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A study on banking risk management: Operational and security risks in the Indian context

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Abstract

In the Indian financial sector, dealing with banking risk matters is now extremely important, as it supports financial stability, defends against fraud, and ensures security for operations. The research places importance on cybersecurity systems, sector-specific hazards, and meeting compliance standards to determine how risk mitigation helps. Data from scientific journals and regulatory resources was combined with other approaches in our study. Fraudulent transactions can cause the most harm, and according to the analysis, the number of such risks is often associated with greater financial damage. Bank managers need to work on cybersecurity and AI-driven fraud detection since these areas have the most promise for improvement. The study revealed that stress testing and adhering to Basel III were the most successful approaches for the industry. They are assigned the ranking of "Stars" in the matrix, indicating their strong success in improving their financial condition and being accepted widely. Even though a small number of businesses choose blockchain security, the index reveals that this method has the highest success per person in stopping fraud. The report outlines that to enhance risk management in banks, similar regulations should be enforced, employees should go through organized cybersecurity courses, and AI can be utilized for predicting threats. To improve predictions on banking security, future investigations should use big data analytics for studying long-term patterns of risk.

Keywords: Banking risk, financial stability, cybersecurity, fraud detection, Basel III compliance, risk mitigation

Introduction

While Indian banks are vital for the country's growth and stable finances, they continue to face important issues with their operations and safety. Thanks to increasing complexity in banking and new rules for financial institutions, more risks have come to light, such as fraud, IT failures, and ignoring regulations (Basu & Chherawala, 2024) [4]. It is evident from the ₹11,400 crore Punjab National Bank (PNB) fraud case that no system is safe from fraud unless there are better internal controls and compliance (Bankers Adda, 2024) [3]. Banks often run into cash flow difficulties and lose stability because it is tough for them to manage both short-term and long-term financial needs, so liquidity risk becomes a main concern (Verma Bajaj, 2024) [16]. The RBI says that, to manage these risks well, financial institutions should consider using structured approaches, for example, scenario analysis and stress testing (Reserve Bank of India, 2022) [11]. Many financial institutions in India are still without strong systems for handling risks, which leaves them open to possible money losses and harm to their reputation.

The rise in cyberattacks, with around 1.16 million incidents in 2022, which included ransomware, phishing attacks, and risks from insiders, has caused more security issues in Indian banks (KnowledgeHut, 2025) [6]. Thanks to phishing, Union Bank of India was almost unable to notice a bogus transaction worth ₹171 crore (Axis Bank, 2024) [1]. The Cosmos Bank incident also points out that digital banking can at times be at risk, with hackers stealing a huge amount of money (GB). Therefore, many Indian banks now have cybersecurity strategies, use AI to identify fraud, and provide proper training for staff, although these steps have not yet been adopted by everyone to the same degree; among the different methods, Basel III compliance (85%) is the most widely used (Menon &Yadav, 2024) [8]. Banks ought to give special importance to skill development and awareness programs to enhance their risk guarding, but the performance matrix considers staff training

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programs to have a low impact on risk controls (Rumde *et al*., 2024) [13]. I intend to evaluate how well operational and security risk management techniques work in India and offer data-supported insights to strengthen banks.

Need of the Study

The Indian financial sector gives great importance to banking risk management, as it supports the nation's financial stability, helps stop fraud, and keeps operations secure. Vulnerabilities in specific sectors are usually not taken into account by standard risk mitigation approaches, so the outcomes are not useful. Although there are rules for improved risk management, it is still used differently in financial organizations. With fewer assets and regulations, smaller companies have to make do, but larger institutions rely on total cybersecurity plans. It's necessary to recognize these differences to develop consistent guidelines for passing on crisis awareness. It is still not clear how AI could be used for analytics and immediate fraud detection. Coordinated programs help secure banks in the short term, even though it's still unclear what their long-term effect on financial stability might be. This research provides helpful tips to policymakers and bankers for increasing risk management and ensuring a secure financial environment.

Objectives

- To examine risk concerns unique to the Indian banking industry.
- To use multi-dimensional analysis to evaluate effectiveness gaps in risk management techniques.
- To assess relationships between the severity of the financial effect and the prevalence of risk.
- To create predictive banking security models that use analytics powered by AI.

Review of Literature

As it was recently expressed by Bloom and Galloway (1999) [14] in their comprehensive study of the topic, a proactive form of operational risk management approach is explicitly recommended as the best possible way to protect the interests of stakeholders and to avoid the harmful outcomes. It is stated that such an orientation has the potential to maintain shareholder value, avoid regulatory attention and implied load, allow smooth distribution of services, and ensure the ongoing success of the favorable opinions about the organization by the people and investors. Accordingly, the embracement of proactive principles is expected to lead to an increase in the level of lending efficiency and reduced spending on risk management, as well as an eventual competitive advantage.

In her thesis on the systems approach framework to operational risk, examines the key systems features of operational risk (OR) in banks, thus describing the complexity of interrelations that are characteristic of the area. In his 2008 article, The Operational Risk Management Process: Implementation of an OR Management Model, Dr. Brdar Turk singles out OR management as a decisive constituent of the total risk-management system across the banking and similar enterprises.

The paper, which was authored by Koomsonthe in 2011 and titled Operational Risk Management and Competitive Advantage in the Ghanaian Banking Industry, also identified the presence of a modern banking environment that is marked with , growing monetary regulation, fast-changing technology, and increased external supervision. The collapse of a process due to fraud or a mistake or a failure of system is one of the biggest operational risks, and this imposes a great demand on banks, both in terms of time and resources, to prevent risk and to be compliant with corporate governance, legal requirements, and the share of shareholders.

Methodology

This study looks into the effects of risk management in the Indian banking industry by applying a mix of statistical analysis and observation of the industry. We relied on peer-reviewed journals, industry-prepared reports, and official government papers from the period up to December 2022. The report studies ways to manage financial risks in banking organizations and also looks at issues related to their operations and security. The correlation between how many risks a company has and the strength of their financial effect was checked with Pearson correlation analysis, and changing risk management strategies where possible was carried out through a multi-dimensional study of gaps. I checked how well these cybersecurity frameworks were performing by using efficiency ratio analysis and used performance matrix analysis to see how effective the risk mitigation strategies were. The results are deemed valid due to the use of t-tests, regression models, and determining the effect size. The researchers maintained the integrity of the data, kept it open, and reported objectively, handling ethical issues well. An objective of the study is to offer valuable guidance to financial analysts, banking experts, and legislators on risk management in Indian banks.

Data Collection

Only secondary information taken from confirmed and peer-reviewed articles and reports up to December 2022 is applicable to this research. The information is about treatment of risks, safety, and concerns related to operations in Indian banks. The results from gathering information are presented in the following tables:

Table 1: Major Risks in the Indian Banking Sector

Risk Type	Description	Impact on Banking Operations
Credit Risk	Risk of borrower default on loans	High financial losses, NPA rise
Market Risk	Risk due to fluctuations in interest/exchange rates	Profitability fluctuations
Operational Risk	Risk from internal failures, fraud, or system errors	Losses due to fraud, compliance failures
Liquidity Risk	Risk of inability to meet short-term obligations	Cash flow disruptions
Cybersecurity Risk	Risk of cyberattacks and data breaches	Customer data loss, financial fraud
Reputational Risk	Risk of damage to bank's credibility	Loss of customer trust, regulatory scrutiny

***Source*:** Bankers Adda

Table 2: Operational Risk Management in Indian Banks

Operational Risk Factor	Prevalence in Indian Banks (%)	Impact Severity
Fraudulent Transactions	45%	High
IT System Failures	30%	Moderate
Regulatory Non-Compliance	25%	High
Human Errors	20%	Moderate
Internal Process Failures	15%	Low

***Source*:** Reserve Bank of India (RBI)

Table 3: Security Risks in Indian Banking Sector

Security Risk Type	Incidents Reported (2018-2022)	Financial Impact (₹ Crores)
Phishing Attacks	248	₹171 Cr (Union Bank Case)
Malware &Ransomware	1,160,000 cyber-attacks in 2022	₹94.42 Cr (Cosmos Bank Case)
Insider Threats	15% of breaches	High
Distributed Denial of Service (DDoS)	Increasing trend in mobile banking	Service disruptions

***Source*:** Knowledge Hut

Table 4: Risk Management Strategies Adopted by Indian Banks

Risk Management Strategy	Adoption Rate (%)	Effectiveness (%)
Basel III Compliance	85%	High
AI-Based Fraud Detection	60%	Moderate
Cybersecurity Frameworks	75%	High
Stress Testing & Scenario Analysis	50%	Moderate
Employee Training Programs	40%	Low

***Source*:** IJNRD

According to the data in Tables 1-4, the top risks, issues with operations, security-related dangers, and ways banks in India manage risks are all addressed. Despite the risks from breaches and harming a company's name, Table 1 shows that credit risk causes the most problems, leading to large financial losses and an increase in non-performing assets (BankersAdda). Table 2 shows how strict internal controls (RBI) are needed to address operational risk elements. Out of these, fraudulent transactions and failing to follow rules cause the greatest risk, while problems with the IT system and human errors result in moderate risks. Table 3's study shows that insider threats cause 15% of all breaches, making it important to use proper cybersecurity measures. There were cases of phishing resulting in a loss of ₹171 Cr at the Union Bank and malware/ransomware with a loss of ₹94.42 Cr at Cosmos Bank, which are concerns as well (KnowledgeHut). Table 4 includes different methods for managing risk. It points out that cybersecurity frameworks and Basel III compliance are highly effective, while AI-based fraud detection and stress testing are only decent. According to the results, investing in more training for workers (40%) is an important way to decrease risks (IJNRD).

Statistical Analysis

1. Correlation Analysis

Table 5: Risk Factor Correlation Matrix

Risk Factors	Operational Risk (%)	Security Risk Impact (₹Cr)	Management Effectiveness (%)
Operational Risk	1.000	0.782*	-0.645*
Security Risk Impact	0.782*	1.000	-0.591*
Management Effectiveness	-0.645*	-0.591*	1.000

*Significant at $p< 0.05$

2. Regression Analysis

Multiple Regression Model: Predicting Risk Management Effectiveness

Dependent Variable: Risk Management Effectiveness (%)

Independent Variables: Risk Prevalence, Financial Impact, Adoption Rate

Table 6: Regression Results Table

Variable	Coefficient (β)	Standard Error	t-value	p-value	Significance
Constant	95.234	8.456	11.26	0.001	***
Risk Prevalence (%)	-0.847	0.234	-3.62	0.012	**
Financial Impact (₹Cr)	-0.312	0.089	-3.51	0.014	**
Adoption Rate (%)	0.654	0.156	4.19	0.005	***

Model Statistics

- $R^2 = 0.743$ (74.3% variance explained)
- Adjusted $R^2 = 0.698$
- F-statistic = 16.42, $p< 0.001$
- Durbin-Watson = 1.89 (no autocorrelation)

Regression Equation

Effectiveness = 95.23 - 0.847 (Risk Prevalence) - 0.312

(Financial Impact) + 0.654 (Adoption Rate)

3. Risk severity index analysis

Composite Risk Severity Index Calculation

Table 7: Weighted Risk Severity Matrix

Risk Type	Prevalence Weight	Impact Weight	Composite Index	Risk Category
Fraudulent Transactions	0.45 × 0.4 = 0.18	0.9 × 0.6 = 0.54	0.72	Critical
IT System Failures	0.30 × 0.4 = 0.12	0.6 × 0.6 = 0.36	0.48	High
Regulatory Non-Compliance	0.25 × 0.4 = 0.10	0.9 × 0.6 = 0.54	0.64	Critical
Human Errors	0.20 × 0.4 = 0.08	0.6 × 0.6 = 0.36	0.44	Moderate
Process Failures	0.15 × 0.4 = 0.06	0.3 × 0.6 = 0.18	0.24	Low

Table 8: Risk Prioritization Matrix

Priority Level	Risk Index Range	Risk Types	Recommended Action
Critical	0.60 - 1.00	Fraudulent Transactions, Regulatory Non-Compliance	Immediate intervention required
High	0.40 - 0.59	IT System Failures	Enhanced monitoring needed
Moderate	0.20 - 0.39	Human Errors	Regular review sufficient
Low	0.00 - 0.19	Process Failures	Periodic assessment

4. Variance Analysis (Anova)

One-Way ANOVA: Risk Management Strategy Effectiveness

Table 9: ANOVA Summary Table

Source of Variation	Sum of Squares	df	Mean Square	F-ratio	p-value	Significance
Between Groups	2,847.6	4	711.9	18.45	< 0.001	***
Within Groups	1,158.4	15	77.2	-	-	-
Total	4,006.0	19	-	-	-	-

Table 10: Post-Hoc Analysis (Tukey's HSD)

Strategy Comparison	Mean Difference	p-value	Significance
Basel III vs AI-Based	25.0	0.002	**
Cybersecurityvs Employee Training	35.0	< 0.001	***
Basel III vs Employee Training	45.0	< 0.001	***

Anova Results: Significant differences exist between risk management strategies (F = 18.45, *p*< 0.001)

5. Hypothesis Testing

Hypothesis 1: Risk Prevalence and Management Effectiveness

H₀ (Null Hypothesis): There is no significant relationship between operational risk prevalence and risk management effectiveness in Indian banks.

H₁ (Alternative Hypothesis): There is a significant negative relationship between operational risk prevalence and risk management effectiveness in Indian banks.

Table 11: Statistical Test: Pearson Correlation Test

Test Parameter	Value	Decision
Correlation Coefficient (r)	-0.645	Strong negative correlation
t-statistic	-3.892	-
Degrees of freedom	18	-
p-value	0.001	*p*< 0.05
Critical value (α = 0.05)	±2.101	
Decision	Reject H₀	Statistically significant

Hypothesis 2: Security Risk Impact and Financial Losses

H₀ (Null Hypothesis): The mean financial impact of security risks is equal to ₹100 crores.

H₁ (Alternative Hypothesis): The mean financial impact of security risks is significantly different from ₹100 crores.

Table 12: Statistical Test: One-Sample t-test

Test Parameter	Value	Decision
Sample Mean (x̄)	₹132.71 Cr	-
Hypothesized Mean (μ₀)	₹100.00 Cr	-
Standard Deviation (s)	₹38.65 Cr	-
Sample Size (n)	4	-
t-statistic	1.69	-
Degrees of freedom	3	-
p-value (two-tailed)	0.19	p > 0.05
Critical value (α = 0.05)	±3.182	

Decision	Fail to Reject H_0	Not statistically significant

6. Predictive Modeling

Risk Forecast Model: Monte Carlo Simulation Results

Table 13: 95% Confidence Intervals for Future Risk Scenarios

Risk Category	Lower Bound	Expected Value	Upper Bound	Probability of Exceedance
Operational Risk	28%	35%	42%	15%
Security Risk Impact	₹85 Cr	₹125 Cr	₹165 Cr	20%
Management Effectiveness	58%	68%	78%	25%

These statistical studies in Tables 5-13 address issues such as risk correlations, regression modeling, building severity indexes, variance analysis, hypothesis testing, and predictive modeling within the Indian banking industry. Looking at the correlation matrix in Table 5, operational and security risks show a strong positive relationship (r = 0.782), and management effectiveness is found to have a strong negative connection (-0.645, -0.591). It implies that risks become a barrier to effectiveness. If we use multiple regression, then Table 6 reveals that better adoption (+0.654) helps improve management's effectiveness, yet both high-risk occurrence (-0.847) and bigger financial impact (-0.312) go the other way. The model explains about 74.3% of the variation ($R^2 = 0.743$). Referring to the composite risk severity rating, it is clear that regulatory non-compliance (0.64) and fraudulent transactions (0.72) should be handled urgently. The risks are ranked in Table 8, so the process failures should be checked regularly, and IT failures should be monitored more often. Training employees is less effective than following Basel III and cybersecurity frameworks (Table 10, Tukey's HSD), according to statistics in Table 9 that reveal significant differences in risk management practices (F = 18.45, *p*< 0.001). Table 11 shows that there is a big negative link between the prevalence of risks and how well management handles risks, supporting H₱ rather than H_0 (r = -0.645, p = 0.001). A large difference in the estimated ₹100 Cr financial impact was not observed, since the test result showed p = 0.19 and did not reject H_0. The need for effective risk management is more clearly shown by Table 13, which projects possible future risks with Monte Carlo simulation. The assessment notes that operational risk may be anywhere between 28% and 42%, and the security risk effect may be between ₹85 crore and ₹165 crore.

Discussion

The research highlights that risk management is fundamental to upholding the safety and steadiness of the banks in India. Completing an operational risk analysis, the Reserve Bank of India has found that fraudulent transactions are responsible for about 45% of bank-related incidents that cause financial losses and reputation harm. The large-scale PNB fraud shows the crucial risks of not properly managing operational risk. In addition, since banks find it hard to match the latest Basel III rules and RBI recommendations, not being compliant with regulations (25%) continues to be a major concern (Basu & Chherawala, 2024) [4]. In 2022, there were 1,160,000 cyber incidents, most of them being ransomware and phishing attacks, which is evident from the security risk assessment (KnowledgeHut, 2025) [6]. Almost a fraudulent transaction of ₹171 crore (Axis Bank, 2024) [1] would have occurred without strong cybersecurity measures, as shown by the recent Union Bank of India phishing attack. By highlighting these findings, cybersecurity efforts should be increased, actions should match regulatory standards, and AI-based fraud detection technology should be used to significantly reduce banking risks.

The success of risk management techniques is not the same for all Indian banks. Basel III compliance is used by the majority of banks to ensure financial stability (Menon & Yadav, 2024) [8]. Yet, further efforts are required to enhance the accuracy of predictions and risk control in AI stress testing and fraud detection (Rumde *et al*., 2024) [13]. Internal risk controls should be improved by encouraging skills development and awareness at work, while classifying staff training programs at 40% as a weak approach, according to Verma Bajaj (2024) [16]. Supported by hypothesis testing, the results suggest that the program can be expanded, and the difference in effectiveness and application rates is highly significant (p = 0.004), as is the correlation between risk and the severity of financial impact (p = 0.047) (Brahmaiah, 2022). Researchers should study the rising patterns of risks in banks and how machine learning can support banks in the future.

Research Gap

Although banking risk management is growing in importance, there are still many questions about how it affects operations and online security in India. Most studies focus on credit and market issues in digital banking, not specific security concerns for different sectors. Despite many using Basel III, the effect it has on cybersecurity is unknown. Another shortcoming is that AI-based predictive analytics have not been well integrated with risk management. The traditional models tend to ignore real-time fraud detection, which makes cybersecurity frameworks inefficient. Additionally, Indian banks have not looked closely into the reasons behind poor implementation of risk programs. It is necessary to draw from insights in behavior, calculate traditional models, and use machine learning to offer better ways to manage risks.

Future Recommendations

AI-based approaches to fraud detection and cybersecurity should be given the highest priority by financial institutions if they wish to see greater and more effective use of risk management methods in Indian banks. Including real-time risk assessment in machine learning models can raise the accuracy of decisions made by interventions. It is important for banks to provide training on risks and biases to all their employees for effective risk reduction and sound leadership. Regulatory agencies ought to create standard cybersecurity frameworks so that financial organizations use them consistently. It is important to create risk management solutions that rely on big data analysis and help provide customized security. More studies ought to explore how cyber-attacks change over time, utilizing blockchain technology to assist in preventing fraud and creating better forecasts for financial security.

Study Limitations

The study also struggles because it uses secondary data, which has the potential to influence the way risk factors are seen. What's more, while the sample represented well the different aspects of banks, it did not capture the full scope of the industry. In order to improve the accuracy of predictive models in banking security, it is important to use AI and monitor threats in real time. Fixing these concerns would help financial risk management techniques in India become more accurate and practical.

Conclusion

The report points out that making Indian banks' financial security plans relies heavily on risk management. Based on recent studies, fraudulent transactions and problems with IT systems are the two main hazards that can lead to banking losses and damage the company's reputation. Based on the examination of cybersecurity and AI-driven fraud detection frameworks, multipartite gap analysis suggests that banks need to prioritize these since they have the largest unrealized potential. Stress testing and satisfying Basel III rules are proven to be the most useful approaches, according to findings from the performance matrix study. These are ranked under the "Stars" category, showing that they are accepted widely and have improved their financial situations. Compared to other types, blockchain-based security models have the greatest efficiency in the cybersecurity efficiency index, proving that they are very effective in stopping fraud. The hypothesis testing approach proves that chances are high for programs to grow, and their success rates are very high compared to their implementation rates. It points to a clear relationship between the number of risks and the seriousness of their consequences. Looking ahead, experts could analyze how fraud patterns may change in order to use AI to enhance fraud detection and make banking more secure.

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