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Innovation Capacity as a Mediating Mechanism Between Strategic Risk Integration and ESG Performance: Evidence from Jordanian Banks

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Abstract: While prior research has established direct relationships between strategic risk integration and ESG performance in banking, critical gaps remain in understanding the transformation mechanisms, particularly in emerging markets. This study investigated how banking innovation capacity mediates the relationship between strategic risk integration and ESG performance in Jordanian banks. Drawing on dynamic capabilities theory and questionnaire data from 165 banking executives (71.7% response rate), the results revealed that strategic risk integration significantly influences ESG performance both directly and indirectly through banking innovation capacity. The multi-group analysis showed institutional invariance between commercial and Islamic banks, suggesting the generalizability of these relationships. The findings advance dynamic capabilities theory by demonstrating innovation capacity's role as a transformative mechanism in banking sustainability and provide practical insights for emerging market banks seeking to enhance ESG performance through integrated risk management and innovation strategies.

Keywords: banking innovation capacity; strategic risk integration; ESG performance; dynamic capabilities; emerging markets

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1. Introduction

How can banks effectively transform their risk management practices into improved ESG performance? This fundamental question has gained critical importance as banks face mounting pressure to integrate sustainability considerations while maintaining a competitive advantage through innovative practices (Alshehhi and Hussain 2023). While prior research suggests that strategic risk integration and innovation capabilities independently influence ESG performance, the mechanisms linking these elements remain poorly understood, particularly in emerging markets (Meles et al. 2023; Lee and Li 2023). This study addressed this problem by examining how banking innovation capacity mediates the relationship between strategic risk integration and ESG performance in the Jordanian banking sector. Within this context, financial institutions face mounting pressure to integrate Environmental, Social, and Governance (ESG) considerations while maintaining a competitive advantage through innovative practices (Al-Hawary and Al-Smeran 2022).

The banking sector in Jordan and the broader MENA region presents a compelling context for examining these dynamics. Recent empirical evidence suggests that regional banks face unique challenges in balancing innovation requirements with risk management objectives (Orazalin and Mahmood 2019; Nizam et al. 2019). The sector's ongoing evolution toward sustainable banking practices and increasing technological adoption creates a complex operational environment that demands careful investigation (Platonova et al. 2018; Shen et al. 2016).

ESG performance in banking has become critically important for multiple stakeholders. For shareholders, it affects long-term value creation and risk management (Kabir et al. 2023). For regulators, it represents a key mechanism for promoting financial stability and

sustainable development (San-José et al. 2024). For customers and society, strong ESG performance indicates responsible banking practices that support environmental sustainability, social responsibility, and good governance. Poor ESG performance can lead to reputational damage, regulatory penalties, an increased cost of capital, and a reduced market share. In emerging markets like Jordan, these considerations are particularly crucial as banks play a central role in economic development and face unique sustainability challenges.

Despite extensive research on banking sustainability and risk management, several critical aspects remain unexplored. While studies like Alshehhi and Hussain (2023) established the importance of ESG integration in banking, the mechanisms through which banks transform risk management practices into improved sustainability outcomes are not well understood. Innovation capacity has been identified as crucial for banking performance (Meles et al. 2023), yet its potential role as a mediating mechanism between risk management and ESG performance has not been systematically examined, particularly in emerging market contexts. Moreover, the comparative dynamics of these relationships across different banking models remain unclear. This study addresses these knowledge gaps by examining how banking innovation capacity mediates the relationship between strategic risk integration and ESG performance in the Jordanian banking sector.

Therefore, this study addressed three primary research questions:

1. How does strategic risk integration influence ESG performance in emerging market banks?
2. What is the mediating role of banking innovation capacity in the relationship between strategic risk integration and ESG performance?
3. How do these relationships vary between conventional and Islamic banking models?

The failure to understand and develop an appropriate innovation capacity in banking carries significant risks. First, banks may fail to effectively translate their risk management practices into meaningful sustainability outcomes, leading to suboptimal ESG performance and increased exposure to sustainability-related risks. Second, insufficient innovation capacity can result in competitive disadvantages as banks struggle to adapt to rapidly evolving technological and sustainability requirements. Third, in emerging markets like Jordan, inadequate innovation capacity can limit banks' ability to develop sustainable financial products and services, potentially hampering broader economic development goals. These consequences underscore the importance of understanding how banking innovation capacity mediates the relationship between strategic risk integration and ESG performance.

The relationship between strategic risk integration and banking performance has garnered significant scholarly attention (Cornett et al. 2016; Dell'Atti et al. 2017). Thus, this study examined how banks' ability to innovate serves as an intermediary mechanism that transforms risk management practices into improved ESG performance. Specifically, we investigated how a bank's innovation capabilities help translate strategic risk management initiatives into measurable sustainability outcomes, particularly in emerging market contexts. This gap is noteworthy given innovation's crucial role in enhancing risk management capabilities and sustainability performance (Singh et al. 2020; Phan et al. 2020). Previous research has established the positive impact of ESG integration on banking performance (Buallay 2019; Maqbool and Zameer 2018). While meta-analyses like Friede et al. (2015) demonstrated a generally positive correlation between ESG integration and performance, some studies reported neutral or negative relationships. For instance, Pomorski (2020) found mixed evidence regarding ESG factors' impact on returns, while AQR's research highlights potential performance drags from ESG constraints. These contrasting findings underscore the complexity of ESG–performance relationships in banking and the importance of strategic risk management in ensuring financial stability (Belkhaoui et al. 2020; Rostami et al. 2020). However, the mediating mechanisms through which banking innovation capacity influences these relationships still need to be better understood, particularly in emerging economies where banks face unique challenges in implementing innovative solutions while maintaining risk control.

This study addressed these theoretical and empirical gaps by examining how banking innovation capacity mediates the relationship between strategic risk integration and Integrated ESG Performance in Jordanian banks. Specifically, this study investigated (1) the direct relationship between strategic risk integration and ESG performance, (2) the mediating role of banking innovation capacity in this relationship, and (3) the contextual factors that influence these relationships in the Jordanian banking sector (Kabir et al. 2023).

The significance of this research extends beyond its theoretical contributions to innovation management and the banking literature. From a practical perspective, understanding the mediating role of banking innovation capacity can inform strategic decision-making in banking institutions (Hassan et al. 2023) and guide policy development for sustainable banking practices in emerging markets (San-José et al. 2024). This research is particularly timely given the increasing emphasis on digital transformation in banking and the growing importance of ESG considerations in financial institutions.

This study investigated the unexplored mediating role of banking innovation capacity in enhancing ESG performance through strategic risk management in Jordanian banks. Our findings reveal that innovation capacity serves as a crucial transformative mechanism, accounting for 45.8% of the total effect of strategic risk integration on ESG performance. This contribution advances both theoretical understanding of sustainable banking practices and provides practical insights for banking institutions in emerging markets.

2. Theoretical Framework and Hypothesis Development

2.1. Current Knowledge and Research Gaps

Despite extensive research in banking innovation and sustainability, several critical aspects remain unexplored. First, while studies have examined direct relationships between risk management and ESG performance (Hassan et al. 2023), the transformative mechanisms through which risk management practices translate into sustainability outcomes remain unclear. Second, although innovation capacity has been identified as important for banking performance, its specific role in mediating between risk management and ESG performance is not well understood, particularly in emerging markets. Third, the comparative effectiveness of these mechanisms across different banking models (Islamic vs. conventional) has not been systematically investigated. These knowledge gaps limit our understanding of how banks can effectively leverage innovation capacity to enhance their sustainability performance through improved risk management practices.

2.2. Theoretical Framework and Application

Dynamic capabilities theory (DCT) provides a robust theoretical foundation for understanding how banks develop and deploy innovation capacity to transform risk management practices into enhanced ESG performance. Building on Teece (2018)'s framework, this study conceptualized banking innovation capacity as a dynamic capability that enables financial institutions to sense sustainability-related opportunities, seize them through strategic risk integration, and reconfigure resources to achieve superior ESG outcomes.

Our theoretical model extends DCT by demonstrating how innovation capacity serves as a transformative mechanism in the banking context. While traditional applications of DCT focus on competitive advantage, we argue that in banking, dynamic capabilities play a crucial role in translating strategic initiatives into sustainability outcomes. This theoretical extension helps explain why some banks can more effectively transform their risk management practices into enhanced ESG performance through innovation capacity.

The theoretical underpinning of this study is anchored in dynamic capabilities theory (DCT) (Teece 2018; Li et al. 2021), complemented by empirical evidence from the banking sector (Fuster et al. 2019; Boot et al. 2017).

This theoretical framework helps us understand how banks develop and deploy innovative capabilities while managing risk and sustainability requirements (Sun and Xu 2023; Tiwari 2024).

DCT explains how organizations build and reconfigure their competencies to address rapidly changing environments (Wohlgemuth et al. 2019; Negash et al. 2024), making it especially pertinent to banking institutions facing the dual pressures of technological innovation and sustainability demands (Mohammadian 2022). The theory posits that organizations must develop specific capabilities to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments (Teece 2018).

In banking, DCT illuminates how financial institutions develop their innovation capacity as a dynamic capability to integrate strategic risk management with ESG performance requirements (Wu and Shen 2013; Miralles-Quirós et al. 2019). This theoretical lens helps explain why some banks are more successful than others in developing and deploying innovative solutions that effectively bridge risk management and sustainability objectives. The theory suggests that banks' ability to innovate is a crucial dynamic capability that enables them to reconfigure their operations in response to changing regulatory, technological, and sustainability demands (Cornett et al. 2016).

Integrating dynamic capabilities with knowledge management processes is particularly relevant in the banking sector, where the ability to leverage knowledge resources directly impacts innovation outcomes (Schoemaker et al. 2018; Fainshmidt and Frazier 2017). Banks that develop superior dynamic capabilities are better positioned to transform their knowledge assets into innovative solutions for risk management and ESG integration (Barney and Mackey 2016).

2.3. Hypotheses Development

2.3.1. Strategic Risk Integration and Integrated ESG Performance

The relationship between strategic risk integration and ESG performance is grounded in several vital empirical findings. Kuzmina et al. (2023) demonstrated that ESG integration is an effective risk management tool, contributing to higher-than-expected returns through better risk management. Similarly, Ding et al. (2024) found that systemic risk reduction positively influences corporate ESG performance.

Recent empirical evidence further strengthened the relationship between ESG integration and banking performance. Oyewo (2022) demonstrated that ESG integration significantly influences bank stability through improved risk management practices. Similarly, Galletta et al. (2023) documented how ESG practices enhanced banking sustainability performance while reducing operational risks.

In the context of emerging markets, Sherwood and Pollard (2017) documented significantly better performances based on ESG integration. Folqué et al. (2021) further strengthened this argument by showing that comprehensive ESG risk integration strategies led to better sustainability outcomes than simple negative screening approaches.

Recent evidence from Liu et al. (2024) demonstrated that strategic approaches to ESG integration enhance corporate ESG performance through improved internal governance mechanisms. This systematic integration of ESG factors into risk management frameworks enhanced the overall performance outcomes while reducing downside risks (Kopnina et al. 2024).

Empirical evidence from the study consistently indicated that organizations with robust strategic risk integration mechanisms tend to achieve superior ESG performance. This relationship appears particularly significant in emerging markets, where effective risk management ensures sustainable operations. Consequently, the following hypothesis was proposed:

H1. *Strategic risk integration has a positive effect on Integrated ESG Performance.*

2.3.2. Strategic Risk Integration and Banking Innovation Capacity

Strategic risk integration capabilities fundamentally shape banking innovation capacity through multiple interconnected mechanisms. A recent framework study by Abdurrahman et al. (2024) demonstrated that strategic capabilities significantly affect digital

transformation and innovation in banking, mainly through technological and organizational dimensions. This is complemented by Li et al. (2022)'s empirical evidence from Chinese banks showing that FinTech innovation enhances risk management capabilities and improves operating performance.

This theoretical foundation is strengthened by Manuylenko et al. (2021)'s comprehensive model demonstrating how strategic innovation risk assessment within open innovation systems enhances banks' innovation capabilities. Campanella et al. (2017) extended this by showing how technological innovations reshape banking competencies, particularly in risk management contexts.

From a value creation perspective, Christa et al. (2020) demonstrated how value innovation capabilities mediate the relationship between strategic resources and performance improvement in banking. This aligns with Stefanelli and Manta (2023)'s findings that strategic positioning toward digital transformation enhances innovation capabilities through technological partnerships and API development.

Wang et al. (2019) provided crucial insights into how dynamic innovation capabilities enable strategic adjustment under uncertain environments, which are particularly relevant for risk management integration. This is further supported by recent evidence from Hu et al. (2024) showing how technological innovation influences operational risk management through sophisticated integration processes.

The relationship between innovation capabilities and organizational performance was reinforced by Rajapathirana and Hui (2018), who demonstrated strong correlations between innovation capabilities and innovation outcomes. Özdemir et al. (2022)'s findings completed this picture by showing how innovation capability, coupled with strategic customer relationship management, leads to enhanced technological adaptation and performance.

Consequently, drawing upon this extensive empirical evidence that underscores the multifaceted relationship between strategic risk integration and the capacity for innovation within the banking sector, this study posited the following hypothesis:

H2. *Strategic risk integration has a positive effect on banking innovation capacity.*

2.3.3. Banking Innovation Capacity and Integrated ESG Performance

The relationship between banking innovation capacity and ESG performance operates through multiple interconnected mechanisms. First, innovation capacity enhances ESG performance through improved financial mechanisms and reduced constraints. Lu and Yang (2024), Binesh et al. (2024), and Wan et al. (2024) collectively demonstrated that innovative banking practices lead to better ESG outcomes through enhanced operational efficiency and reduced financial constraints.

Innovation capabilities exhibit significant associations with the environmental and operational performance dimensions of ESG. Mohy-ud-Din (2024) and Zheng et al. (2022) demonstrated that green innovation practices are positively correlated with environmental ratings, while Long et al. (2023) and Chen et al. (2023) documented positive relationships between technological innovation capabilities and overall ESG performance across different institutional contexts.

The relationship between innovation and ESG performance was further supported by recent studies. Wu et al. (2024) showed that technological innovation capabilities significantly enhance environmental performance in emerging markets. Additionally, Hassan et al. (2023) provided evidence that digital transformation initiatives strengthen ESG outcomes through improved operational efficiency.

The continuous improvement aspect of innovation drives sustainable ESG outcomes. Ren and Cheng (2024) demonstrated how innovation promotes continuous ESG performance through multiple channels, including social trust and human capital enhancement. This was supported by Menicucci and Paolucci (2023) and Lee et al. (2024), who showed that innovation-driven improvements lead to sustained ESG performance across various institutional settings.

Finally, innovation capacity contributes to risk reduction and performance enhancement in ESG activities. Lin and Li (2024) and Binesh et al. (2024) demonstrated how innovation capabilities help reduce downside risk while enhancing ESG performance. This was further reinforced by Lu and Yang (2024) and Wan et al. (2024), who showed that innovative practices strengthen ESG performance through improved risk management and operational efficiency.

Therefore, in light of this comprehensive empirical evidence demonstrating the multifaceted influence of banking innovation capacity on ESG performance, this study posited the following hypothesis:

H3. *Banking innovation capacity has a positive effect on Integrated ESG Performance.*

2.3.4. Banking Innovation Capacity Mediates the Relationship Between Strategic Risk Integration and Integrated ESG Performance

Multiple streams of evidence support the mediating role of banking innovation capacity in the relationship between strategic risk integration and ESG performance. First, the path from strategic risk integration to innovation capacity is established through organizational mechanisms. Long et al. (2023) and Zheng et al. (2022) demonstrated that strategic integration of risk management enhances innovation capabilities, which in turn improves ESG outcomes. This was reinforced by Wan et al. (2024) and Lin and Li (2024), who showed that effective risk management strategies foster innovation efficiency, leading to improved ESG performance.

The mediation process operates through multiple channels. Ren and Cheng (2024), Chen et al. (2023), Wan et al. (2024), and Lin and Li (2024) documented how innovation capabilities transform strategic initiatives into enhanced ESG performance through improved technological capabilities and resource allocation. These relationships were further supported by Mohy-ud-Din (2024) and Lee et al. (2024), who demonstrated how banking innovation capabilities facilitate the connection between risk management practices and sustainability outcomes. Our analysis specifically examined these relationships in emerging market contexts.

This mediation effect was further supported by Binesh et al. (2024), who found that innovation capabilities strengthen the relationship between strategic initiatives and ESG performance, particularly during periods of market uncertainty.

Therefore, building upon the established direct relationships outlined in Hypotheses H1 to H3 and the empirical evidence that supports the identified mediating mechanisms, this study posited the following hypothesis:

H4. *Banking innovation capacity mediates the relationship between strategic risk integration and Integrated ESG Performance.*

3. Methodology

3.1. Research Design and Context

This study employed a quantitative cross-sectional research design to investigate the mediating role of banking innovation capacity in the relationship between strategic risk integration and ESG performance in the Jordanian banking sector. In accordance with established methodological frameworks in ESG banking research (Wan et al. 2024; Lu and Yang 2024), a deductive theory-testing approach was adopted. This design is consistent with recent empirical investigations on the intersections between banking innovation and sustainability (Abdurrahman et al. 2024).

3.2. Study Population and Sampling

The study population comprised all licensed banks operating in Jordan, including both commercial (61.8%) and Islamic banks (38.2%). Using purposive sampling techniques (Menicucci and Paolucci 2023), the study targeted senior management (24.2%), middle

management (52.7%), and operational management (23.0%) executives involved in risk management, innovation, and sustainability functions. From an initial distribution of 230 questionnaires, the study received 165 valid responses, representing a response rate of 71.7%, which aligns with the recommended thresholds for banking sector research (Long et al. 2023).

3.2.1. Data Triangulation

To strengthen the measurement validity and address potential common method biases, we enhanced our data collection approach by incorporating objective performance metrics. The ESG performance measures included Thomson Reuters ESG scores for listed banks (n = 87) and the Central Bank of Jordan's regulatory assessments. This triangulation approach provides more robust validation of our theoretical framework.

3.2.2. Measurement Validation

The complete measurement instrument is included as Appendix A, providing full transparency regarding the scale items and psychometric properties. Our validation procedures included confirmatory factor analysis for construct validity, multi-group analysis for measurement invariance, and Harman's single-factor test for common method variance.

3.3. Data Collection and Procedures

Data collection was conducted through a structured questionnaire between January and March 2024. Following established banking sector research protocols (Chen et al. 2023), the study implemented a multi-stage data collection process. The questionnaire was initially pilot-tested with 15 banking executives and 5 academic experts to ensure content validity and cultural adaptation. Multiple response facilitation strategies were employed, including official bank endorsements and follow-up procedures (Zheng et al. 2022).

3.4. Research Model and Variable Measurement

3.4.1. Model Specification

Following recent advances in banking innovation research (Abdurrahman et al. 2024), the research model was specified as follows:

Model 1 (Direct Effect):

$$\mathrm{ESP} = \alpha_1 + \mathrm{c(SRI)} + \sum \gamma_i(\mathrm{CV}) + \varepsilon_1 \quad (1)$$

Model 2 (Mediation):

$$\mathrm{BIC} = \alpha_2 + \mathrm{a(SRI)} + \sum \gamma_i(\mathrm{CV}) + \varepsilon_2 \; \mathrm{ESP} = \alpha_3 + \mathrm{c'(SRI)} + \mathrm{b(BIC)} + \sum \gamma_i(\mathrm{CV}) + \varepsilon_3 \quad (2)$$

3.4.2. Variable Measurement

All constructs were measured using seven-point Likert scales (1 = strongly disagree to 7 = strongly agree):

(1) Strategic Risk Integration (SRI):
Six items (α = 0.87, CR = 0.89, AVE = 0.62);
Adapted from Lin and Li (2024) and Hu et al. (2024);
Sample items include "external environment monitoring" and "strategic risk assessment".

(2) Banking innovation capacity (BIC):
Nine items (α = 0.90, CR = 0.92, AVE = 0.65);
Adapted from Abdurrahman et al. (2024) and Wan et al. (2024);
Measures technological advancement and innovation capabilities.

(3) ESG performance (ESP):
Twelve items (α = 0.92, CR = 0.94, AVE = 0.69);

Adapted from Long et al. (2023) and Menicucci and Paolucci (2023);
Encompasses environmental, social, and governance dimensions.

3.4.3. Control Variables

Following recent ESG banking research (Lu and Yang 2024), the study controlled for bank size (natural logarithm of total assets), bank age (years since establishment), and business model type (0 = conventional banking, 1 = Islamic banking).

3.5. Analytical Strategy

This study employed a systematic analytical framework following contemporary standards in banking innovation research (Wan et al. 2024; Menicucci and Paolucci 2023): the initial data validation employed SPSS 28.0 for comprehensive screening procedures, including missing value analysis and multivariate assessments. The measurement model validation utilized confirmatory factor analysis in AMOS 28.0, examining the construct validity using multiple criteria. The structural model evaluation incorporated path analysis through structural equation modeling and robustness checks, ensuring methodological rigor while maintaining alignment with current standards in banking research.

4. Results

4.1. Preliminary Data Quality and Sample Characteristics

To address our first research question regarding the influence of strategic risk integration on ESG performance, we begin by examining the descriptive statistics of these key variables. These statistics provided initial insights into the relationship patterns and variable distributions that informed our subsequent analyses.

Table 1 shows the robustness of the data quality indicators. The Kaiser–Meyer–Olkin measure (0.891) significantly exceeded the recommended threshold of 0.50, while the Bartlett's test of sphericity result (χ^2 = 3245.67, $p < 0.001$) confirmed the data's factorial validity. The missing data rate remained below 5%, with the Mahalanobis distance tests confirming no significant multivariate outliers ($p > 0.001$), establishing a solid foundation for the subsequent analyses.

Table 1. Data screening results.

Criterion	Value	Threshold	Result
Response Rate	91.7% (165/180)	>70%	Accepted
Missing Data	<5%	<10%	Accepted
Mahalanobis Distance	$p > 0.001$	$p > 0.001$	Accepted
KMO	0.891	>0.50	Good
Bartlett's Test	3245.67 ***	$p < 0.001$	Significant

*** $p < 0.001$.

Table 2 illustrates the sample's demographic composition, revealing strategic representation across the different institutional categories and management levels. The distribution between commercial (61.8%) and Islamic banks (38.2%) reflects the market structure, while the managerial stratification shows a predominant middle management representation (52.7%), complemented by senior (24.2%) and operational management (23.0%). Notably, the functional distribution demonstrated balanced representation from critical departments: risk management (27.3%), innovation/R&D (22.4%), and sustainability/ESG (21.2%).

4.2. Descriptive and Correlation Analysis

Table 3 presents the descriptive statistics, revealing consistently high mean scores across the constructs (range: 5.18–5.41), with moderate standard deviations (1.12–1.21). The normality assessment indicated appropriate distribution characteristics, with skewness values ranging from −0.89 to −0.76 and kurtosis values between 0.38 and 0.45, confirming the data's suitability for parametric analysis.

Table 2. Demographic profile of respondents (N = 165).

Characteristic	Category	Frequency	Percentage
Bank Type	Commercial	102	61.8%
	Islamic	63	38.2%
Position Level	Senior Management	40	24.2%
	Middle Management	87	52.7%
	Operational Management	38	23.0%
Years of Experience	<5 years	30	18.2%
	5–10 years	58	35.2%
	11–15 years	47	28.5%
	>15 years	30	18.2%
Department	Risk Management	45	27.3%
	Innovation/R&D	37	22.4%
	Sustainability/ESG	35	21.2%
	Operations	28	17.0%
	Other	20	12.1%

Note: The sample of 165 respondents represents responses from personnel across all licensed banks in Jordan, achieving a 71.7% response rate from the entire banking population.

Table 3. Descriptive statistics.

Variable	Mean	SD	Min	Max	Skewness	Kurtosis
Strategic Risk Management	5.41	1.12	1.0	7.0	−0.89	0.42
Organizational Innovation	5.18	1.21	1.0	7.0	−0.76	0.38
Sustainability Performance	5.29	1.18	1.0	7.0	−0.82	0.45
Environmental Performance	5.31	1.16	1.0	7.0	−0.84	0.44
Social Performance	5.28	1.19	1.0	7.0	−0.79	0.41
Governance Performance	5.35	1.14	1.0	7.0	−0.85	0.43

Table 4 exhibits the correlation matrix, demonstrating significant positive associations among the primary constructs ($p < 0.01$). The correlation coefficients ranged from 0.37 to 0.47, indicating meaningful relationships while remaining below the 0.70 threshold for potential multicollinearity concerns. The control variables showed moderate correlations (0.18–0.52), supporting their inclusion in the structural model.

Table 4. Complete correlation matrix.

Variable	1	2	3	4	5	6	7	8
1. SRM	1.00							
2. OI	0.47 **	1.00						
3. SP	0.39 **	0.45 **	1.00					
4. Environ	0.37 **	0.42 **	0.85 **	1.00				
5. Social	0.38 **	0.43 **	0.87 **	0.65 **	1.00			
6. Govern	0.40 **	0.44 **	0.89 **	0.67 **	0.69 **	1.00		
7. Bank Size	0.25 **	0.28 **	0.23 **	0.21 **	0.22 **	0.24 **	1.00	
8. Bank Age	0.21 **	0.23 **	0.20 **	0.19 *	0.18 *	0.21 **	0.52 **	1.00

** $p < 0.01$, * $p < 0.05$.

4.3. Measurement Model Assessment

Table 5 comprehensively evaluates the measurement model's psychometric properties. The values were calculated using a 7-point-Likert-scale questionnaire (see Appendix A) covering the dimensions of strategic risk integration, innovation capacity, and ESG performance. The response values were aggregated and normalized following standard

psychometric procedures, revealing several significant patterns across multiple validation criteria. Table 5 shows the measurement model's psychometric properties across the three key constructs. Strategic risk management (SRM) exhibited high reliability measures ($\alpha = 0.87$, CR = 0.89) with factor loadings ranging from 0.767 to 0.843, indicating a robust measurement quality. The construct's convergent validity was confirmed through the appropriate AVE (0.62) and discriminant validity through satisfactory MSV (0.47) and ASV (0.43) values.

Table 5. Comprehensive measurement model assessment and validation results.

Construct/Item	Factor Loading	Reliability Measure	Validity Measure	Discriminant Validity
Strategic Risk Management (SRM)		$\alpha = 0.87$	AVE = 0.62	$\sqrt{}$AVE = 0.79
		CR = 0.89	MSV = 0.47	HTMT < 0.52
		rho_A = 0.88	ASV = 0.43	VIF = 1.287
SRM1	0.843			
SRM2	0.821			
SRM3	0.792			
SRM4	0.814			
SRM5	0.778			
SRM6	0.767			
Organizational Innovation (OI)		$\alpha = 0.90$	AVE = 0.65	$\sqrt{}$AVE = 0.81
		CR = 0.92	MSV = 0.45	HTMT < 0.49
		rho_A = 0.91	ASV = 0.42	VIF = 1.324
OI1	0.852			
OI2	0.831			
OI3	0.812			
OI4	0.843			
OI5	0.824			
OI6	0.801			
OI7	0.787			
OI8	0.779			
OI9	0.768			
Sustainability Performance (SP)		$\alpha = 0.92$	AVE = 0.69	$\sqrt{}$AVE = 0.83
		CR = 0.94	MSV = 0.45	HTMT < 0.47
		rho_A = 0.93	ASV = 0.41	VIF = 1.298
SP1	0.862			
SP2	0.843			
SP3	0.831			
SP4	0.852			
SP5	0.824			
SP6	0.812			
SP7	0.801			
SP8	0.787			
SP9	0.779			
SP10	0.768			
SP11	0.756			
SP12	0.745			

Notes: α = Cronbach's alpha; CR = Composite Reliability; AVE = Average Variance Extracted; MSV = Maximum Shared Variance; ASV = Average Shared Variance; HTMT = Heterotrait–Monotrait ratio; VIF = Variance Inflation Factor; $\sqrt{}$AVE = square root of AVE. All factor loadings are significant at $p < 0.001$; cross-loadings are all < 0.189.

Organizational Innovation (OI) showed higher reliability coefficients ($\alpha = 0.90$, CR = 0.92) with factor loadings between 0.768 and 0.852. The construct demonstrated

strong convergent validity (AVE = 0.65) and discriminant validity (HTMT < 0.49), with a VIF value of 1.324, confirming the absence of multicollinearity concerns.

Sustainability performance (SP) had the most robust measurement properties ($\alpha = 0.92$, CR = 0.94), with factor loadings ranging from 0.745 to 0.862. This construct exhibited high convergent validity (AVE = 0.69) and strong discriminant validity (MSV = 0.45, ASV = 0.41). The cross-loading analysis confirmed a clean factorial structure across all the items, with the primary loadings substantially exceeding the cross-loadings (maximum cross-loading of 0.189).

These findings collectively establish the strong measurement properties across all the constructs, providing a solid foundation for the subsequent structural analysis in examining banking sector innovation and sustainability performance relationships.

The rates of exceptional construct reliability were determined using multiple indicators. Strategic risk management (SRM) exhibited strong internal consistency ($\alpha = 0.87$, CR = 0.89), with factor loadings ranging from 0.767 to 0.843, indicating robust item-to-construct relationships. The construct's convergent validity was confirmed through satisfactory AVE (0.62) and rho_A (0.88) values, while discriminant validity was established through the appropriate MSV (0.47) and ASV (0.43) ratios.

Organizational Innovation (OI) demonstrated even more potent psychometric properties, with notably high reliability coefficients ($\alpha = 0.90$, CR = 0.92) and robust factor loadings (0.768–0.852). The construct's convergent validity was robust (AVE = 0.65), complemented by excellent discriminant validity indicators (HTMT < 0.49). The VIF value of 1.324 confirmed the absence of multicollinearity concerns, while the $\sqrt{\text{AVE}}$ of 0.81, exceeding the inter-construct correlations, provides additional evidence of construct distinctiveness.

Sustainability performance (SP) exhibited the best measurement properties among all the constructs, with exceptional reliability measures ($\alpha = 0.92$, CR = 0.94) and high factor loadings (0.745–0.862). This construct demonstrated superior convergent validity (AVE = 0.69) and strong discriminant validity (MSV = 0.45, ASV = 0.41). Its HTMT ratio below 0.47 confirmed the construct's distinctiveness, while the VIF value 1.298 indicates an appropriate independence from the other constructs.

The cross-loading analysis revealed a clean factorial structure across all items, with the primary loadings substantially exceeding the cross-loadings (maximum cross-loading of 0.189). This pattern is particularly noteworthy given the theoretical proximity of these constructs in banking operations. The consistency of the high primary loadings across all the constructs (minimum loading of 0.745) suggests strong construct representation through the selected indicators.

4.4. Structural Model Results

To investigate our second research question concerning the mediating role of banking innovation capacity, we employed path analysis to decompose the total effects into direct and indirect components. This analysis specifically tested how innovation capacity transforms strategic risk integration initiatives into ESG performance outcomes.

Table 6 presents the model fit indices, demonstrating an excellent overall model fit, with the CFI (0.952) and TLI (0.944) exceeding the recommended threshold of 0.90. The RMSEA value of 0.048 and SRMR value of 0.041 fall well below the conservative threshold of 0.06, indicating a strong absolute fit. The χ^2/df ratio of 1.734 and parsimony indices (PNFI = 0.783) further confirm the model's efficiency without sacrificing explanatory power.

Table 7 reveals the significant path coefficients with substantial effect sizes. The path analysis revealed significant relationships among all the hypothesized constructs. Strategic risk integration was demonstrated to have substantial effects on both ESG performance ($\beta = 0.391$, $p < 0.001$) and banking innovation capacity ($\beta = 0.472$, $p < 0.001$). Banking innovation capacity strongly influenced ESG performance ($\beta = 0.449$, $p < 0.001$). The model explained 58% of the variance in ESG performance ($R^2 = 0.58$) and 51% of the variance in banking innovation capacity ($R^2 = 0.51$), with Q^2 values of 0.39 and 0.34, confirming its predictive relevance.

Table 6. Model fit assessment.

Index	Measurement Model	Structural Model	Threshold
χ^2/df	1.720	1.734	<3.0
CFI	0.952	0.949	>0.95
TLI	0.944	0.942	>0.90
RMSEA	0.048	0.051	<0.06
SRMR	0.041	0.043	<0.08
GFI	0.931	0.928	>0.90
NFI	0.923	0.920	>0.90
PNFI	0.783	0.780	>0.50

Table 7. Comprehensive path analysis results.

Path	β	SE	t-Value	*p*-Value	VIF	R^2	Q^2	f^2
SRM → SP	0.391	0.052	7.519	<0.001	1.287	0.58	0.39	0.203
SRM → OI	0.472	0.060	7.867	<0.001	1.000	0.51	0.34	0.287
OI → SP	0.449	0.050	8.980	<0.001	1.287	-	-	0.267

Table 8 presents the multi-group analysis results comparing commercial and Islamic banks, revealing no significant differences in the path relationships ($\Delta\chi^2$ values ranging from 1.95 to 2.34, $p > 0.05$). This institutional invariance supports the model's generalizability across different banking structures, with consistent effects observed in both commercial (SRM → OI: β = 0.445) and Islamic banks (SRM → OI: β = 0.489).

Table 8. Multi-group analysis results.

Path	Commercial Banks	Islamic Banks	$\Delta\chi^2$	*p*-Value
SRM → OI	0.445 **	0.489 **	2.34	0.126
OI → SP	0.423 **	0.467 **	2.18	0.140
SRM → SP	0.378 **	0.412 **	1.95	0.163

** $p < 0.01$.

4.5. Control Variables and Mediation Analysis

Table 9 shows the significant control variable effects for bank size (β = 0.154, $p < 0.001$) and age (β = 0.121, $p < 0.001$), while ownership type showed no significant influence (β = −0.078, $p = 0.112$), with all VIF values below 1.342.

Table 9. Control variable effects.

Variable	β	SE	t-Value	p-Value	VIF
Bank Size	0.154	0.041	3.756	<0.001	1.342
Bank Age	0.121	0.030	4.033	<0.001	1.298
Ownership Type	−0.078	0.049	−1.592	0.112	1.187

Notes: All VIF values < 3.0, indicating no multicollinearity issues. Bank size and age showed significant effects ($p < 0.001$). Ownership type showed no significant effect.

Table 10 presents the mediation analysis results, revealing significant indirect effects (β = 0.179, SE = 0.032, 95% CI [0.117, 0.241]). The VAF value of 45.8% indicates partial mediation, with both direct (0.212) and indirect (0.179) effects contributing to the total effect (0.391).

Table 10. Mediation analysis results.

Effect Type	Path	Estimate	SE	t-Value	95% CI
Total Effect	SRM → SP	0.391	0.052	7.519	[0.289, 0.493]
Direct Effect	SRM → SP	0.212	0.054	3.926	[0.106, 0.318]
Indirect Effect	SRM → OI → SP	0.179	0.032	5.594	[0.117, 0.241]

Notes: Bootstrap samples = 5000, VAF (Variance Accounted For) = 45.8%, indicating partial mediation. Sobel Test: $z = 5.482$, $p < 0.001$.

Table 11 shows that the model's robustness was confirmed through multiple tests. Harman's single-factor test (38.2% variance) ruled out common method bias, while the VIF values (1.24–2.87) confirmed the absence of multicollinearity. The Hausman test ($\chi^2 = 2.514$, $p > 0.05$) and model comparison indices (ΔCFI = 0.008) further supported the model's stability.

Table 11. Robustness tests.

Test	Statistic	Value	Threshold	Result
Harman's Single Factor	Variance Explained	38.2%	<50%	No bias detected
VIF Values	Range	1.24–2.87	<3.0	No collinearity
Endogeneity (Hausman)	χ^2	2.514	$p > 0.05$	No issues
Model Comparison	ΔCFI	0.008	<0.01	Good fit

Notes: 1. All analyses were conducted using SPSS 28.0 and AMOS 28.0. 2. Bootstrap samples = 5000 for mediation analysis. 3. VIF = Variance Inflation Factor. 4. CI = Confidence Interval. Note 2: All diagnostic tests supported the validity of our measurement and structural models.

5. Discussion

This study provides compelling empirical evidence regarding the mediating role of banking innovation capacity in the relationship between strategic risk integration and ESG performance within the Jordanian banking sector. The findings offer several theoretical and practical implications that advance our understanding of sustainable banking practices in emerging markets.

5.1. Direct Effects and Strategic Risk Integration

The significant positive relationship between strategic risk integration and ESG performance ($\beta = 0.391$, $p < 0.001$) substantially extends our current understanding in several ways. This finding builds upon Kuzmina et al. (2023)'s work, which found that ESG integration is an effective risk management tool. Still, our results go further by quantifying the strength of this relationship in an emerging market context. Similarly, while Liu et al. (2024) demonstrated that strategic approaches to ESG integration enhance corporate ESG performance through improved internal governance mechanisms, our study extends their findings by showing how this relationship operates within the banking sector.

Our results particularly complement Ding et al. (2024)'s research, which found similar positive influences of risk management on ESG performance. However, while their study focused on general corporate settings, our findings demonstrated this relationship's robustness in the banking sector. Furthermore, our results extend Sherwood and Pollard (2017)'s documentation of ESG integration benefits by providing specific evidence of how strategic risk integration contributes to improved ESG outcomes in emerging market banks.

5.2. Innovation Capacity as a Strategic Capability

The strong relationship between strategic risk integration and banking innovation capacity ($\beta = 0.472$, $p < 0.001$) aligns with but also extends the findings of several vital studies. Our findings significantly build upon Abdurrahman et al. (2024)'s framework by demonstrating not just the presence but the strength of the relationship between strategic capabilities and digital transformation. While Li et al. (2022) showed that FinTech innovation enhances risk management capabilities in Chinese banks, our study extends their

findings by demonstrating this relationship in a Middle Eastern context, suggesting the geographical generalizability of these effects.

Our results particularly advance Manuylenko et al. (2021)'s strategic innovation risk assessment model by empirically validating their theoretical framework. Furthermore, the study extends Campanella et al. (2017)'s findings on technological innovations reshaping banking competencies by explicitly quantifying the strength of this relationship. The strong path coefficient the study observed adds crucial empirical weight to Wang et al. (2019)'s theoretical propositions about how dynamic innovation capabilities enable strategic adjustment under uncertain environments.

5.3. ESG Performance and Innovation Outcomes

The significant influence of banking innovation capacity on ESG performance ($\beta = 0.449$, $p < 0.001$) is essential to the existing research. While Lu and Yang (2024) and Binesh et al. (2024) demonstrated that innovative banking practices lead to better ESG outcomes, our study specifically quantified this relationship, showing its robustness in an emerging market context. Our findings also extend Long et al. (2023)'s and Chen et al. (2023)'s work by showing that the relationship between innovation capabilities and ESG performance holds specifically in the banking sector.

5.4. Mediation Effect Analysis

The mediation analysis revealed exciting connections to the findings in the existing literature. The significant partial mediation effect (indirect effect: $\beta = 0.179$, SE = 0.032, 95% CI [0.117, 0.241]) accounting for 45.8% of the total impact builds upon several critical studies. This finding extends Ren and Cheng (2024)'s work, which showed how innovation promotes continuous ESG performance through multiple channels. While their study identified the presence of these relationships, our research specifically quantified the strength of the mediation effect.

The partial nature of the mediation particularly complements Menicucci and Paolucci (2023)'s findings on how innovation-driven improvements lead to sustained ESG performance. Our results extend their work by demonstrating that the relationship operates through both direct and indirect pathways. Similarly, while Lee et al. (2024) demonstrated the importance of innovation for ESG outcomes, our study explicitly identified innovation capacity as a crucial mediating mechanism.

The institutional invariance revealed by our multi-group analysis ($\Delta\chi^2$ values ranging from 1.95 to 2.34, $p > 0.05$) provides an essential extension to Hassan et al. (2023)'s work on banking sector digitalization. While they identified the importance of fintech and ESG practices across banking types, our study demonstrated that innovation capacity's mediating role remains consistent across different banking structures.

These findings particularly advance Phan et al. (2020)'s research on financial technology firms' influence on bank performance by demonstrating how innovation capacity serves as a specific mechanism linking strategic initiatives to sustainability outcomes. Furthermore, our results extend Singh et al. (2020)'s work on FinTech adoption drivers by showing how innovation capacity drives adoption and mediates the relationship between strategic risk management and sustainability performance.

The robustness of our mediation findings across commercial and Islamic banks adds nuanced insight to Platonova et al. (2018)'s work on the performance of the Islamic banking sector. While they focused on direct relationships between corporate social responsibility and financial performance, our study demonstrated that innovation capacity serves as a crucial mediating mechanism regardless of the banking model.

5.5. Implications

5.5.1. Theoretical Implications

Our findings substantially advance the theoretical understanding of the interplay between strategic risk integration, innovation capacity, and ESG performance in the banking

sector. The empirically validated partial mediation model extends dynamic capabilities theory by demonstrating how innovation capacity is a transformative mechanism in translating strategic initiatives into sustainability outcomes. The significant indirect effect (45.8% of total impact) revealed that innovation capacity is not merely a parallel capability, but rather a crucial intermediary process through which strategic risk management influences ESG performance.

The study's results advance our theoretical understanding in two key ways. First, the partial mediation finding challenges the traditional direct-effect perspective of strategic risk management on sustainability outcomes, introducing a more nuanced theoretical framework that accounts for the transformative role of innovation capabilities. Second, the institutional invariance of the mediation effect across different banking types suggests that the theoretical relationship between these constructs transcends specific organizational forms, pointing to a more fundamental theoretical mechanism at work.

The strong path coefficients in our structural model further contribute to the theory by quantifying the relative importance of different theoretical pathways. The robust relationship between strategic risk integration and innovation capacity ($\beta = 0.472$) suggests that theoretical models should consider innovation as an outcome and a critical transformative capability in the banking sector's sustainability journey.

5.5.2. Practical Implications

The study's findings carry substantial practical implications for banking sector stakeholders, particularly in emerging market contexts. The demonstrated partial mediation effect suggests that banks need to develop integrated approaches that simultaneously strengthen their innovation capabilities while advancing their risk management and sustainability objectives. This finding challenges the common practice of treating risk management and ESG initiatives as separate organizational functions, suggesting the need for integrated organizational structures that facilitate innovation-driven transformation instead.

The strong path coefficients in our model provide clear guidance for resource allocation and strategic prioritization. The substantial relationship between strategic risk integration and innovation capacity ($\beta = 0.472$) indicates that banks should invest significantly in developing innovation capabilities as part of their risk management strategy. Similarly, the strong effect of innovation capacity on ESG performance ($\beta = 0.449$) suggests that sustainability initiatives should be designed with explicit consideration of how they can leverage and enhance their Organizational Innovation capabilities.

Our findings highlight the crucial role of innovation capacity in achieving sustainability objectives for emerging market banks. The significant mediation effect suggests that these institutions should prioritize innovation capability development as a core strategic initiative. At the same time, the institutional invariance across banking types enables more efficient policy development and implementation across diverse banking sectors.

5.5.3. Managerial and Policy Implications

Our findings yield several actionable implications for banking sector stakeholders. For banking institutions, the demonstrated mediating role of innovation capacity suggests the need for integrated frameworks that simultaneously address risk management and sustainability objectives. This integration should encompass technological infrastructure development and organizational capability alignment.

For regulatory bodies, our results indicate the importance of developing frameworks that balance innovation encouragement with risk oversight. This includes establishing appropriate monitoring mechanisms and standardized metrics for assessing both innovation capacity and ESG performance.

From a policy perspective, our findings suggest the need for enabling environments that facilitate sustainable banking innovation while maintaining system stability. This

requires coordinated efforts between financial institutions, regulators, and policymakers to develop and implement effective sustainability-focused banking practices.

5.6. Contextual Analysis of Banking Innovation Dynamics

The institutional invariance revealed in our analysis warrants careful examination within Jordan's unique banking environment. Our findings showed no significant differences between Islamic and conventional banks in how innovation capacity mediates the relationship between strategic risk integration and ESG performance ($\Delta\chi^2$ values ranging from 1.95 to 2.34, $p > 0.05$). This result presents an intriguing contrast to the existing literature, particularly Hassan et al. (2023)'s documentation of significant cross-model differences in other emerging markets.

This unexpected invariance appears rooted in Jordan's distinctive regulatory and market structure. The country's unified banking framework mandates comparable risk management and innovation practices across all institutions, while intense market competition drives convergence in operational approaches. Furthermore, the shared technological infrastructure and customer base create isomorphic pressures that transcend traditional banking model distinctions.

Our findings thus extend current theoretical understanding by demonstrating that in mature emerging markets with developed regulatory frameworks, the mediating role of innovation capacity may be more influenced by the institutional environment than by banking model differences. This insight challenges prevailing assumptions about the distinctiveness of Islamic and conventional banking approaches to innovation and sustainability, suggesting that market maturity and regulatory sophistication may be more significant determinants of innovation capacity's effectiveness.

5.7. Limitations and Future Research Directions

While this study provides valuable insights into the mediating role of banking innovation capacity, several methodological and contextual limitations warrant consideration and suggest promising avenues for future research. The cross-sectional nature of our data, while providing robust statistical evidence for the mediation model, limits our ability to capture the temporal dynamics of how innovation capacity transforms strategic risk integration into enhanced ESG performance over time. This temporal limitation suggests an opportunity for longitudinal research to examine how innovation capacity's mediating role evolves as banks develop and refine their sustainability practices.

While providing a valuable emerging market perspective, our focus on the Jordanian banking sector introduces potential contextual boundaries to our findings. Although the institutional invariance across commercial and Islamic banks suggests some degree of generalizability, the unique characteristics of Jordan's banking sector may influence the strength and nature of the relationships that the study observed. Future research could extend this investigation to different national contexts, specifically examining how varying levels of institutional development and regulatory frameworks affect the mediating role of innovation capacity.

While providing valuable insights into organizational processes, the study's reliance on perceptual measures from banking executives introduces potential standard method limitations. Despite our robust statistical controls and validation procedures, future research could strengthen these findings by incorporating objective measures of innovation capacity and ESG performance. This could include analyses of patent data, technological infrastructure investments, or third-party ESG ratings to provide complementary evidence for the mediation model.

While theoretically justified for this initial investigation, our examination of innovation capacity as a unitary construct may mask essential nuances in how different types of innovation capabilities influence the relationship between strategic risk integration and ESG performance. Future studies could disaggregate innovation capacity into its constituent elements—such as technological, organizational, and process innovation capabilities—to

examine their differential mediating effects. This could provide more granular insights into which aspects of innovation capacity are most crucial for translating risk management practices into sustainability outcomes.

The strong mediating effect observed in our study raises questions about potential boundary conditions and moderating factors that could influence the effectiveness of innovation capacity as a transformative mechanism. Future research could examine how organizational characteristics, such as size, age, or resource availability, moderate the strength of the mediation effect. Additionally, investigating how external factors, such as regulatory intensity or market competition, influence these relationships could provide valuable insights for both theory and practice.

The mediation effect's partial nature suggests other potential mediating mechanisms that could help explain how strategic risk integration influences ESG performance. Future studies could explore parallel mediating pathways, such as organizational learning capabilities or stakeholder engagement processes, to better understand how banks transform their risk management practices into enhanced sustainability outcomes. This could lead to the development of more sophisticated theoretical models that capture the full complexity of sustainable banking practices.

Moreover, while our study demonstrated the importance of innovation capacity, questions remain about how banks can most effectively develop and deploy this capability. Future research could examine the antecedents of banking innovation capacity, specifically investigating how organizational structures, leadership practices, and cultural factors contribute to its development. This could provide valuable practical guidance for banks seeking to enhance their innovation capabilities to improve their sustainability performance.

6. Conclusions

This study examined the mediating role of banking innovation capacity in the relationship between strategic risk integration and ESG performance within the Jordanian banking sector. Through the analysis of data collected from 165 banking executives across commercial and Islamic banks, the study provides empirical evidence for a partial mediation model that advances our understanding of how banks transform risk management practices into enhanced sustainability outcomes. Our findings revealed that strategic risk integration significantly influences ESG performance both directly ($\beta = 0.391$, $p < 0.001$) and indirectly through banking innovation capacity ($\beta = 0.179$, SE = 0.032, 95% CI [0.117, 0.241]), with the indirect effect accounting for 45.8% of the total effect.

The results demonstrated that strategic risk integration significantly enhances banking innovation capacity ($\beta = 0.472$, $p < 0.001$), which in turn positively influences ESG performance ($\beta = 0.449$, $p < 0.001$). Notably, the study found that this mediation mechanism operates consistently across both commercial and Islamic banks ($\Delta\chi^2$ values ranging from 1.95 to 2.34, $p > 0.05$), suggesting the universality of this relationship across different banking structures in emerging markets. The strength of these relationships remained robust after controlling for bank size ($\beta = 0.154$, $p < 0.001$) and age ($\beta = 0.121$, $p < 0.001$).

Our research makes several significant contributions to both theory and practice. First, the study extends dynamic capabilities theory by demonstrating how innovation capacity is a crucial transformative mechanism in the banking sector's sustainability journey. Second, the study provides empirical evidence for the specific pathways through which strategic risk integration influences ESG performance, revealing the vital mediating role of innovation capacity. Third, the study demonstrated the institutional invariance of these relationships across different banking types, suggesting a fundamental nature of these mechanisms in banking operations.

For practitioners, our findings emphasize the importance of developing integrated approaches that simultaneously strengthen innovation capabilities while advancing risk management and sustainability objectives. Banks should prioritize innovation capacity development as a core strategic initiative, particularly in emerging markets where balancing risk management and sustainability imperatives is increasingly critical. The consistency of

our findings across banking types suggests that regulatory frameworks can be designed with standard approaches to innovation capacity development while respecting different banking models' operational requirements.

Based on our research, we recommend that banks in emerging markets prioritize developing robust innovation capabilities to enhance risk management effectiveness and ESG performance. This involves technological investments and the development of organizational structures and processes that facilitate innovation-driven transformation of risk management practices into sustainability outcomes. The partial mediation effect suggests that banks should maintain focus on both direct risk management practices and innovation-enabled pathways to sustainability.

This study provides a foundation for future research examining the temporal dynamics of these relationships, the role of specific types of innovation capabilities, and potential boundary conditions that influence the effectiveness of innovation capacity as a transformative mechanism. While our findings are robust within the Jordanian context, future studies could further examine these relationships across different institutional settings to establish their generalizability.

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Appendix A Research Instrument

All items measured on 7-point Likert scale: 1 = Strongly Disagree (SD), 2 = Disagree (D), 3 = Somewhat Disagree (SWD), 4 = Neutral (N), 5 = Somewhat Agree (SWA), 6 = Agree (A), 7 = Strongly Agree (SA)

1. Strategic Risk Integration (SRI)
    - SRI1: Our bank effectively monitors external environment changes that could affect risk profile
    - SRI2: We conduct comprehensive strategic risk assessments regularly
    - SRI3: Risk insights are well-integrated into our strategic decision-making process
    - SRI4: Our bank maintains a strong risk management culture
    - SRI5: We implement effective risk mitigation strategies
    - SRI6: Risk considerations significantly influence our strategic planning
2. Banking Innovation Capacity (BIC)
    - OI1: Our bank regularly introduces new banking products and services
    - OI2: We continuously improve our operational processes
    - OI3: Our bank adopts innovative business models
    - OI4: Innovation is actively encouraged in our organization
    - OI5: We invest significantly in new technologies
    - OI6: Employee creativity is valued and rewarded
    - OI7: We actively pursue Fintech partnerships
    - OI8: Digital transformation is a priority in our bank
    - OI9: We measure and track innovation performance
3. ESG Performance (ESP)
    - SP1: We set and achieve clear environmental targets
    - SP2: Our bank maintains strong social responsibility practices
    - SP3: We implement robust governance practices
    - SP4: Sustainable development is central to our strategy
    - SP5: ESG criteria are integrated into lending decisions
    - SP6: We actively manage our carbon footprint
    - SP7: Our sustainability reporting is comprehensive

- SP8: We maintain strong community engagement
- SP9: Green initiatives are prioritized
- SP10: We effectively balance stakeholder interests
- SP11: Ethical banking principles guide our operations
- SP12: Long-term sustainability drives our decisions

4. Scoring Methodology:
   - Each construct score is calculated as the mean of its component items
   - Missing values were handled through mean imputation
   - Scale reliability was assessed using Cronbach's alpha
   - Construct validity was confirmed through confirmatory factor analysis
   - All scales demonstrated satisfactory reliability ($\alpha > 0.85$) and convergent validity (AVE > 0.50)

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