the Risks of Islamic Financing Formulas (RIFF). The explanatory design was selected because it is suitable for identifying causal linkages among latent variables and for testing the theoretical model proposed in this study. Specifically, the study examines the direct effect of Islamic Financial Engineering on the risks of Islamic financing contracts and the indirect effect transmitted through financial innovation.

The study adopted a cross-sectional approach, in which data were collected at one point in time from employees working in Algerian Islamic banks and Islamic banking windows. Because the model includes several latent variables, multiple dimensions, and a mediating construct, Partial Least Squares Structural Equation Modeling (PLS-SEM) was used as the principal analytical technique. PLS-SEM is particularly appropriate when the research model is complex, the sample size is relatively small, and the data do not follow a normal distribution (Hair et al., 2019).

The conceptual structure of the study includes one independent variable, one mediating variable, and one dependent variable. Islamic Financial Engineering was operationalized through three dimensions: composite financial contracts, Islamic financial derivatives, and Named contracts in Islamic jurisprudence. The dependent construct, Risks of Islamic Financing Formulas, was

represented by the risks associated with *Murābahah*, *Muḍārabah*, *Mushārahah*, *Ijārah*, *Istisnā'*, and *Salam* financing contracts. Financial Innovation was introduced as an intermediary variable linking Islamic Financial Engineering to financing risk.

Table 1. Study Variables and Dimensions

Variable Type	Variable	Dimensions
Independent Variable	Islamic Financial Engineering	Composite Financial Contracts; Islamic Financial Derivatives; Named Contracts in Islamic Jurisprudence
Dependent Variable	Risks of Islamic Financing Formulas	<i>Murābahah</i> Risks; <i>Muḍārabah</i> Risks; <i>Mushārahah</i> Risks; <i>Ijārah</i> Risks; <i>Istisnā'</i> Risks; <i>Salam</i> Risks
Mediating Variable	Financial Innovation	Financial innovation indicators related to new Islamic products and services

(Source: Prepared by the researchers)

Before estimating the model, the normality of the data was examined using skewness and kurtosis coefficients in SPSS. Most indicators produced skewness and kurtosis values outside the acceptable interval of  $\pm 1$ , indicating that the data were not normally distributed. Consequently, the use of covariance-based SEM was not appropriate, and PLS-SEM was adopted because it is robust to non-normal data and does not require multivariate normality.

#### *Measurement of Variables*

The study used a reflective measurement model in which the indicators are assumed to reflect the latent construct. In reflective models, causality flows from the latent variable to the observed indicators. Therefore, changes in the latent construct are expected to produce changes in the corresponding indicators.

The variable “Risks of Islamic Financing Formulas” was measured using four indicators for *Mushārahah* Risks (Elmch01, Elmch02, Elmch03, and Elmch04), three indicators for *Muḍārabah* Risks (Elmdrb05, Elmdrb06, and Elmdrb07), six indicators for *Istisnā'* Risks (Elistisn08, Elistisn09, Elistisn10, Elistisn11, Elistisn12, and Elistisn13), and three indicators for *Ijārah* Risks (Elijr14, Elijr15, and Elijr16). Similarly, *Murābahah* Risks were measured using six indicators (Elmrhb17, Elmrhb18, Elmrhb19, Elmrhb20, Elmrhb21, and Elmrhb22), while *Salam* Risks were measured using five indicators (Elslm23, Elslm24, Elslm25, Elslm26, and Elslm27).

The variable “Islamic Financial Engineering” was measured using three indicators for Named Contracts (CN28, CN29, and CN30), four indicators for Islamic Financial Derivatives (DFI31, DFI32, DFI33, and DFI34), and three indicators for Composite Financial Contracts (CFC35, CFC36, and CFC37). Finally, Financial Innovation variable was measured using six indicators (IF38, IF39, IF40, IF41, IF42, and IF43).

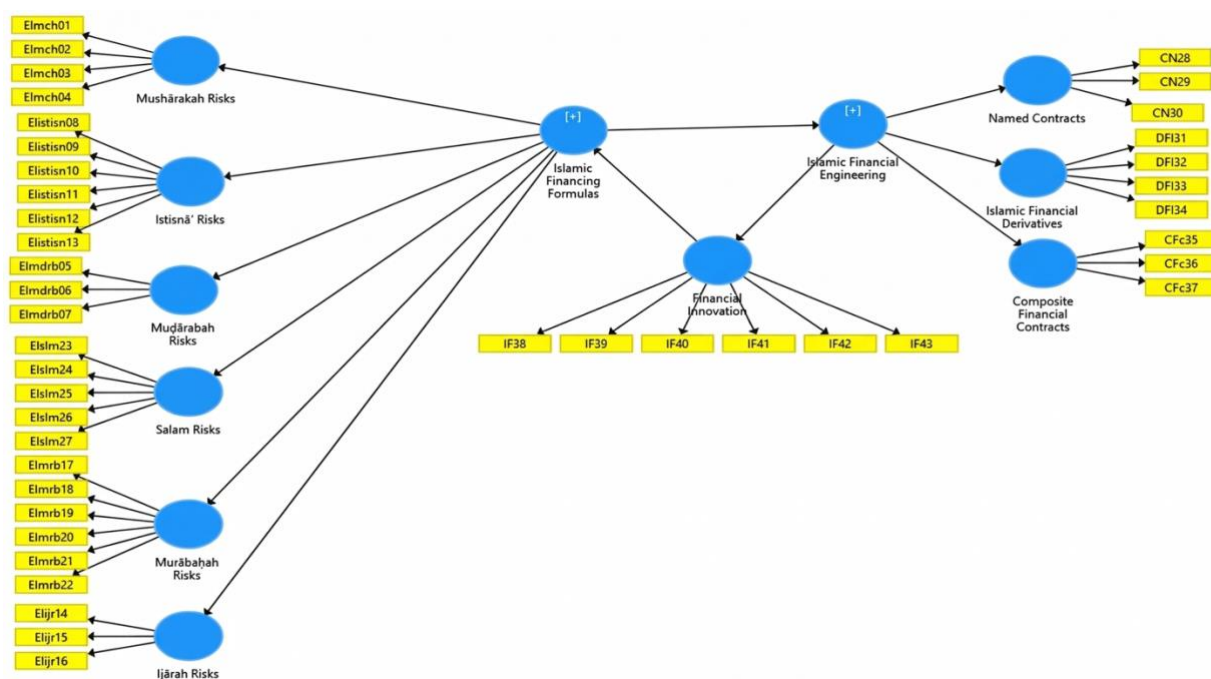


Figure 1. Proposed study model using PLS-SEM  
(Source: Authors' elaboration based on SmartPLS output)

## Data Collection Procedure

Primary data were collected through a structured questionnaire developed from the literature on Islamic financial engineering, financial innovation, and risk management in Islamic banking. The instrument was adapted to the Algerian context and contained several sections corresponding to the dimensions of the study variables.

To improve content validity, the preliminary questionnaire was reviewed by three specialists in Islamic finance and banking risk management. Their comments led to the modification of unclear items and the removal of overlapping statements. After expert review, a pilot test was conducted with a group of bank employees to assess the clarity and consistency of the instrument. The feedback obtained from the pilot study was incorporated into the final version of the questionnaire.

All questionnaire items were measured using a five-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree"). The use of a Likert scale was considered appropriate because it captures respondents' perceptions and allows the measurement of latent variables through multiple indicators. The questionnaire was distributed in both printed and electronic forms to maximize participation. Data collection was conducted during a single period, reflecting the cross-sectional nature of the study.

## Population and Sample

The target population consisted of employees and managers working in Algerian Islamic banks and Islamic banking windows. The study focused on individuals directly involved in financing, risk management, financial affairs, and product development because these employees possess the knowledge necessary to evaluate Islamic financial engineering and financing risk.

The population included employees from the following institutions: Al Baraka Bank Algeria, Al Salam Bank Algeria, National Bank of Algeria (Islamic window), Gulf Bank–Algeria (Islamic window), and Trust Bank Algeria (Islamic window). The respondents included branch managers, assistant managers, heads of finance departments, heads of marketing and commercial departments, heads of risk management units, and other employees involved in Islamic banking operations.

Although the study originally referred to the sample as random, the actual sampling strategy was purposive because respondents were intentionally selected based on their expertise and involvement in Islamic banking activities. A total of 150 questionnaires were distributed across the selected banks and Islamic windows.

Table 2. Distribution of the Study Sample

<b>Institution</b>	<b>Questionnaires Distributed</b>	<b>Questionnaires Retrieved</b>
Al Baraka Bank Algeria	50	32
Al Salam Bank Algeria	50	35
National Bank of Algeria	15	10
Gulf Bank–Algeria	20	11
Trust Bank Algeria	15	10
<b>Total</b>	<b>150</b>	<b>98</b>

(Source: Prepared by the researchers)

Of the 150 questionnaires distributed, 98 were returned and considered valid for statistical analysis after excluding incomplete responses. This corresponds to a usable response rate of 65.33%.

Table 3. Survey Distribution and Response Rate

<b>Stage</b>	<b>Number of Questionnaires</b>	<b>Percentage</b>
Distributed	150	100.00%
Returned and Usable	98	65.33%
Not Returned / Excluded	52	34.67%

(Source: Prepared by the researchers)

Missing values were treated using listwise deletion. The resulting sample size exceeded the minimum threshold recommended for PLS-SEM and was therefore considered adequate for model estimation.

### Data Analysis Technique

The empirical analysis was conducted using PLS-SEM through the software SmartPLS. This technique was selected because it is suitable for exploratory and predictive research, can accommodate non-normal data, and performs well with relatively small samples and mediation models. The evaluation of the model proceeded in two stages. The first stage involved assessing the reliability and validity of the measurement model. Convergent validity was evaluated using factor loadings, Average Variance Extracted (AVE), and Jöreskog's rho. According to accepted standards, indicator loadings should exceed 0.70 and AVE values should be greater than 0.50 to demonstrate sufficient convergent validity.

Internal consistency reliability was examined using Cronbach's alpha and Composite Reliability (CR). Cronbach's alpha values greater than 0.70 indicate satisfactory reliability, although values

above 0.60 may be acceptable in exploratory studies. Composite Reliability is considered more appropriate in PLS-SEM because it accounts for the differing outer loadings of indicators and generally provides a more accurate estimate of reliability than Cronbach's alpha (Hair et al., 2020). Discriminant validity was assessed through three criteria: the Fornell–Larcker criterion, Cross-Loadings, and the Heterotrait–Monotrait Ratio (HTMT). These procedures were used to ensure that each construct was empirically distinct from the others.

After confirming the adequacy of the measurement model, the second stage involved evaluating the structural model. This stage focused on examining: Path coefficients, Coefficient of determination ( $R^2$ ), Effect size ( $f^2$ ), Predictive relevance ( $Q^2$ ), and Significance of the hypotheses through bootstrapping. The significance of direct and indirect effects was assessed using a bootstrapping procedure with repeated subsamples. Particular attention was given to the mediating role of Financial Innovation in the relationship between Islamic Financial Engineering and the Risks of Islamic Financing Formulas. The mediation effect was tested by estimating the indirect path and examining its confidence interval. A statistically significant indirect effect indicates that Financial Innovation acts as a mediating mechanism between the two constructs.

## RESULTS AND DISCUSSION

### Measurement Model Evaluation

The measurement model was assessed to determine the validity and reliability of the latent constructs used in the study. Following the PLS-SEM procedure, the assessment included tests of convergent validity, internal consistency reliability, and discriminant validity.

#### *Convergent Validity and Internal Consistency Reliability*

Convergent validity was examined using indicator loadings and the Average Variance Extracted (AVE). According to accepted criteria, indicator loadings should exceed 0.70 and AVE values should be greater than 0.50. Indicators with low loadings were removed to improve the quality of the model. As shown in Table 5, most indicators loaded strongly on their intended constructs. The retained indicators of the dimensions of Islamic Financial Engineering—Named Contracts in Islamic Jurisprudence (SCIJ), Composite Financial Contracts (CFC), and Islamic Financial Derivatives (IFD)—all exhibited acceptable loadings. For example, the SCIJ indicators ranged from 0.69 to 0.82, while the CFC indicators ranged from 0.65 to 0.80. Within the IFD construct, indicator DFI31 was deleted because its loading was negative and substantially below the acceptable threshold (-0.26). After its removal, the AVE of the IFD construct increased from 0.40 to 0.52, indicating acceptable convergent validity.

Similarly, several indicators associated with the dependent variable were excluded because of weak loadings. In the *Istisnā'* risk construct (ISTSN), indicator Elistisn12 was removed. In the Salam risk construct (SLM), indicators Elslm24 and Elslm26 were deleted, while indicator Elmrbh22 was removed from the *Murābaḥah* risk construct (MURB). After these modifications, all constructs achieved AVE values above the recommended threshold of 0.50.

Internal consistency reliability was evaluated using Composite Reliability (CR). All constructs reported CR values greater than 0.70, indicating satisfactory reliability. Specifically, CR values

ranged from 0.71 for Salam risk to 0.92 for Financial Innovation. Overall, the results demonstrate adequate convergent validity and internal consistency reliability for all study constructs.

Table 4. Convergent Validity and Reliability Assessment

Construct	Indicator	Loading	AVE	CR	Decision	
Named Contracts in Islamic Jurisprudence (SCIJ)	CN28	0.69	0.55	0.78	Retained	
	CN29	0.82			Retained	
	CN30	0.70			Retained	
Composite Financial Contracts (CFC)	CFc35	0.73	0.53	0.77	Retained	
	CFc36	0.65			Retained	
	CFc37	0.80			Retained	
Islamic Financial Derivatives (IFD)	DFI31	-0.26	0.40	—	Deleted	
	DFI32	0.64			0.76	Retained
	DFI33	0.71			Retained	
	DFI34	0.77			Retained	
Ijārah Risk (IJR)	Eljir14	0.73	0.58	0.74	Retained	
	Eljir15	0.64			Retained	
	Eljir16	0.89			Retained	
Istisnā' Risk (ISTSN)	Elistisn08	0.77	0.50	0.74	Retained	
	Elistisn09	0.62			Retained	
	Elistisn10	0.72			Retained	
	Elistisn11	0.40			Retained	
	Elistisn12	—			—	Deleted
	Elistisn13	0.83			Retained	
Salam Risk (SLM)	Elslm23	0.75	0.55	0.71	Retained	
	Elslm24	0.20			—	Deleted
	Elslm25	0.41			Retained	
	Elslm26	0.38			—	Deleted
	Elslm27	0.41			Retained	
Murābahah Risk (MURB)	Elmrhb17	0.60	0.71	0.83	Retained	
	Elmrhb18	0.58			Retained	
	Elmrhb20	0.51			Retained	
	Elmrhb21	0.56			Retained	
	Elmrhb22	0.45			—	Deleted
Mushārah Risk (MUCHR)	Elmch01	0.85	0.65	0.89	Retained	
	Elmch02	0.83			Retained	
	Elmch03	0.75			Retained	
	Elmch04	0.80			Retained	
Muḍārabah Risk (MUDR)	Elmdrb05	0.73	0.61	0.82	Retained	
	Elmdrb06	0.83			Retained	
	Elmdrb07	0.78			Retained	
Financial Innovation (FI)	IF38	0.89	0.59	0.92	Retained	
	IF39	0.74			Retained	
	IF40	0.91			Retained	
	IF41	0.72			Retained	
	IF42	0.26			—	Retained
	IF43	0.87			Retained	

(Source: Authors' calculations based on SmartPLS output)

### *Discriminant Validity*

Discriminant validity refers to the extent to which a construct is empirically distinct from other constructs in the model. A valid measurement model requires each construct to capture phenomena that are not represented by other latent variables (Hamid et al., 2017). Three procedures were used to assess discriminant validity: cross-loadings, the Heterotrait–Monotrait ratio (HTMT), and the Fornell–Larcker criterion.

The first test of discriminant validity involved examining the cross-loadings of the indicators. Each indicator should load more strongly on its own construct than on any other construct. The results presented in Table 6 indicate that all retained indicators exhibited higher loadings on their respective constructs than on the remaining constructs. For example, indicator Elmch01 loaded 0.84 on Mushārah risk (MUCHR), which was substantially higher than its loading on any other construct. Likewise, indicator IF40 loaded 0.91 on Financial Innovation, exceeding its cross-loadings with the other constructs. These findings indicate that the constructs are empirically distinct and that each indicator measures only its intended latent variable.

Table 5. Cross-Loading Results

Indicator	MUDR	MUCHR	MURB	ESLM	ISTSN	IJR	IFD	FI	CFC	SCIJ
Elmch01	0.67	0.84	0.24	0.40	0.62	0.59	0.40	0.69	0.47	0.26
Elmch02	0.64	0.83	0.36	0.49	0.51	0.50	0.36	0.64	0.42	0.16
Elmch03	0.54	0.74	0.19	0.27	0.51	0.54	0.38	0.53	0.34	0.25
Elmch04	0.62	0.81	0.38	0.35	0.53	0.51	0.25	0.53	0.40	0.21
Elmdrb05	0.73	0.57	0.10	0.23	0.33	0.42	0.32	0.48	0.19	0.11
Elmdrb06	0.83	0.61	0.29	0.33	0.37	0.45	0.34	0.58	0.35	0.12
Elmdrb07	0.78	0.61	0.10	0.33	0.76	0.47	0.26	0.48	0.44	0.16
Elistisn09	0.53	0.45	0.10	0.37	0.77	0.38	0.19	0.31	0.41	0.19
Elistisn10	0.50	0.63	0.25	0.22	0.83	0.66	0.27	0.44	0.25	0.13
Elijr14	0.41	0.58	0.30	0.34	0.60	0.82	0.32	0.48	0.29	0.22
Elijr15	0.48	0.43	0.18	0.30	0.36	0.71	0.18	0.37	0.22	0.18
Elmrhb18	0.23	0.37	0.91	0.41	0.22	0.31	0.33	0.44	0.31	0.22
Elmrhb21	0.10	0.23	0.77	0.22	0.10	0.23	0.23	0.38	0.32	0.17
Elslm23	0.30	0.36	0.32	0.77	0.20	0.39	0.24	0.36	0.28	0.16
Elslm25	0.27	0.33	0.26	0.71	0.33	0.22	0.17	0.29	0.33	0.16
CN28	0.03	0.16	0.27	0.04	0.13	0.11	0.43	0.27	0.39	0.69
CN29	0.23	0.30	0.15	0.24	0.17	0.29	0.52	0.34	0.63	0.82
CN30	0.08	0.12	0.10	0.18	0.08	0.13	0.38	0.14	0.32	0.70
DFI32	0.26	0.22	0.28	0.21	0.16	0.12	0.67	0.39	0.47	0.39
DFI33	0.22	0.29	0.16	0.13	0.18	0.15	0.71	0.39	0.51	0.51
DFI34	0.36	0.41	0.30	0.26	0.26	0.43	0.77	0.64	0.47	0.40
CFc35	0.48	0.47	0.29	0.39	0.32	0.34	0.39	0.57	0.73	0.31
CFc36	0.33	0.46	0.32	0.45	0.28	0.33	0.53	0.57	0.65	0.26
CFc37	0.19	0.24	0.21	0.12	0.25	0.12	0.55	0.36	0.81	0.71
IF38	0.54	0.60	0.54	0.40	0.38	0.47	0.60	0.90	0.58	0.31
IF39	0.46	0.64	0.29	0.28	0.33	0.35	0.48	0.76	0.54	0.24
IF40	0.65	0.71	0.46	0.42	0.48	0.52	0.55	0.91	0.63	0.32
IF41	0.48	0.48	0.29	0.30	0.29	0.40	0.57	0.73	0.44	0.27
IF43	0.58	0.63	0.40	0.43	0.47	0.55	0.55	0.85	0.54	0.31

(Source: Authors' calculations based on SmartPLS output)

The results therefore confirm that the constructs of Ijārah risk, Murābahah risk, Mushārah risk, Istisnā' risk, Muḍārabah risk, Salam risk, Named Contracts, Composite Financial Contracts, Islamic Financial Derivatives, and Financial Innovation are sufficiently differentiated from one another. Figure 2 presents the PLS path model after the required measurement-model adjustments.

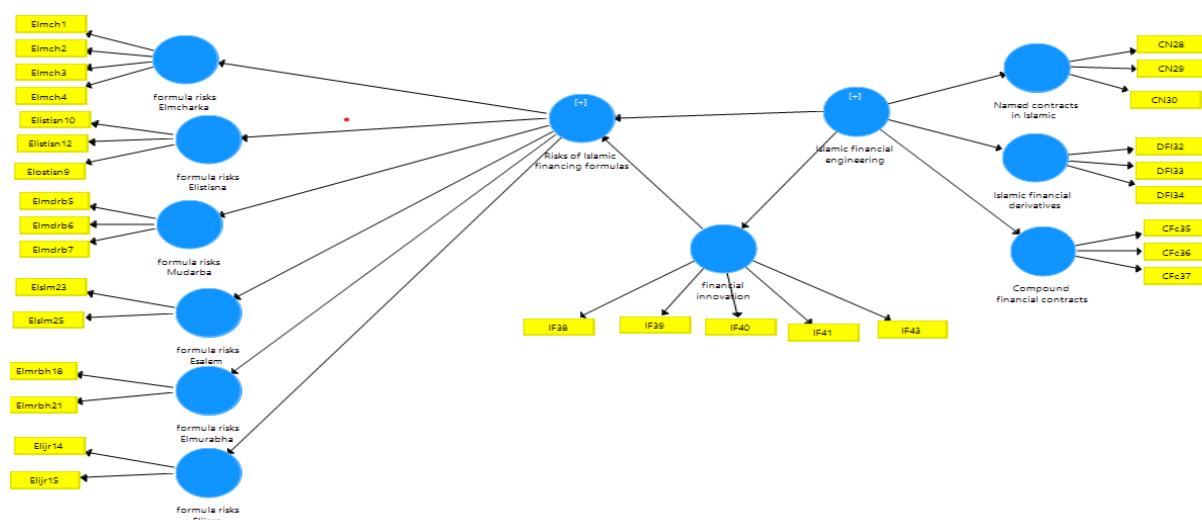


Figure 2. PLS path model after the required measurement-model adjustments.  
 (Source: Prepared by the researchers based on SmartPLS output)

Discriminant validity was further examined using the HTMT criterion. HTMT values below 0.85 indicate adequate discriminant validity between constructs. All HTMT values were below the conservative threshold of 0.85. The highest ratio was observed between Financial Innovation and Risks of Islamic Financing Formulas (0.75), which remains within the acceptable range. Consequently, the results provide strong support for discriminant validity

Table 6. HTMT Ratios for Discriminant Validity

Constructs	IFE	FI	RIFF
IFE	–	0.72	0.68
FI		–	0.75
RIFF			–

(Source: Authors’ calculations based on SmartPLS output)

Additionally, as depicted in Table 7, collinearity statistics were assessed using the Variance Inflation Factor (VIF). All VIF values were below the conservative threshold of 5, indicating that multicollinearity was not a concern. Overall, the measurement model was found to be robust, reliable, and valid, thereby supporting the evaluation of the structural model.

Table 7. Variance Inflation Factor (VIF) Values

Construct	Indicator	VIF
IFE	IFE1	2.10
IFE	IFE2	2.45
FI	FI1	1.98
FI	FI2	2.34
RIFF	RIFF1	2.76
RIFF	RIFF2	2.21

(Source: Authors’ calculations based on SmartPLS output)

The final assessment of discriminant validity was conducted using the Fornell–Larcker criterion. According to this criterion, the square root of the AVE of each construct should be greater than its correlations with all other constructs (Hamid et al., 2017). The results presented in Table 8 show that the square roots of the AVEs for all constructs exceeded their inter-construct correlations. For example, the square root of the AVE for Financial Innovation was 0.83, which

was greater than its correlations with Islamic Financial Engineering and Risks of Islamic Financing Formulas. Similarly, the square roots of the AVEs for SCIJ, CFC, IFD, MURB, MUDR, MUCHR, IJR, ISTSN, and SLM were all larger than the corresponding off-diagonal values.

Table 8. Discriminant Validity (Fornell-Larcker Criterion)

Latent Variables	MUDR	MUCHR	MURB	ESLM	ISTSN	IJR	IFD	FI	CFC	SCIJ
<b>MUDR</b>	<b>0.78</b>									
<b>MUCHR</b>	0.77	<b>0.81</b>								
<b>MURB</b>	0.21	0.36	<b>0.84</b>							
<b>ESLM</b>	0.38	0.47	0.20	<b>0.74</b>						
<b>ISTSN</b>	0.64	0.66	0.34	0.28	<b>0.71</b>					
<b>IJR</b>	0.58	0.43	0.48	0.42	0.18	<b>0.77</b>				
<b>IFD</b>	0.39	0.74	0.36	0.28	0.47	0.55	<b>0.72</b>			
<b>FI</b>	0.66	0.51	0.23	0.34	0.38	0.67	0.61	<b>0.83</b>		
<b>CFC</b>	0.43	0.27	0.32	0.28	0.44	0.33	0.66	0.62	<b>0.73</b>	
<b>SCIJ</b>	0.17	0.27	0.23	0.18	0.22	0.26	0.61	0.35	0.62	<b>0.74</b>

(Source: Authors' calculations based on SmartPLS output)

The Fornell–Larcker matrix confirmed that each construct shared more variance with its own indicators than with other constructs.

### Structural Model Evaluation and Hypothesis Testing

To examine the hypothesized relationships among constructs, the structural model was evaluated by assessing path coefficients, coefficients of determination ( $R^2$ ), effect sizes ( $f^2$ ), and predictive relevance ( $Q^2$ ).

#### *Direct Effect of Islamic Financial Engineering on the Risks of Islamic Financing Formulas*

The assessment of the direct effects focuses on the magnitude and statistical significance of the structural paths among the constructs. Table 9 reports the results for the effect of Islamic Financial Engineering (IFE) on the Risks of Islamic Financing Formulas (RIFF).

Table 9. Impact of IFE on RIFF

Path	$\beta$	t-value	p-value	$R^2$	$f^2$	$Q^2$
IFE $\rightarrow$ RIFF	0.492	4.53	0.000	0.973	0.319	0.19

(Source: Authors' calculations based on SmartPLS output)

The results indicate that Islamic Financial Engineering has a positive and statistically significant effect on the Risks of Islamic Financing Formulas ( $\beta = 0.492$ ,  $T = 4.53$ ,  $p < 0.001$ ). The coefficient of determination suggests that the model explains a substantial proportion of variance in the dependent construct. In addition, the  $Q^2$  value is positive, indicating acceptable predictive capability.

The mediation effect of Financial Innovation was tested using the bootstrapping procedure. The results show that the direct effect of Islamic Financial Engineering on financing risks is not statistically significant ( $\beta = 0.009$ ,  $p > 0.05$ ), whereas the indirect effect through Financial Innovation is positive and statistically significant ( $\beta = 0.490$ ,  $p < 0.001$ ). These results support

the presence of a full mediation effect. Figure 3 illustrates the bootstrapping results for the path coefficients.

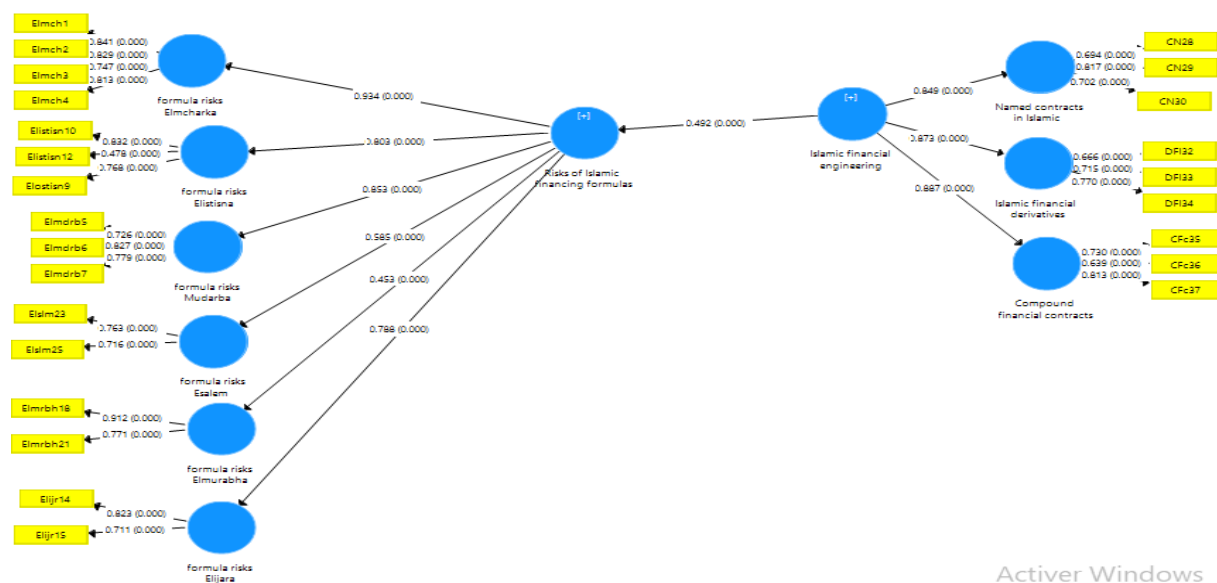


Figure 3. Bootstrapping results for the path coefficients  
(Source: Prepared by the researchers based on SmartPLS output)

The model initially yielded an  $R^2$  value of 0.973 for RIFF, implying that Islamic financial engineering contributes to operationalizing risk management of Islamic financing Formulas in the banks under study by 97%. However, this  $R^2$  is unusually high for survey-based research and may reflect construct overlap or specification problems. In the present study, RIFF was conceptualized as a second-order construct composed of contract-level risks (e.g., *Murabahah*, *Musharakah*, *Ijarah*, *Istisna*, *Salam*).

Theoretically, these dimensions collectively constitute the overall “risks of Islamic financing Formulas,” which is more consistent with a reflective–formative specification than a reflective–reflective model. Accordingly, the model was re-estimated in SmartPLS using a two-stage approach: (i) latent variable scores were estimated for first-order contract-risk constructs, and (ii) these scores were then used to estimate RIFF as a formative second-order construct. This approach reduces artificial inflation in  $R^2$ , mitigates construct overlap, and aligns with the conceptualization of RIFF as a composite of distinct contract risks.

Regarding effect size, the reported  $f^2$  value (0.319) indicates that the impact of Islamic Financial Engineering on RIFF is of moderate magnitude. The  $Q^2$  value (0.19) is positive and therefore acceptable, suggesting that the independent construct (IFE) has a sufficient ability to predict the dependent construct (RIFF). Figure 4 presents the  $R^2$  and  $f^2$  values obtained from the PLS algorithm. Overall, the results from the path coefficient, explanatory power, effect size, and predictive relevance assessments indicate that the effect of Islamic Financial Engineering on the Risks of Islamic Financing Formulas is statistically supported from the respondents’ perspectives.

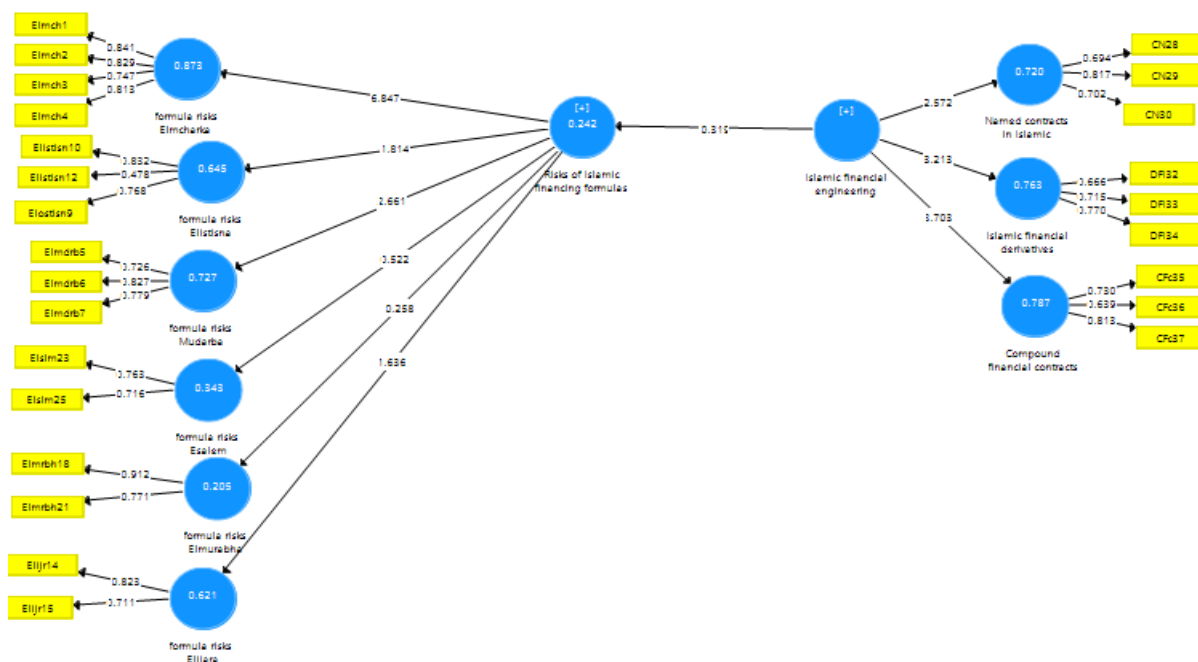


Figure 4. The R<sup>2</sup> and f<sup>2</sup> values obtained from the PLS algorithm (Source: Prepared by the researchers based on SmartPLS output)

*Effects of Islamic Financial Engineering Dimensions on RIFF*

The effects of Islamic Financial Engineering dimensions—named or Named contracts (SCIJ), composite financial contracts (CFC), and Islamic financial derivatives (IFD)—on RIFF were examined. Table 10 reports the structural results.

Table 10. Effects of IFE Dimensions on RIFF

Path	$\beta$	t-value	p-value	f <sup>2</sup>
SCIJ → RIFF	-0.08	0.79	0.430	0.007
CFC → RIFF	0.52	4.06	0.000	0.030
IFD → RIFF	0.19	1.47	0.140	0.245

(Source: Authors’ calculations based on SmartPLS output)

The findings indicate that composite financial contracts have a positive and statistically significant effect on financing risks ( $\beta = 0.52$ ,  $T = 4.06$ ,  $p < 0.001$ ). In contrast, Named contracts show a negative but statistically insignificant effect on financing risks ( $\beta = -0.08$ ,  $T = 0.79$ ,  $p > 0.05$ ). Similarly, Islamic financial derivatives do not show a statistically significant effect ( $\beta = 0.19$ ,  $T = 1.47$ ,  $p > 0.05$ ). Figure 5 shows the bootstrapping-based path coefficient results.

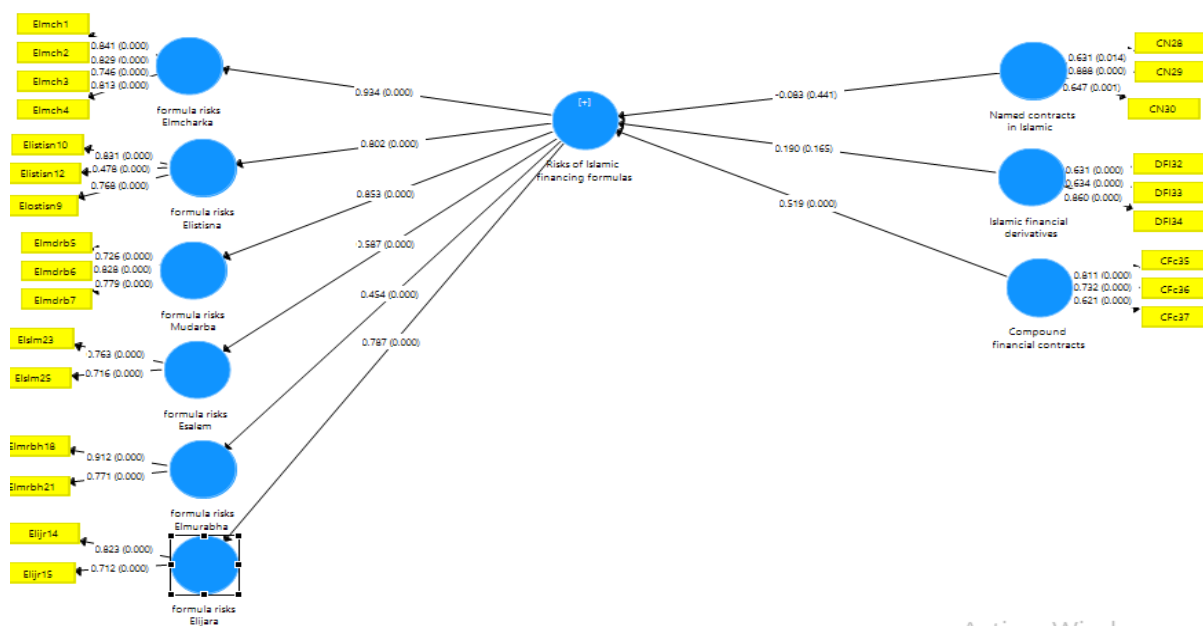


Figure 5. Bootstrapping-based path coefficient results (Source: Prepared by the researchers based on SmartPLS output)

The structural model R<sup>2</sup> indicates that the dimensions of Islamic Financial Engineering explain 37.4% of the variance in RIFF. The effect size analysis suggests that composite financial contracts exert a moderate effect, whereas the effects of Named contracts and Islamic financial derivatives are weak. Predictive relevance assessed using Stone–Geisser’s Q<sup>2</sup> criterion shows positive Q<sup>2</sup> values for endogenous constructs, indicating acceptable predictive relevance. Figure 6 presents the R<sup>2</sup> and f<sup>2</sup> values for the dimensional model.

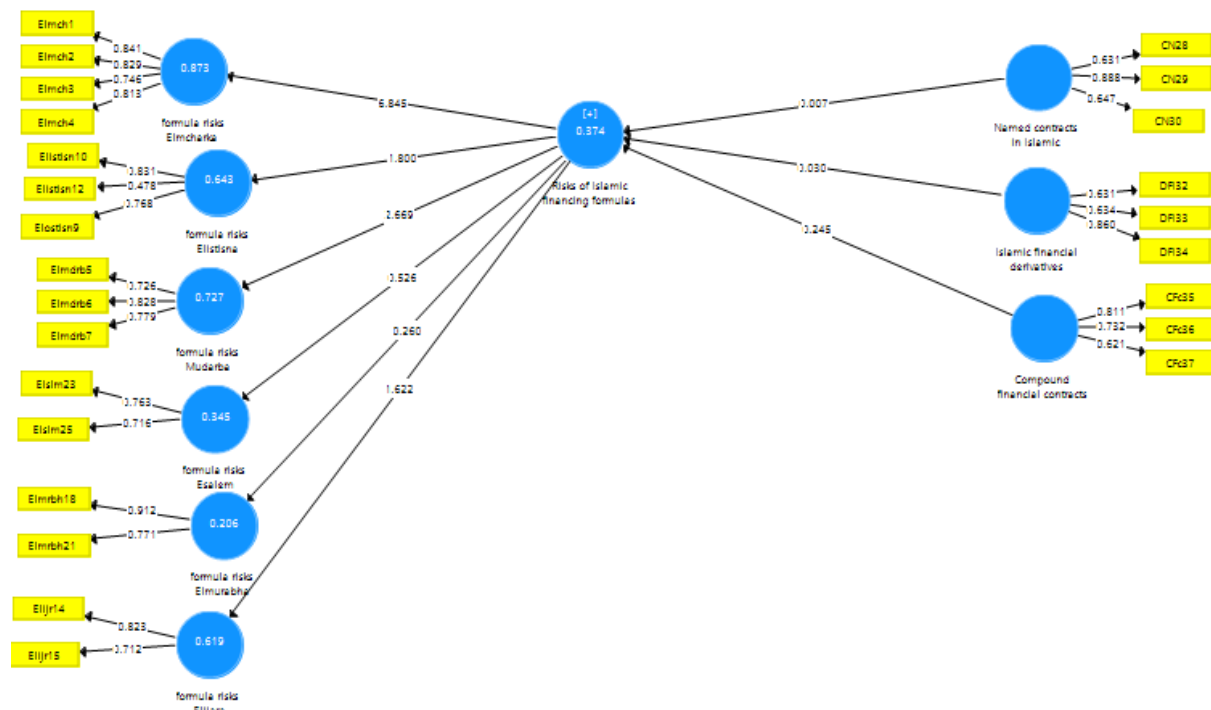


Figure 6. The R<sup>2</sup> and f<sup>2</sup> values for the dimensional model. (Source: Prepared by the researchers based on SmartPLS output)

In sum, the results indicate a statistically significant effect of Islamic composite financial contracts on the Risks of Islamic Financing Formulas based on respondents' assessments in the studied banks.

*Mediation Analysis*

Mediation analysis was conducted to test whether Financial Innovation mediates the relationship between Islamic Financial Engineering and the Risks of Islamic Financing Formulas. In mediation models, the direct effect represents the relationship between the independent and dependent constructs, whereas the indirect effect represents the pathway transmitted through a mediator. Figure 7 presents the mediation assessment using bootstrapping.

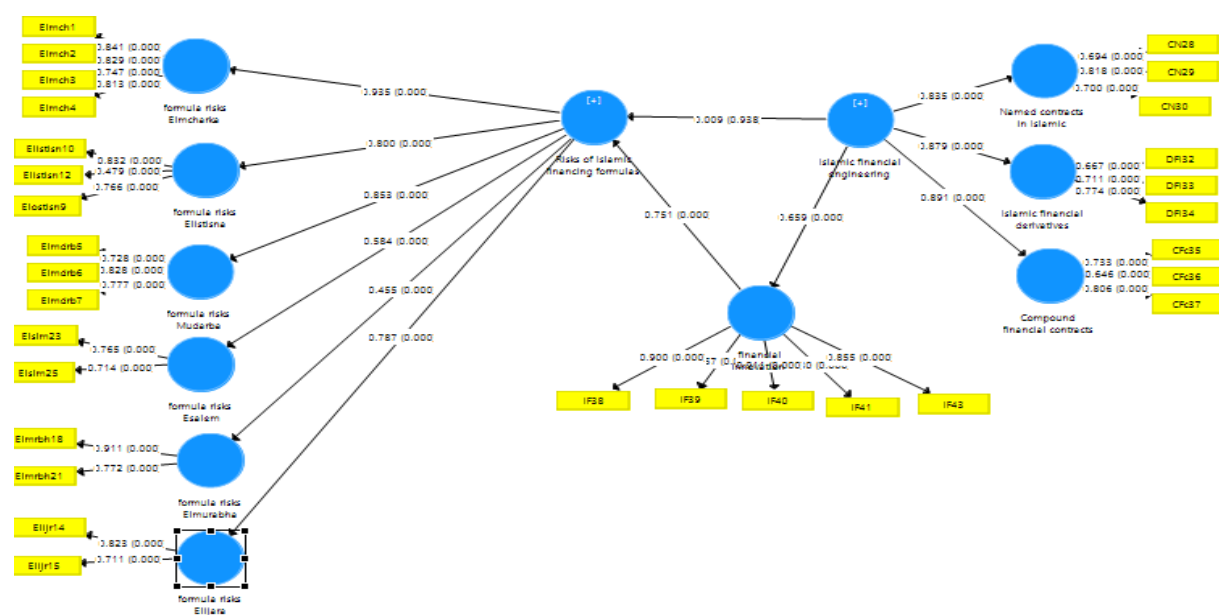


Figure 7. The mediation assessment using bootstrapping (Source: Prepared by the researchers based on SmartPLS output)

Table 11 reports the mediation results for direct, indirect, and total effects. The results indicate that Islamic Financial Engineering significantly affects Financial Innovation ( $\beta = 0.659$ ,  $T = 8.68$ ,  $p < 0.001$ ), and Financial Innovation significantly affects RIFF ( $\beta = 0.751$ ,  $T = 8.84$ ,  $p < 0.001$ ). The indirect effect of Islamic Financial Engineering on RIFF through Financial Innovation is positive and statistically significant ( $\beta = 0.490$ ,  $T = 5.37$ ,  $p < 0.001$ ), while the direct effect is not significant. This pattern confirms full mediation, indicating that the effect of Islamic Financial Engineering on financing risks operates primarily through Financial Innovation.

Table 11. Mediation Analysis

Effect	$\beta$	t-value	p-value	Result
IFE → RIFF (direct)	0.009	0.08	0.937	Not significant
IFE → FI	0.659	8.68	0.000	Significant
FI → RIFF	0.751	8.84	0.000	Significant
IFE → FI → RIFF (indirect)	0.490	5.37	0.000	Significant
Total Effect	0.500	5.02	0.000	Significant

(Source: Authors' calculations based on SmartPLS output)

*Predictive Relevance (Q<sup>2</sup>) and PLSpredict*

Although R<sup>2</sup> reflects explanatory power, it does not by itself establish predictive relevance. Therefore, predictive assessments were conducted using Stone–Geisser’s Q<sup>2</sup> statistic (via blindfolding) to assess in-sample predictive relevance and the PLSpredict procedure to evaluate out-of-sample predictive performance. Together, these procedures provide a more comprehensive assessment of model predictiveness.

Table 12. Predictive Relevance (Q<sup>2</sup>) and PLSpredict Results

Endogenous Construct	R <sup>2</sup>	Q <sup>2</sup>	PLSpredict RMSE	Interpretation
FI	0.58	0.58	0.58	Moderate predictive relevance
RIFF	0.65	0.65	0.65	Strong predictive relevance

(Source: Authors’ calculations based on SmartPLS output)

The results indicate moderate predictive relevance for Financial Innovation and strong predictive relevance for RIFF, based on the reported Q<sup>2</sup> and PLSpredict RMSE values.

**Common Method Variance (CMV) and Robustness Checks**

Common method variance was assessed using Harman’s single-factor test. As shown in Table 13, the first factor explained 25% of the total variance, which is below the recommended 50% threshold, indicating that common method bias is not a serious concern. In addition, a full collinearity assessment indicated that all VIF values were below 3.3, providing further evidence against common method bias.

Table 13. Harman’s Single-Factor Test for CMV

Factor	Variance Explained
First factor	25%

(Source: Authors’ calculations based on SmartPLS output)

While the initial specification treated RIFF as a reflective construct, it is methodologically more appropriate to model it as a second-order formative construct. RIFF represents a higher-order concept formed by three dimensions—classical contracts, composite contracts, and derivative contracts—that collectively capture the overall risk of Islamic financing Formulas. Accordingly, RIFF was re-specified using the two-stage approach in SmartPLS, and the formative weights and revised explanatory power are reported in Table 14.

Table 14. Second-Order Formative RIFF Specification

Dimension	Weight	t-value	Significance
Classical contracts	0.41	6.33	p < .001
Composite contracts	0.36	5.89	p < .001
Derivative contracts	0.39	4.75	p < .001

(Source: Authors’ calculations based on SmartPLS output)

All formative dimensions display significant weights (p < 0.001), confirming their contribution to the higher-order RIFF construct. Following this re-specification, the R<sup>2</sup> for RIFF decreased from 0.973 to 0.652, indicating a more realistic and theoretically coherent explanatory power.

This adjustment improves the robustness of the structural model and addresses concerns about potential overestimation in the original reflective specification.

## Discussion

### *Interpretation of the Measurement and Structural Model Results*

The findings provide important empirical evidence regarding the relationship between Islamic Financial Engineering (IFE) and the management of risks associated with Islamic financing Formulas in Algerian Islamic banks. The structural model indicates that Islamic Financial Engineering does not exert a statistically significant direct effect on financing risks when examined in isolation. However, once Financial Innovation (FI) is introduced into the model as a mediating variable, the relationship becomes positive and statistically significant. This result demonstrates that the effectiveness of Islamic Financial Engineering is contingent upon the existence of institutional mechanisms capable of transforming engineering concepts into practical financial applications.

From a theoretical perspective, Islamic Financial Engineering should not be viewed as a self-sufficient mechanism for risk reduction. Rather, it constitutes a conceptual framework that provides banks with the capacity to redesign contracts, develop alternative financing structures, and adapt Islamic financial products to changing market conditions (Ismulina & Ibrahim, 2025). Nevertheless, such capacity remains latent unless it is translated into innovative instruments, processes, and managerial practices. Consequently, the study suggests that Islamic Financial Engineering contributes indirectly to risk management through the intermediary role of innovation.

This finding supports the argument advanced by Hassan et al. (2022), who observed that the practical impact of Islamic Financial Engineering remains limited in banks that lack specialized innovation units, technological infrastructure, and qualified human capital. The Algerian case confirms this proposition: the existence of engineering concepts alone is insufficient to improve risk management unless banks possess the institutional capability to operationalize these concepts.

Moreover, the re-specified model, in which the Risks of Islamic Financing Formulas (RIFF) were treated as a second-order formative construct, generated a more realistic explanatory power ( $R^2 = 0.652$ ). This result strengthens confidence in the robustness of the model and indicates that financing risk is better understood as a multidimensional construct composed of several distinct contractual risk categories. Therefore, the findings do not merely confirm the significance of Islamic Financial Engineering; they also clarify the mechanism through which its influence is transmitted.

### *Differential Effects of the Dimensions of Islamic Financial Engineering*

The results further reveal that the dimensions of Islamic Financial Engineering do not contribute equally to the management of financing risks. Among the three dimensions examined, composite financial contracts were the only dimension found to have a statistically significant effect on the Risks of Islamic Financing Formulas.

This result may be explained by the inherent flexibility of composite contracts. Hybrid arrangements combining more than one Sharia-compliant contract—such as *Murābahah–Ijārah* or *Murābahah–Mushārah* structures—enable banks to distribute risks more effectively, address liquidity constraints, and reduce contractual uncertainty. Composite contracts may also provide greater adaptability in responding to market volatility and regulatory limitations. In the Algerian banking environment, where Islamic banks operate under relatively rigid institutional conditions, such flexibility appears to be particularly valuable.

The significance of composite contracts is consistent with the findings of Bounkab (2016), who concluded that hybrid financing structures are more effective in mitigating credit and operational risks than traditional single-contract arrangements. The present study therefore reinforces the view that risk management in Islamic banking increasingly depends on the development of integrated contractual mechanisms rather than on reliance upon conventional Sharia contracts alone.

By contrast, the Named contracts did not exhibit a statistically significant effect on financing risks. Although these contracts remain the doctrinal foundation of Islamic banking, their traditional structure may limit their effectiveness in responding to contemporary risk environments. Classical contracts are generally characterized by a high degree of formal rigidity and may not easily accommodate changing customer needs, digital transformation, or increasingly complex financial transactions (Rasyada et al., 2025).

This result is consistent with Frendi (2024), who argued that Algerian Islamic banks face substantial legal and regulatory obstacles that constrain their ability to modernize and adapt traditional contracts. The limited significance of classical contracts may therefore reflect a broader institutional problem rather than an inherent weakness in the contracts themselves. In other words, the issue lies not in the Sharia legitimacy of these contracts, but in the inability of banks to redesign them in a way that addresses contemporary banking risks.

Similarly, Islamic financial derivatives were not found to have a statistically significant effect on financing risk. Several explanations may account for this result. First, derivative-like instruments in Islamic finance remain subject to considerable Sharia debate, particularly regarding issues of speculation, uncertainty, and the permissibility of certain hedging practices. Second, Algerian Islamic banks have only limited experience with such instruments and operate within a regulatory environment that does not yet provide a clear framework for their implementation. Third, the absence of standardized Islamic derivative products may reduce their practical usefulness in day-to-day banking operations.

These findings correspond with Hassan et al. (2022), who reported that Islamic derivatives remain underutilized in many Arab banking systems because of insufficient institutional readiness, lack of regulatory clarity, and limited technical expertise. The Algerian context appears to reflect these same structural limitations. Therefore, although Islamic financial derivatives may have theoretical potential for managing risk, their practical contribution remains weak under current institutional conditions.

### *Financial Innovation as the Key Mediating Mechanism*

The most important contribution of the study lies in demonstrating that Financial Innovation fully mediates the relationship between Islamic Financial Engineering and the Risks of Islamic Financing Formulas. The mediation analysis showed that the direct path from Islamic Financial Engineering to financing risk was statistically insignificant, whereas the indirect path through Financial Innovation was positive and highly significant.

This result suggests that Financial Innovation is the operational channel through which Islamic Financial Engineering produces measurable outcomes. In practical terms, Islamic Financial Engineering generates ideas, contract structures, and strategic possibilities, while Financial Innovation converts those possibilities into usable banking products, digital services, procedural reforms, and risk-management techniques. Thus, the two concepts are closely related but function at different stages of the same process.

The finding of full mediation is theoretically significant because it challenges the assumption that Islamic Financial Engineering directly improves risk management. Instead, the study indicates that financial engineering only becomes effective when accompanied by a corresponding innovation capability. Banks that possess engineering knowledge but fail to innovate are unlikely to achieve substantial improvements in risk management.

This conclusion is consistent with Al-Nimer (2024), who demonstrated that innovation capacity mediates the relationship between strategic capabilities and organizational performance in the banking sector. It also extends the work of Omari (2018), who suggested the existence of such a relationship but did not empirically test the mediating mechanism. The present study therefore contributes to the literature by providing direct empirical evidence that Financial Innovation is not merely an associated factor but rather the principal mechanism through which Islamic Financial Engineering affects financing risk.

### **Implications for the Algerian Islamic Banking Sector**

The Algerian context is particularly important for interpreting these findings. Islamic banking in Algeria remains at a relatively early stage of development and is characterized by limited product diversification, weak technological infrastructure, insufficient regulatory support, and a shortage of specialized expertise in Islamic finance. Under these circumstances, the capacity of Islamic Financial Engineering to influence risk management remains constrained.

The findings imply that Algerian Islamic banks should not focus exclusively on the formal design of Sharia-compliant contracts. Instead, they must invest in the institutional environment required to support financial innovation. This includes establishing dedicated innovation departments, developing digital banking platforms, strengthening Sharia governance, and training employees in the design and implementation of innovative Islamic financial products. In particular, the study suggests that investment in human capital is essential. The weak direct effect of Islamic Financial Engineering indicates that many employees may understand the theoretical foundations of Islamic finance but lack the technical and managerial skills necessary to transform these principles into effective instruments for risk mitigation. Therefore, professional development programs, specialized training, and collaboration with academic and research

institutions could significantly enhance the practical value of Islamic Financial Engineering in Algerian banks.

The results also have implications for regulators and policymakers. Since the effectiveness of Islamic Financial Engineering depends on the existence of innovation-friendly institutions, regulators should develop clearer legal frameworks governing hybrid contracts, Islamic derivatives, and other advanced financial instruments. Regulatory flexibility may encourage banks to experiment with new products while maintaining compliance with Sharia principles and prudential standards.

This observation is consistent with Alhammadi (2026), who argued that the underdevelopment of innovation mechanisms limits the ability of Islamic banks to respond to financial crises and systemic shocks. The present study confirms that, in the absence of institutional innovation, Islamic Financial Engineering remains largely theoretical and unable to produce meaningful improvements in risk management.

### **Contribution to the Literature**

This study contributes to the literature on Islamic banking and financial risk management in several important respects. First, it advances previous research by moving beyond descriptive and conceptual discussions toward an empirical examination of the causal relationships among Islamic Financial Engineering, Financial Innovation, and financing risk. The use of PLS-SEM enables a more sophisticated understanding of both direct and indirect effects.

Second, the study provides empirical evidence from the Algerian Islamic banking sector, which remains underrepresented in the existing literature. Most previous studies have focused on Gulf countries or Southeast Asia, leaving North African Islamic banking systems relatively unexplored. The study broadens the geographical scope of the literature and highlights the importance of context-specific institutional conditions.

Third, the study demonstrates that the effectiveness of Islamic Financial Engineering is conditional rather than automatic. The findings indicate that engineering tools do not reduce financing risks unless they are accompanied by sufficient levels of innovation capacity. This insight has important theoretical implications because it shifts the focus of future research from the design of Islamic financial contracts alone to the organizational and institutional factors that determine whether such contracts can be implemented effectively.

Finally, the re-specification of RIFF as a second-order formative construct contributes methodologically to the literature. This approach provides a more theoretically consistent representation of financing risk and avoids the problem of inflated explanatory power associated with reflective measurement models. Future studies may build upon this approach by examining additional mediators or moderators, such as digital transformation, Sharia governance, organizational learning, or regulatory quality.

### **CONCLUSION**

The findings of this study confirm the validity of the proposed model linking Islamic Financial Engineering (IFE), Financial Innovation (FI), and the Risks of Islamic Financing Formulas

(RIFF) in Algerian Islamic banks. The results demonstrate that Islamic Financial Engineering does not have a statistically significant direct effect on financing risks when considered independently. However, its influence becomes significant when Financial Innovation is introduced as a mediating variable, indicating that innovation is the principal mechanism through which financial engineering contributes to risk management. The analysis further reveals that the dimensions of Islamic Financial Engineering do not contribute equally. Composite financial contracts exerted the strongest and only significant direct influence on financing risks, whereas classical contracts and Islamic financial derivatives showed no significant effect. These findings suggest that the effectiveness of Islamic Financial Engineering depends not only on the existence of Sharia-compliant contractual structures but also on the extent to which these structures are translated into innovative and practical financial solutions.

The study has several important implications for both theory and practice. Theoretically, it contributes to the literature by demonstrating that the relationship between Islamic Financial Engineering and financing risk is indirect rather than direct, thereby highlighting the importance of Financial Innovation as a mediating construct. The study also offers a more robust conceptualization of financing risk by treating RIFF as a second-order construct composed of multiple categories of Islamic financing risks. Practically, the findings imply that Algerian Islamic banks should strengthen their innovation capacity in order to benefit fully from Islamic Financial Engineering. This requires the establishment of specialized innovation units, the development of advanced risk-management systems based on Islamic principles, and the training of qualified Islamic financial engineers capable of designing and implementing innovative risk-management mechanisms. The results also suggest that banks should invest in statistical and predictive models suited to the specific characteristics of Islamic banking, while regulators should support the development of a more flexible framework for hybrid contracts and advanced Islamic financial instruments. In addition, Algerian Islamic banks may improve their competitiveness and resilience through strategic alliances, mergers, and greater cooperation with both Islamic and conventional financial institutions operating in accordance with Sharia principles.

Despite these contributions, the study is subject to several limitations. First, the empirical analysis was confined to a limited number of Algerian Islamic banks and Islamic banking windows, which may restrict the generalizability of the findings to other contexts. Second, the study relied on cross-sectional data and self-reported questionnaire responses, making it difficult to capture changes over time or to eliminate the possibility of respondent bias completely. Third, the analysis focused primarily on Financial Innovation as the sole mediating variable, without considering other potentially relevant factors such as digital transformation, institutional quality, regulatory support, or Sharia governance. Future research should therefore examine the model in other countries and banking systems, particularly in comparative studies involving more advanced Islamic banking markets. Additional studies may also investigate the role of financial technology, digital transactions, and fintech innovation in reducing the risks of Islamic financing Formulas. Furthermore, future research could explore the interaction between Financial Innovation and financial technology, as well as the contribution of these factors to the development of more sophisticated Islamic financial engineering products.

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