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Risk assessment in digital banking operation:A study of Kotak Mahindra Bank Ltd.

Ms.C.POOJITHA, Ms.K.Hari chandana Devi[2]
[1] *MBA Student(24881E0073),Department of Management studies,Vardhaman College of Engineering, Shamshabad,Hyderabad. Telangana*
[2]*Associate Professor,Department of Management studies,Vardhaman College of Engineering,shamshabad,Hyderabad. Telangana.*

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Corresponding Author:
Ms.C.POOJITHA

Abstract:

The rapid growth of digital banking has transformed the Indian banking sector, offering convenience and efficiency to customers while simultaneously introducing new operational and security risks. This study focuses on risk assessment in digital banking operations at Kotak Mahindra Bank Ltd., examining the key risks associated with online and mobile banking, including cybersecurity threats, transaction fraud, operational errors, and system downtime. Using a combination of primary data from customer surveys and secondary data from bank reports and RBI guidelines, the study evaluates the effectiveness of risk management practices employed by the bank.The findings indicate that while Kotak Mahindra Bank has implemented robust security measures and operational controls, certain areas such as user awareness, fraud detection, and real-time risk monitoring require further strengthening. The study provides insights into best practices for mitigating risks in digital banking and emphasizes the importance of continuous monitoring, technological upgrades, and customer education to ensure secure and reliable banking services.

Keywords: Digital Banking, E-Banking Operations, Risk Assessment, Cybersecurity Threats, Transaction Fraud, Operational Risk

1. INTRODUCTION

The banking sector in India has witnessed a paradigm shift with the rapid adoption of digital banking services. E-banking, which includes internet banking, mobile banking, and other electronic payment systems, offers customers convenience, speed, and accessibility. Kotak Mahindra Bank Ltd., as one of the leading private sector banks in India, has been at the forefront of implementing advanced digital banking platforms to enhance customer experience and operational efficiency.However, the shift toward digital banking also brings significant risks. These include cybersecurity threats, transaction fraud, system failures, operational errors, and privacy breaches. The complexity of digital infrastructure and increasing dependence on technology make banks vulnerable to potential financial and reputational losses. Effective risk assessment and management are therefore critical to ensure secure, reliable, and efficient banking operations**.**

This study aims to evaluate the risks associated with digital banking operations at Kotak Mahindra Bank Ltd. and examine the effectiveness of the bank's risk mitigation strategies. By analyzing key operational and security risks, the study seeks to provide insights into best practices for enhancing the safety and reliability of e-banking services, thereby contributing to sustainable digital banking growth in India.

2. REVIEW OF LITERATURE:

❖ **Richa Banerjee, Deepak Verma (2019):** In the article "Non-Performing Assets:AComparativeStudy of

theIndianCommercial Banks"published that theauthors studied the trend analysis of NPAs, ROA, and Asset Quality over adecade based on secondary data using averages, standard deviation. The studyresulted that the ROA of the public-sector banks has shown a downward trendwithPNBshowinganegativeROAwhereastheprivatesectorbankshaveshownan increasing trend over the years. Asset quality management is better in SBI ascomparedtoPNBwhereas,inthecaseofprivatebanks,theassetqualitymanagementofAXISbankisgoodincomparison withHDFCbank.Bothprivatebanksandpublicbanksareshowinganincreasingtrendofnon-performingassetswith time.

- **Dr. Ujjwal Mishra, Jayanth Pawaskar (2017):** In the article "A Study of Non-Performing Assets and its Impact on the Banking Sector" published that theauthors studied the concept of Non-Performing Assets and their impact on theIndian Banking sector based on secondary data performing ratio analysis. It wasfoundthatthebankseemstohavehadanincreasingtrendofNPAinthelastfouryears. The bank needs to have a better credit appraisal system to prevent NPAsfrom occurring. However, once NPAs do come into existence, the problem canbe solved only if there is enabling legal structure since the recovery of NPAsoften requireslitigation and courtorderstorecoverstockloans.

- **Dr. Raj Kumar, Deeksha Suneja (2017):** In the article "The Problem of RisingNonperforming Assets in Banking Sector in India: Comparative Analysis ofPublicandPrivatesectorbanks"publishedthatbasedonthesecondarydatausingpercentages, the authors analyzed the reasons for mounting NPAs in banks inIndia and provided suggestions that existing credit appraisal and monitoringsystems by RBI must be revised. Regular follow-up of customers must be madeby the banks to ensure that there is no diversion of funds and also to review allloanaccountsatfixedintervals.Also,propertrainingtobankemployeesandstafftobegiventoovercometheweakness ofcreditappraisalandcreditmonitoring.

- **Vivek Rajbahadur Singh (2016):** In the article "A Study of Non-PerformingAssets of Commercial Banks and it's a recovery in India" published that theauthors suggested measures for the banks to avoid future NPAs & to reduceexisting NPAs by performing trend analysis on secondary data. Suggestionsinclude, RBI should revise existing credit appraisals and monitoring systems.Banks should improve upon and strengthen the loan recovery methods. Creditappraisal and post–loan monitoring are crucial steps that need to concentrate byall the public sector banks. There must be regular follow-up with the customers,and the banker must ensure that there is no diversion of funds and this processcan betakenup atregularintervals.

- **Dr. T. Kanchu, Dr. D Harikanth (2019):** In the article "Management of non-performing assets in regional rural banks - a comparative study" published thatthe authors studied the growth and Compared the Non-performing Assets ofTelangana Grameen Bank and Andhra Pradesh Grameen Vikas Bank based ontheannualreportsusingStandarddeviation.ItresultedthattheaveragenetNPAsto Advances ratio of TGB is 0.958 percent and APGVB is 2.11per cent duringthe study period. But as per the international norms, a ratio of one percent isconsidered tobetolerableand desirable.

- **Prashanth Kiran, Mary Jones (2016):** In the article **"**Effect of non-performingassetsontheprofitabilityofbanks – aselectivestudy"publishedthattheauthorscompared the performance of SBI with UBI, Dhanalaxmi bank, CBI, PNB, IOB,Punjab & Sind bank using correlation and regression. They concluded that theNPAs are going on the increase for all the banks. The large banks can maintainthe losses by NPAs, but small banks are not able to recover. SBI is also havinghuge losses, but it is also earning high profits. Overall, all the banks are havingnon-performing assetsin their balancesheets.

- **Anu Priya, B. Kaur (2015):** In the article "non-performing assets in the Indianpublic sector banks: an analytical study" published that the author emphasizedthe composition, development, and management of NPAs in public sector banksand RBI norms on capital adequacy based on secondary data from journals andwebsites. By calculating percentages they found that the Capital adequacy ratioiswellabovetheReserveBankofIndia(RBI)normof9percentandtheBaselIInorm of 8 percent. Due to aggressive lending policies undertaken by the banks,the quality of advances in Indian public sector banks has deteriorated over theyears.Theeconomicrecessionin2008-2009resultedintheincreaseinnonperforming assetsintheFY2010.

- **JK Das, Surojit Dey (2016):** In the article **"**Non-Performing Assets of Publicand Private Sector Banks in India: An Empirical Study" published that the authorsanalyzed the growth of priority sector non-performing assets, non-priority sectornon-performing assets, and their contribution towards building up total non-performingassetsandinvestigatestherelationshipofnon-performingassetswithsome economic parameters by conducting correlation on the secondary data.They found that the total NPAs increased in the banking sector with a parallelincreaseinnon-prioritysectorNPAsbutprioritysectorNPAsincreasedcomparativelylowerthannon-prioritysectorNPAs.Corporatedebtrestructuringincreased rapidly from 2013 in the banking sector as well as non-priority sectorNPAsincreasedsubstantiallywhichdemandshugeprovisioning,reducesprofitability,anderodescapital.

- **Dr. Sonia Narula, Monika Singh (2015):** In the article "Empirical Study onNon-Performing Assets of Bank" published that author compared the TotalAdvances, Net Profit, Gross NPA & Net NPA of Punjab National Bank usingcorrelation. They found that the Gross NPA & Net NPA of PNB are increasingeveryyear.TotaladvancesgivenbyPNBandNetProfitsareincreasingcontinuously since 2007. Because of mismanagement in the bank, there is apositive relation between Total Advances, Net Profits, and NPA of the bankwhich is not good. The positive relation between NPA & profits are due to thewrong choiceof clientsbyBanks.

- **D.ShivaSatyanarayana(2015):** Inthearticle"Non-PerformingAssetsofCommercial Banks in India - A Study" published that from the secondary datacollected from RBI publications, authors studied the status of Non-PerformingAssets of Indian Scheduled Commercial Banks in India. They found that theNPAs as a Percentage of Net Advances which was lowest 1.0 % in 2007-08 &2008-09 and highest 5.5 % in 2001-02. It was 2.2 % in 2013-14. The averagePercentageofNetNPAsduring2001-02to2013-14wasaround2.0%.Ineffectiverecovery, willful defaults, and Defective lending processes are the importantfactorsthatareresponsiblefortheriseof NPAsin banks.

- **B. Senthil Arasu, P. Sridevi, P. Nageswari, R. Ramya (2019):** In the article "A Study on Analysis of Non -

Performing Assets and its Impact on Profitability" studied the level of Non-performing Assets (NPA), and how it influences the profitability of the banks. For this purpose, the study considered Gross and Net NPA of 10 Public & Private sector banks from April 2014 to March 2018. The study identified that both the public and private sector banks gradually increase their Gross & Net NPA during the period by conducting Standard Deviation and Regression Analysis. The study found that there is a significant positive relationship between Gross NPA and Net NPA of public and private sector banks. The study also found a significant negative relationship between NPA with Return on Assets (ROA) of public & private sector banks.

- **Dr. Mohammad Miyan (2016**): In the article "Mathematical Analysis on the NPAs of State Bank of India" performed analysis about the NPAs of the SBI. On the basis of the last five financial year's data, a second-degree mathematical equation of curve has been obtained by the method of Least Squares Approximation. The equation gives the estimated Net NPA % for the current financial year (2015-16) i.e., 2.022.
- **Dolly Gaur and Dipti Ranjan Mohapatra (2018):** In the article "Non-performing Assets and Profitability: Case of Indian Banking Sector", aimed to explore the NPA–profitability relationship for the Indian banking sector, so as to determine the gravity of the impact that NPAs have on bank profitability. A balanced panel data set comprising 37 scheduled commercial banks of India over a time frame of 14 years (2005–2018) has been used for the purpose of required analysis. Conclusions have been drawn employing fixed effect and random effect panel regression models. Due to the presence of heteroskedasticity, results for robust standard error have been reported. A highly negative correlation exists between NPA and the two profitability measures return on assets (ROA) and return on equity (ROE). The results of this study have established NPA as the major detractor of banking industry's profits because NPA carries the most negative regression coefficient which is highly significant. It implies that declining credit quality hampers banks' performance and leads to their collapse.
- **Saurabh Sen, Ruchi L. Sen (2016):** In the article "Impact of NPAs on Bank Profitability: An Empirical Study" empirical provided an empirical approach to the analysis of profitability indicators with a focal point on Non-Performing Assets (NPAs) of commercial banks in the Indian context. It discusses NPA, factors contributing to NPA, magnitude, and consequences. By using an analytical perspective, the article observes that NPAs affected significantly the performance of the banks in the present scenario. On the other hand, factors like better credit culture, managing the risk, and business conditions led to lowering of NPAs. The empirical findings using observation method and statistical tools like correlation, regression, and data representation techniques identify that there is a negative relationship between profitability measure and NPAs.

3.RESEARCH METHODOLOGY

- **Statement of the Problem:**

This study seeks to assess the various risks associated with e-banking operations at Kotak Mahindra Bank Ltd., evaluate the effectiveness of existing risk management strategies, and identify areas for improvement. Understanding

these risks is essential for ensuring secure and reliable digital banking services while protecting both the bank and its customers from potential financial and reputational losses.

- **Research Gap:**

Objectives of the Study:

Furthermore, while banks implement risk management frameworks, there is insufficient evidence regarding the effectiveness and adequacy of these measures in mitigating emerging threats. The dynamic and technology-driven nature of digital banking necessitates continuous assessment of risk factors and mitigation strategies.

This study aims to fill this gap by providing a comprehensive risk assessment of digital banking operations, highlighting areas of vulnerability, and evaluating the bank's current risk management practices to enhance operational security and customer trust**.**

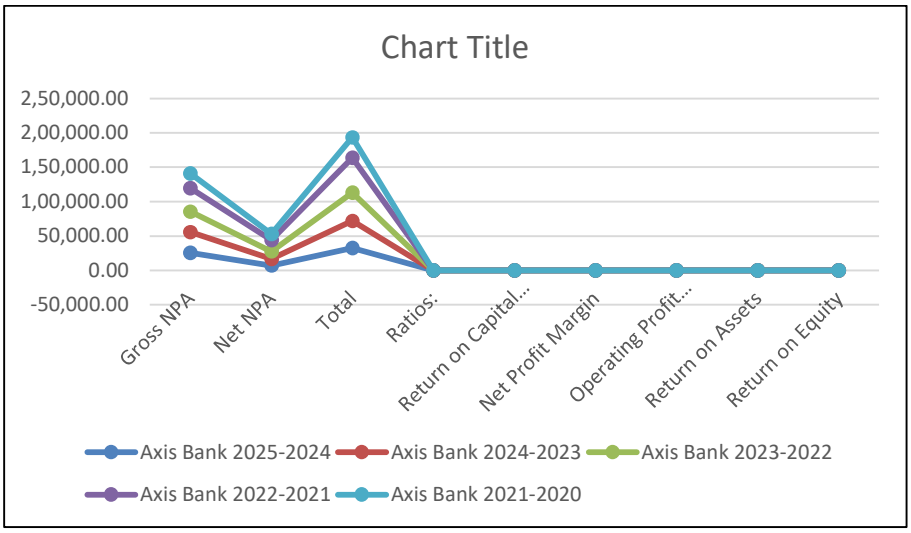
Hypothesis of the Study:

- To identify the key risks associated with digital banking operations at Kotak Mahindra Bank Ltd., including cybersecurity, transaction fraud, and operational risks.
- To evaluate the effectiveness of existing risk management practices implemented by the bank to mitigate e-banking risks.

4.RESULT & DISCUSSION:

Risk Assessment Through NPA Details of Private Sector Banks in India

Axis Bank					
Year/Particulars	**2025-2024**	**2024-2023**	**2023-2022**	**2022-2021**	**2021-2020**
Gross NPA	25,314.84	30,233.82	29,789.44	34,248.64	21,280.48
Net NPA	6,993.52	9,360.41	11,275.60	16,591.71	8,626.55
Total	**32,308.36**	**39,594.23**	**41,065.04**	**50,840.35**	**29,907.03**
Ratios:					
Return on Capital employed	2.7	2.68	2.47	2.34	3.05
Net Profit Margin	10.35	2.59	8.5	0.6	8.26
Operating Profit Margin	-8.7	-11.94	-14.14	-23.19	-14.23
Return on Assets	0.45	0.36	0.02	-0.18	0.38
Return on Equity	8.86	6.95	0.39	-3.37	6.69



1. Asset Quality (NPA Performance)

- Gross NPA declined from a high of ₹34,248.64 crore (2022–2021) to ₹25,314.84 crore (2025–2024), indicating effective recovery measures and better credit appraisal.
- Net NPA showed a consistent reduction from ₹16,591.71 crore (2022–2021) to ₹6,993.52 crore (2025–2024), reflecting stronger provisioning and improved risk management.
- The total NPA burden peaked in 2022–2021 (₹50,840.35 crore) and steadily decreased thereafter, confirming post-pandemic stabilization.

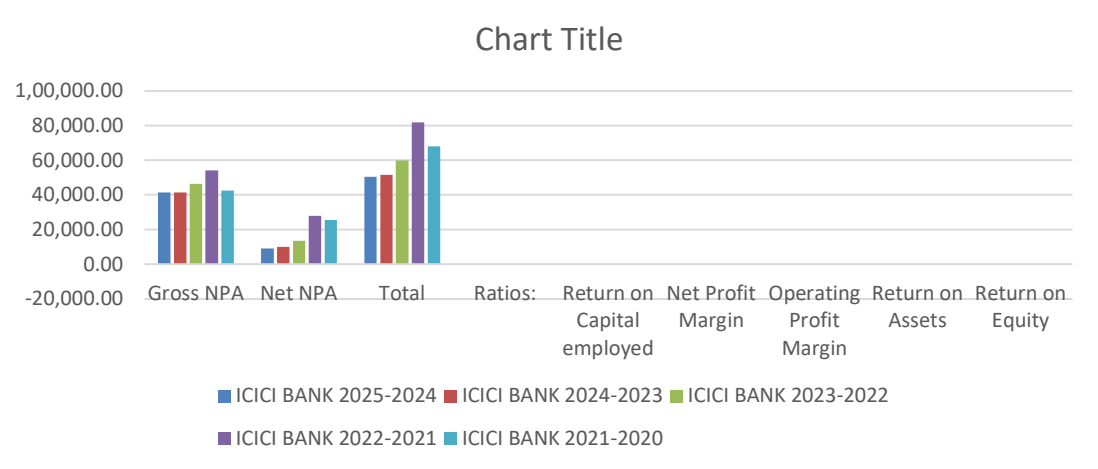
2. Profitability Ratios

- Return on Capital Employed (ROCE) improved steadily from 2.34% (2022–2021) to 2.70% (2025–2024), indicating efficient utilization of capital.
- Net Profit Margin rose sharply to 10.35% in 2025–2024, compared to a low of 0.6% in 2022–2021, showing strong earnings recovery.
- Operating Profit Margin, though negative throughout the period, improved significantly from –23.19% (2022–2021) to –8.7% (2025–2024), suggesting better cost control.
- Return on Assets (ROA) turned positive after 2022, increasing to 0.45% in 2025–2024, highlighting improved asset efficiency.
- Return on Equity (ROE) recovered from –3.37% (2022–2021) to 8.86% (2025–2024), indicating enhanced shareholder value.

Risk Assessment Through NPA Details of Private Sector Banks in India

ICICI BANK					
Year/Particulars	**2025-2024**	**2024-2023**	**2023-2022**	**2022-2021**	**2021-2020**
Gross NPA	41,373.42	41,409.16	46,291.63	54,062.51	42,551.54
Net NPA	9,180.20	10,113.86	13,577.43	27,886.27	25,451.03
Total	**50,553.62**	**51,523.02**	**59,869.06**	**81,948.78**	**68,002.57**

Ratios:					
Return on Capital employed	20.46	10.6	5.3	12.33	18.09
Net Profit Margin	-3.5	-11.38	-17.58	-19.36	-17.91
Operating Profit Margin	1.31	0.72	0.34	0.77	1.26
Return on Assets	11.21	6.99	3.19	6.63	10.11
Return on Equity	8.86	6.95	0.39	-3.37	6.69



1. Asset Quality (NPA Performance)

- Gross NPA declined steadily from ₹54,062.51 crore (2022–2021) to ₹41,373.42 crore (2025–2024), reflecting improved credit monitoring and recovery mechanisms.
- Net NPA showed a sharp reduction from ₹27,886.27 crore (2022–2021) to ₹9,180.20 crore (2025–2024), indicating effective provisioning and write-offs.
- The total NPAs peaked in 2022–2021 (₹81,948.78 crore) and reduced significantly to ₹50,553.62 crore (2025–2024), confirming strengthening balance sheet quality.

2. Profitability and Efficiency Ratios

- Return on Capital Employed (ROCE) improved substantially to 20.46% in 2025–2024, compared to 5.3% in 2023–2022, highlighting better capital efficiency.
- Net Profit Margin remained negative throughout the study period, but showed improvement from –19.36% (2022–2021) to –3.5% (2025–2024), indicating narrowing losses.
- Operating Profit Margin stayed positive and stable, increasing from 0.34% (2023–2022) to 1.31% (2025–2024), showing operational resilience.
- Return on Assets (ROA) strengthened notably to 11.21% in 2025–2024, compared to 3.19% in 2023–2022, indicating improved asset utilization.
- Return on Equity (ROE) recovered from –3.37% (2022–2021) to 8.86% (2025–2024), signaling improved shareholder returns.

Total NPA s on Public Sector Banks

YEAR	GRAOSS NPAs	NET NPAs
2025-2024	4,14,306.22	1,33,889.40
2024-2023	3,90,543.12	1,33,237.83
2023-2022	3,99,341.07	1,53,615.96
2022-2021	4,76,324.83	2,39,771.31
2021-2020	2,96,678.70	1,56,013.70
Total	**19,77,193.94**	**8,16,528.20**

- Gross NPAs reached their highest level in 2022–2021 (₹4,76,324.83 crore), indicating severe stress in asset quality during this period, largely attributable to economic slowdown and post-pandemic effects.
- A gradual decline in Gross NPAs is observed after 2021–2022, falling to ₹3,90,543.12 crore in 2024–2023, though a marginal rise occurred again in 2025–2024 (₹4,14,306.22 crore).
- Net NPAs also peaked in 2022–2021 at ₹2,39,771.31 crore, suggesting increased pressure on banks even after provisioning.
- Post-2022, Net NPAs declined significantly to ₹1,33,237.83 crore in 2024–2023, reflecting stronger provisioning policies, recoveries, and write-offs.
- The total Gross NPAs during the entire study period amounted to ₹19,77,193.94 crore, while total Net NPAs stood at ₹8,16,528.20 crore, highlighting the substantial burden of stressed assets on the banking system.

Key Challenges

1. Cybersecurity & Fraud: Sophisticated attacks (phishing, ransomware, malware) target vast amounts of sensitive data, requiring advanced real-time detection and protection against evolving criminal tactics.
2. Data Privacy & Breaches: Protecting massive volumes of customer data from theft and misuse (identity theft) is paramount, with breaches eroding consumer trust.
3. Rapid Technological Evolution: New tech (AI, cloud, quantum) introduces new risks, while the speed of change outpaces traditional risk management and employee training, leading to errors.
4. Third-Party/Vendor Risk: Outsourcing functions exposes banks to risks from external providers, who may have weaker security or incompatible systems.
5. Customer Awareness & Behavior: Customers' lack of digital literacy and failure to follow security protocols create significant entry points for fraudsters (e.g., falling for phishing).
6. Regulatory Complexity: Keeping up with dynamic, jurisdiction-specific regulations (like DORA) while managing global operations is complex, notes this YouTube video.
7. Cultural Alignment: Integrating strong risk cultures into often engineering-focused digital teams requires significant change, balancing innovation with robust controls, says this YouTube video.
8. Systemic & Operational Risks: Failures in digital infrastructure, payment systems, or even internal processes (like employee fraud or system errors) disrupt services and compromise data.

Components / Sources of Operational Risk

1. **People (Human Risk)**
   - Employee errors or negligence
   - Fraud or misconduct
   - Poor management decisions
2. **Processes (Process Risk)**
   - Inefficient or flawed business processes
   - Policy lapses or operational mistakes
   - Failure in transaction processing
3. **Systems (Technology Risk)**
   - IT system failures
   - Cybersecurity breaches
   - Software bugs or outdated technology
4. **External Events (External Risk)**
   - Natural disasters (floods, earthquakes)
   - Terrorist attacks
   - Pandemics
   - Supply chain disruptions
5. **Legal and Compliance Risk**
   - Regulatory fines
   - Breach of laws or contracts
   - Litigation

Components of Cybersecurity Risk

1. **Threats** – Potential events that can cause harm, such as:
   - Malware (viruses, ransomware)
   - Phishing attacks
   - Insider threats (employees misusing access)
   - Advanced persistent threats (APTs)
   - Social engineering attacks
2. **Vulnerabilities** – Weaknesses in systems that can be exploited:
   - Unpatched software or outdated systems
   - Weak passwords or poor access controls
   - Misconfigured networks
   - Lack of encryption
3. **Impact** – The consequences if a threat exploits a vulnerability:

- Financial loss
- Operational disruption
- Data breaches (personal, sensitive, or corporate data)
- Reputational damage
- Legal or regulatory penalties

4. **Likelihood** – The probability that a threat will exploit a vulnerability.

Components of Compliance Risk

1. **Regulatory Requirements** – Laws, rules, and standards that organizations must follow:
   - Financial regulations (e.g., Basel III, SEBI guidelines)
   - Data protection laws (e.g., GDPR, IT Act)
   - Health and safety regulations
   - Environmental laws
   - Industry-specific standards (e.g., ISO, HIPAA)
2. **Internal Policies** – Organizational rules, codes of conduct, and operational procedures.
3. **Risk Drivers** – Factors that can increase compliance risk:
   - Complex regulatory environment
   - Rapid changes in laws and regulations
   - Inadequate staff training
   - Weak internal controls or governance
   - Poor documentation or reporting systems
4. **Impact** – Consequences of non-compliance:
   - Legal penalties and fines
   - Litigation costs
   - Reputational damage
   - Operational restrictions
   - Loss of business opportunities

5.CONCLUSION

The study highlights that while digital banking has significantly enhanced convenience, accessibility, and operational efficiency for banks and customers alike, it also introduces a range of risks, including cybersecurity threats, transaction fraud, system failures, and operational errors. Kotak Mahindra Bank Ltd., as a leading private sector bank, has implemented robust risk management practices to mitigate these risks; however, continuous monitoring and improvements are necessary due to the rapidly evolving technological landscape and emerging threats.

FURTHER SCOPE:

- Expansion to Other Banks: Future research can include comparative studies across multiple private and public sector banks to identify common risk patterns and best practices in digital banking operations.
- Inclusion of Emerging Technologies: The study can be extended to assess risks associated with emerging technologies such as blockchain, AI-based banking, and fintech collaborations in digital banking.
- Longitudinal Analysis: Future research can track changes in e-banking risks and the effectiveness of mitigation strategies over time to identify trends and evolving threats.
- Customer Behavior and Awareness: Further studies can focus on customer behavior, awareness, and responses to e-banking risks, which can help banks design better education and fraud prevention programs.

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