



Technological Innovation and Commercial Banks' Financial Performance: A Mediation Analysis of Risk Management Practices

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ABSTRACT

The purpose of the study is to investigate the association between technological innovations and the financial performance of commercial banks using risk management practices as a mediator. The study's primary focus was on commercial banks in Uganda's Kampala Central region. A quantitative method was used to adopt a cross-sectional survey design. The study selected bank employees from 24 Kampala-based commercial banks using the convenience sampling technique. To accomplish the study's goals, mediation analysis were done using Baron and Kenny, while correlation, regression and inferential statistics were examined using the Statistical Package for Social Scientists (SPSS) PROCESS MACRO. The results of the study showed that the study variables had a significant positive association. The results of the regression show that risk management techniques and technological innovation are predictive of financial performance. The results showed that risk management procedures significantly impacted the connection between technological innovation and financial performance. Results also indicate that the association between financial performance and technological innovation is mediated by risk management strategies. The study provides many implications for management and theory.

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Introduction

In today's evolving business setting, technology innovations have become a game-changer for many industries, including the banking sector. Commercial banks are now leveraging technology advancements to improve their operations, enhance customer experience, and mitigate risks (Starnawska, 2021). However, the impact of these technology innovations on risk management practices and overall performance in commercial

banks is a topic that warrants further investigation. The adoption of technology innovations in commercial banks has revolutionized the way they operate (Kyambade et al., 2023). From the implementation of robust online banking platforms to the utilization of machine learning algorithms and artificial intelligence for fraud detection, technology has significantly transformed the banking industry. These technological advancements offer banks the opportunity to increase efficiency, reduce costs, and improve customer engagement (Lee et al., 2021). However, it is essential to determine whether these innovations also have an impact on risk management practices and overall performance. Numerous Studies have studied technological innovation, risk management and financial performance independently in the banking sector especially in developed economies (Ousama et al., 2020; Uzkurt et al., 2013). Therefore this study bridges this gap by studying the association between technological innovation and financial performance with risk management practices as a mediator in a developing country Uganda.

Given that their performance is constantly changing, commercial banks operate in a dynamic and competitive environment (Guan et al., 2019). Due to the establishment of numerous banks, there is now room for competitive banking services that could satisfy their clients (Supriyanto et al., 2021). With the exception of Uganda's banking industry, this as of 2022 had 24 commercial banks. The World Bank reports that in 2020, commercial banks' competitive advantage grew by 15.9 percent in relation to government securities, up from 6.1 percent, while lending increased by 3.7 percent compared to 19.7 percent. This indicates a shift in the bank's portfolio from riskier to safer assets, which is being driven by the decline in asset quality. According to Haabazoka et al., (2021) shows financial statements for the year 2021 indicated that while some Ugandan commercial banks reported positive results, others were drowning in losses. The unstable nature of the economy and the bank closures in 2017 were mirrored in the performance of certain commercial banks. The GDP growth estimate for 2022 has been lowered from the original 5% estimate to 4.5%, primarily because of the slowing economy. In previous years, Barclays Bank and Crane Bank, two of Uganda's top banks, failed as a result of the country's "significant undercapitalization." The later bank failed after reporting a staggering Shs3.1 billion loss in 2015, compared to a Shs50.6 billion profit in 2014. This was brought on by a high level of non-performing loans, that rose from Shs19.36 billion in 2014 to Shs142.3 billion in 2015—a 122.9% increase. Two banks, Commercial Bank of Africa (CBA) and Cairo International Bank (CIB), clearly reported losses while many other banks reported a decline in profits. A loss of Shs1.45 billion was reported by Cairo International Bank, a little less than the Shs1.46 billion reported in 2016.

The process through which technological advancements are made is referred to as technological innovation (Ahmad et al., 2020). The innovation process consists of several steps that improve the capacity to create new goods and services (innovations in products) or new manufacturing techniques (innovations in processes). According to Chege and Wang (2020), the idea of a flow generation, application, and dissemination of technologies is connected to the concept of technological innovation. Technology innovation has been widely acknowledged as a key factor in lowering risks and improving financial performance for commercial banks. In order to minimize, control, and monitor the probability and/or influence of unfortunate events, risk management practices involve the identification, assessment, and prioritization of risks, followed by the coordinated and economical application of resources (Brashear, 2020). It is not a strategy for totally avoiding risks or eliminating them. Essentially, risk management involves controlling change before it becomes a problem (El Baz & Ruel, 2021). In order to optimize a firm's value, Kamiya et al. (2021) emphasize the significance of effective practices of risk management. In particular, the latter claims that a company that implements effective enterprise risk management will have a long-term competitive advantage over those that handle and monitor risks on an individual basis. According to the former, implementing sensible and efficient risk management procedures can guarantee best practices and boost profits. As a result, and in light of this, a comprehensive approach to risk management is recommended. For the vast majority of commercial banks, risk management is essential to their survival (Huy et al., 2021). In addition to controlling risks resulting from the

possibility that a client won't repay the loan, risk management practices promote the adoption of regulations to restrict insider lending and significant exposures to related parties (Eling et al., 2021).

Technological innovation plays a vital role in shaping the financial performance of commercial banks. By incorporating cutting-edge technological solutions, banks can streamline their processes, enhance operational efficiency, and deliver a superior customer experience. For example, the adoption of online banking platforms and mobile applications allows customers to conveniently make transactions, access their accounts, and manage their finances from anywhere, at any time. This improved accessibility and convenience not only attract new customers but also foster customer loyalty, ultimately boosting the financial performance of banks. While technology innovation can lead to significant improvements in financial performance, it also introduces new risks and challenges for commercial banks. Therefore, effective risk management practices are crucial for mitigating these risks and ensuring the success of technological initiatives. By effectively managing risks associated with technology innovation, banks can safeguard their operations, protect customer data, and prevent financial losses. Further to understand the association between technology innovation, risk management practices, and financial performance, mediation analysis comes into play. First, technology innovation has a positive direct result on financial performance, indicating that the adoption of innovative technologies leads to improved financial outcomes for commercial banks. Second, risk management practices mediate the association between technology innovation and financial performance. Effective practices of risk management amplify the positive influence of technology innovation on financial performance by reducing associated risks and enhancing operational resilience. Effective risk management practices serve as a critical bridge between technology innovation and financial performance for commercial banks. They provide a systematic framework for identifying, assessing, and moderating risks associated with technology adoption. Without proper risk management, even the most innovative technological initiatives can lead to adverse financial consequences, such as data breaches, operational disruptions, and reputational damage.

Literature Review

The corporate risk management theory aims to identify and mitigate risks that a company faces. It involves the strategic planning and implementation of various risk management techniques to minimize the adverse impact of unforeseen events on the financial performance of a company (Can Saglam et al., 2021). Effective theory of risk management can greatly contribute to improving financial performance of a company by reducing uncertainties and creating a stable operating environment (Mutamimah et al., 2022). One of the main goals of corporate risk management theory is to assess and identify potential risks that a company faces. This includes evaluating various external and internal factors that may pose a threat to the financial health of a company, such as market volatility, economic uncertainty, regulatory changes, or natural disasters. By understanding and identifying these risks, companies like banks can develop policies to effectively manage and mitigate them, thereby safeguarding their financial performance. Furthermore, Barauskaite & Streimikiene, (2021) report that the successful implementation of risk management theory can also positively impact the financial performance of a company by increasing profitability and reducing costs. By identifying and managing potential risks, companies can avoid or minimize the financial impact of unpredictable events. This can include implementing insurance programs, diversifying investments, or developing contingency plans. By taking proactive measures to address potential risks, companies can protect their financial resources and ensure a more stable and profitable operation according to Shan et al., (2023). Corporate risk management theory plays a vital role in determining a bank's financial performance. By identifying and mitigating potential risks, companies can create a stable operating environment and safeguard against the adverse impact of unforeseen events. Effective risk management theory can also lead to cost reduction and increased profitability by minimizing the financial impact of unpredictable events. Therefore, integrating risk management theory into corporate strategies is essential for companies to achieve sustainable financial success.

Technological Innovation

Technology innovation has become a driving force in the banking industry, allowing banks to streamline operations, improve customer experience, and enhance security measures. One of the prominent areas of innovation is digital banking, with a shift towards mobile and online platforms (Kitsios et al., 2021). Banks are increasingly offering mobile apps and online platforms that allow customers to perform daily banking activities, such as making payments, checking account balances, and transferring funds (Shahid et al., 2022). This shift towards digital channels not only provides convenience to customers, but also reduces operating costs for banks by decreasing the need for physical branches and tellers. Moreover, the literature emphasizes the importance of enhancing security measures to protect customers' sensitive information as digital banking gains popularity. Another key theme in the literature is the adoption of emerging technologies in banking processes (Kyambade et al., 2023). Hentzen et al., (2022) report that AI is being utilized in numerous areas, such as customer service chatbots, fraud detection, and personalized financial advice. The integration of AI technologies helps banks automate manual tasks, improve enhance customer experience and decision-making processes. Blockchain technology has also gained traction in the banking sector for its potential to improve security, streamline payment processes, and reduce fraud (Rella, 2019). Biometrics, including fingerprint, face, and voice recognition, are being implemented to enhance authentication and improve security measures in banking transactions. The literature review on technology innovation in banks highlights the significant impact of digital banking and the adoption of emerging technologies on the banking sector. The shift towards digital channels has revolutionized customer experience and reduced operating costs for banks. The integration of AI, blockchain, and biometrics in banking processes has enhanced efficiency, security, and decision-making capabilities. As technology continues to advance, banks must stay ahead of the curve by embracing innovation to remain competitive in the rapidly evolving banking industry.

Risk Management Practices

Managing Risk in banks involves assessing, identifying, and mitigating risks to ensure the stability and safety of the financial institution and its stakeholders. One prominent risk management practice employed by banks is the adoption of robust risk assessment techniques (Thach et al., 2021). Banks utilize quantitative models to assess and measure several risks, such as market risk, credit risk, and operational risk (Gadzo et al., 2019). These models help banks to evaluate the potential influence of risks on their financial health and make informed decisions regarding risk exposure. However, the literature also acknowledges the limitations of these models, such as their inability to capture rare and extreme events and their dependence on historical data. Another key aspect as per Girling, (2022) of managing risk in banks is the implementation of risk mitigation measures. Banks employ a range of strategies to minimize the impact of risks, including diversification of investments, hedging, and the use of derivative products. Literature highlights that effective risk mitigation requires a comprehensive understanding of risks and their interrelationships, as well as the implementation of robust risk management frameworks and policies (Can Saglam et al., 2021). However, the literature also acknowledges that risk mitigation is not foolproof, and banks may still be exposed to unforeseen risks and vulnerabilities (Uddin et al., 2023). The literature review also sheds light on the challenges faced by banks in implementing risk management practices. One major challenge as per (Lamba & Kaur, 2023) is the ever-evolving nature of risks, which requires banks to constantly update their risk management strategies. Additionally, the complexity of financial products and markets poses a challenge in accurately assessing and managing risks. The review also highlights the importance of risk culture and awareness among bank employees, as well as the need for regulatory frameworks to ensure effective risk management practices. Overall, the literature review emphasizes the crucial role of risk management in ensuring the steadiness and long-term banks sustainability and the whole of financial system.

Financial Performance

Financial performance in banks is crucial in understanding and evaluating the overall health, stability, and profitability of these institutions. Several studies have been conducted worldwide to analyze and measure banks financial performance, examining factors such as profitability ratios, efficiency indicators, solvency ratios, and liquidity levels (Rashid, 2021; Dahiyat et al., 2021). One key area of study in the literature is profitability ratios, which provide insight into a bank's ability to generate profits from its operations (Ali & Puah, 2019). These ratios include return on equity (ROE), return on assets (ROA), and net interest margin (NIM). Studies have shown that profitability ratios are influenced by factors such as bank size, risk management practices, interest rate spreads, and the level of non-performing loans in a bank's portfolio (Do et al., 2020). Furthermore, scholars have also examined efficiency indicators, such as overhead cost ratio and cost-to-income ratio (CIR) (Gupta & Mahakud, 2020). These ratios measure the ability of the bank to control its costs and operate efficiently. Research of Ayalew, (2021) has found that banks with lower CIR and lower overhead costs tend to be more efficient, leading to higher profitability. Finally, studies on financial performance in banks also delve into solvency and liquidity ratios, such as loan-to-deposit ratio, capital adequacy ratio (CAR), and liquidity coverage ratio (LCR) (Noori, 2021). These ratios assess the ability of the bank to meet its obligations, manage risks, and maintain sufficient liquidity. The literature suggests that higher solvency and liquidity ratios contribute to the stability and soundness of banks. Overall, the literature review on financial performance in banks provides a complete understanding of the factors influencing the profitability, efficiency, solvency, and liquidity of these institutions. By analyzing financial ratios and indicators, researchers have discovered key drivers of bank performance and identified areas for improvement. This knowledge is crucial for stakeholders, including bank managers, investors, regulators, and policymakers, as they work towards ensuring the stability and growth of the banking sector.

Technology Innovation and Financial Performance

Technology innovation plays a vital role in shaping the financial performance of businesses in today's dynamic market environment. Studies have revealed that technology innovation positively impacts financial performance (Chege et al., 2020). By taking on technological advancements, companies can reduce costs, improve their operational efficiency, and enhance productivity. For example, Ragazou et al., (2023) reports that implementing new software systems, automation processes, or utilizing big data analytics can help companies streamline their operations and make more decisions that are informed. This ultimately leads to improved financial performance, as companies can achieve higher revenues, profitability, and return on investment. Scholars have also highlighted the importance of continuous technological innovation to sustain financial performance in the long run (Zhang et al., 2019). The rapidly changing business landscape demands companies to adapt and innovate constantly to remain competitive. Failure to innovate can lead to a decline in financial performance and even extinction. Literature emphasizes the need for companies to invest in research and development activities and foster a culture of innovation according to Chatterjee et al., (2021). By doing so, companies can stay ahead of their competitors, unlock new revenue streams and create new products and services that drive sustainable financial performance. The positive association between technology innovation and financial performance highlights the importance of investing in technological advancements to improve operational efficiency, reduce costs, and drive revenue growth. Furthermore, continuous technological innovation is necessary to stay competitive and sustain financial performance over the long term.

H1: There's a positive association between Technology Innovation and Financial Performance

Technology innovations and risk management practices

Technology innovations have revolutionized the world, bringing about significant advancements and efficiencies (Chen et al., 2021). However, these innovations also come with their own set of risks and challenges that need to be managed effectively. Practices of Risk management play a vital role in mitigating the potential

threats associated with technology innovations (Sun et al., 2020). The rapid advancement of technology has introduced new risks that organizations must navigate. Cyber security has become a paramount concern as hackers and cybercriminals exploit vulnerabilities in technology systems (Razaque et al., 2021). Risk management practices such as regular security audits, penetration testing, and the implementation of robust firewalls and encryption protocols help organizations safeguard their sensitive data from potential breaches. Additionally, the use of machine learning and artificial intelligence in risk management has enabled organizations to identify potential threats in real-time, allowing for quick response and mitigation strategies according to Radanliev et al., 2020). Furthermore, technology innovations have brought about operational risks such as system failures and disruptions. Organizations must adopt risk management practices to ensure business continuity and minimize potential financial losses (Settembre-Blundo et al., 2021). Implementing redundant systems, backup and recovery procedures, and disaster recovery plans are essential in mitigating the risks associated with technological failures. According to Li et al., (2021) Regular maintenance and updates of technology systems also enhance their reliability and minimize the likelihood of unexpected disruptions. Technology innovations have significantly transformed various industries, but they also bring about their own set of risks. Effective risk management practices are crucial in addressing these risks and ensuring the smooth operation of organizations. By implementing proactive measures such as strong cyber security protocols and disaster recovery plans, organizations can mitigate potential threats and exploit the benefits of technology innovations while minimizing their associated risks.

H2: There's a positive relationship between Technology innovations and risk management practices

Risk Management Practices and Financial Performance

Risk management practices help banks identify, measure, monitor, and mitigate these risks, ensuring the stability and profitability of the institution. Effective risk management practices enable banks to allocate resources efficiently and make informed decisions, leading to improved financial performance (Harb et al., 2023). One of the key components of risk management practices is credit risk management. Banks must carefully assess the creditworthiness of borrowers and ensure that proper measures are in place to mitigate the risk of default according to Ferretti, (2021). By implementing sound credit evaluation processes and establishing credit limits, banks can minimize the occurrence of bad loans and non-performing assets. This helps to safeguard the financial health of the bank and maintain a healthy loan portfolio, resulting in improved financial performance. Another important aspect of risk management practices is operational risk management (Munir et al., 2020). Banks face various operational risks including internal fraud, system failures, and human errors (Ferreira & Dickason-Koekemoer, 2019). Through having robust operational risk management frameworks in place, banks can identify potential vulnerabilities and take preventive measures to mitigate the risk. This helps in minimizing operational losses and ensures smooth operations, leading to improved financial performance according to Hunjra et al., (2022). Risk management practices significantly impact the financial performance of banks. By effectively managing various risks, banks can ensure stability, profitability, and sustainable growth. This requires banks to adopt a risk management framework that is comprehensive that encompasses market risk management, credit risk management, liquidity risk management and operational risk management. Through these practices, banks can make well-informed decisions, allocate capital efficiently, and protect themselves from potential losses, resulting in improved financial performance.

H3: There's a positive association between Risk Management Practices and Financial Performance

Mediating Role Of Risk Management Practices On The Association Between Technology Innovations And Financial Performance

Effective practices of risk management are crucial for the smooth functioning of commercial banks (Harb et al., 2023). These practices involve assessing, identifying, and mitigating various types of risks, including

market, credit, operational, and reputational risks. With the advancement of technology, cyber risk has emerged as a significant concern for banks. According to Perera et al., (2022) reports that Cyber-attacks can lead to financial losses, data breaches, and reputational damage. Therefore, banks must employ robust risk management practices to safeguard against technological risks. Technology innovations have the potential to revolutionize the banking industry. From online banking to artificial intelligence, these innovations offer opportunities for banks to improve customer experience, improve operational efficiency, and create new revenue streams according to Manser Payne et al., (2021). The performance of banks is determined by several factors, including profitability, customer satisfaction, and market share. Technology innovations can positively impact these performance indicators by streamlining processes, reducing costs, and providing personalized services (Wirtz et al., 2023). Practices of Risk management act as a mediator in the association between technology innovations and financial performance in commercial banks (Sleimi, 2020). Cheng & Qu, (2020) reports that by effectively managing risks associated with technology, banks can maximize the benefits of innovation while minimizing potential drawbacks. When banks integrate new technologies, they must assess the risks involved and develop policies to lessen them. This proactive approach enables banks to protect their systems, data, and customers from potential threats. Technology innovations offer immense opportunities for commercial banks to improve performance and meet the evolving demands of customers. However, they also pose certain risks that need to be managed effectively. Practices of Risk management play a vital mediating role in ensuring that the integration of technology translates into improved performance for banks. Through implementing robust strategies for risk management, banks can navigate the complexities of technology innovations, improve security, and gain a competitive edge in the market. It is imperative for banks to strike the right balance between embracing innovation and mitigating associated risks to thrive in today's digital banking landscape.

H4: risk management practices mediate the association between technology innovations and financial performance.

Methodology

Research Design

A cross-sectional survey design was employed, utilizing a quantitative methodology. This was mostly utilized because it facilitates the data collection needed to draw conclusions about the population of interest at a given moment in time. Furthermore, the cross-sectional design had to be used because of the study's time frame. A statistical representation of the association between the variables of technological innovations, risk management practices, and commercial banks' financial performance is improved by the use of a quantitative research approach.

Sampling

The term "study population" refers to the grouping of all items that the researcher finds interesting and needs to conduct an investigation. The portion of the study population that participates in the investigation is called a sample. Thus, in accordance with the Krejcie and Morgan table (Krejcie & Morgan, 1970), the sample size of 24 commercial banks and 199 employees was taken into consideration from these banks. Convenience sampling was the method the researcher employed to select responders. In order to gather information from a conveniently accessible pool of respondents, convenience sampling was used. Commercial banks were the unit of analysis, and bank employees aside from support staff were the unit of inquiry. The first target population was at institutional level where the study targeted 24 licensed commercial banks in Uganda. The banks that were considered in this study are those that were properly and officially registered with bank of Uganda where they receive their trading licenses. The second level of target population was senior management employees. The main reason for choosing senior management employees was because they are responsible for performance, risk management and technological advancements of their respective banks and have higher level of

appreciation on how innovations influence financial performance. They are also responsible for managing performance of their units through the departmental budgets and action plans. This was due to the fact that these respondents were expected to be staff members involved in the actual bank operations and to possess sufficient experience and significant knowledge regarding the study's concepts.

Data Collection Tools

Data collection techniques and tools, according to Creswell Birmingham & Wilkinson, (2003), assist researchers in taking large amounts of data, condensing it into meaningful classes, forms, and subjects, and then interpreting the information. A self-administered questionnaire was employed by the researcher to gather information regarding the study's concepts. In order to collect data from research participants, questionnaires are composed of a series of questions and prompts (Moser & Korstjens, 2018). A self-administered questionnaire approach, according to Saunders & Kulchitsky (2021), is inexpensive, allows for anonymity, may produce more truthful responses, and can clarify issues during the data collection process.

The study was approved by the Faculty of Management ethics committee of Makerere University Business School. Consent to participate was also obtained from participants verbally and was written on our survey questionnaires. Our research assistants were able to read this consent letter that our respondents agreed to verbally to ensure clarity and understanding. This approach ensured that all respondents in the study were fully aware of the research objectives and data usage. Consent was gotten verbally since we didn't have enough time to give each respondent a consent form to sign at their own pace and given that we had research assistants moving to collect data, it would be easier for the assistants to read the consent form for the respondents as they consent to participate.

Data Processing and Analysis

Questionnaires were used to gather data from the field, which was then edited, sorted, and coded to create a sense of the data. The field data was analyzed using SPSS PROCESS macro, which produced both inferential statistics and descriptive about the data. Correlation and inferential statistics were used to ascertain the associations between the research variables. Regression analysis and other statistical techniques were employed to investigate the influence of independent variables on the dependent variable. Further, the mediation analysis of risk management practices on the association between technological innovation and financial performance was examined using the Baron and Kenny approach.

Validity and Reliability

According to Cook and Beckman (2006), validity refers to the information's accuracy and significance in light of the research findings. According to him, validity refers to the degree of accuracy of findings derived from data analysis that accurately reflect the real-world scenario being studied. Validity is defined by Adcock & Collier (2001) as the ability of data collection tools to measure the things they are intended to measure. In order to ensure validity, the researcher had practitioners, experts, and supervisors examine the data collection tool. Reliability, according to Zohrabi (2013), is a gauge of how well a research tool produces or provides consistent data or results following multiple trials. For an instrument to be used, the Cronbach's Alpha coefficient needs to be 0.7 or higher (Taber, 2018). Reliability and Validity results are shown below in Table 1.

Table 1: Reliability and Validity findings

Variable	Validity	Reliability
Technology Innovation	0.845	0.764
Risk Management Practices	0.756	0.841
Financial Performance	0.897	0.718

Source: Primary Data

Measurement of Variables

A five-point Likert-like scale, ranging from 1–5 strongly disagree to 5–5 strongly agree, was used to measure each variable in the survey. This aided the respondents in evaluating their answers in relation to the provided items on the different measures. Among the measures were the following: The technologies developed by Haabazoka (2019) for telephone banking, automated teller machines, internet banking, and mobile banking were used to measure technological innovation. Risk identification, risk measurement, and risk monitoring all developed by Paape & Speklé (2012) were used to gauge risk management practices. According to Ayoush et al. (2021) methodology, financial performance was evaluated in terms of profitability, liquidity, and solvency.

Results

Demographic characteristics of the Respondents

The researcher established the demographic characteristics of respondents such as respondents' gender; age; marital status; level of education and experience. These were presented in the table 2 below;

Table 2: Demographic Characteristics of Respondents

Variable/Item	Frequency	Percentage
Gender: Male	102	51.7
Female	97	48.3
Age: 20-25 Years	87	44.3
25-30 Years	72	35.8
30-35 Years	25	12.4
35-40 Years	8	4.0
40 Years Above	7	3.5
Marital Status: Single	106	53.7
Married Divorced	77	38.3
	16	8.0
Education: Diploma	17	8.5
Degree PostgraduateMasters	145	73.1
	17	8.5
	20	10.0
Experience: 1-2 Years	59	29.4
2-4 Years	65	33.3
4-6 Years	46	22.9
Above 6 Years	29	14.5
Total	199	100

Source: Primary Data

The data in table 2 indicates that men made up the majority of responders, suggesting that men continue to dominate Uganda's banking industry and have greater access to technology and risk management skills than women. Most of the respondents, as seen in the table, are between the ages of 20 and 35, indicating that a youthful and invigorating workforce may be able to take advantage of more innovations and risk-taking skills in light of current banking issues. According to the respondents' marital status, the majority of bank employees are single individuals with few or no stressors that could cause them to focus their creative energies on other tasks, this means they can give reliable information on our study variables without distortion of information.

The table indicates that at least 145 employees out of the 201 respondents had earned a bachelor's degree, suggesting that the workforce is capable of embracing new technological advancements and can be taught risk management techniques. Finally, a minimum of 65 employees had two years of experience working for the same bank.

Correlation Analysis

Table 3 below shows the relationship between the study variables (independent and dependent variables) was determined by the researcher using a Pearson's correlation coefficient analysis. This analysis was conducted to determine whether the association existed between the independent and dependent variables.

Table 3. Correlation Analysis

	1	2	3	TI	4	5	6	RMP	7	8	9	FP
Automated Teller Machine (1)	1											
Internet Banking (2)	.728**	1										
Mobile Banking Technologies (3)	.549**	.561**	1									
Technology Innovation (TI)	.864**	.854**	.858**	1								
Risk Identification (4)	.497**	.500**	.341**	.506**	1							
Risk Analysis (5)	.530**	.529**	.418**	.563**	.407**	1						
Risk Management (6)	.595**	.600**	.490**	.644**	.494**	.605**	1					
Risk Management Practices (RMP)	.656**	.659**	.501**	.692**	.795**	.831**	.821**	1				
Profitability (7)	.312**	.293**	.233**	.320**	.270**	.251**	.207**	.302**	1			
Liquidity (8)	.246**	.222**	.241**	.277**	.222**	.289**	.248**	.311**	.767**	1		
Solvency (9)	.299**	.275**	.218**	.302**	.205**	.284**	.214**	.290**	.800**	.834**	1	
Financial Performance (FP)	.305**	.281**	.248**	.320**	.247**	.296**	.240**	.323**	.910**	.936**	.947**	1

** Correlation is significant at the 0.01 level (2-tailed).

Source: primary data

Technology Innovation and Financial performance

Technology innovation and financial performance have a significant positive association, as indicated by the correlation results in the above table ($r=.320^{**}$, $P<.01$). This implies that the bank's financial performance will rise with an increase in technological innovation and vice versa. This suggests that there is a positive correlation between a notable rise in automated teller machines, internet banking, and mobile banking technologies and a notable improvement in financial performance (bank profitability, liquidity, and solvency).

Technological Innovation and Risk Management

Technology innovation and risk management have a strong positive relationship, according to the correlation results in the above table ($r=.692^{**}$, $P<.01$). This implies that the bank's risk management will improve with a rise in technological innovation and vice versa. This means that there is a positive significant

correlation between the increase in risk analysis, risk identification, and risk monitoring and a significant decrease in automated teller machines, internet banking, and mobile banking technologies.

Risk Management and Financial Performance

Risk management practices and financial performance have a significant positive relationship ($r=.323^{**}$, $P<.01$), according to the correlation results in the above table. This implies that a positive improvement in risk management procedures will likewise improve the bank's financial performance and vice versa. This suggests that a notable increase in bank profitability, liquidity, and solvency is positively correlated with a notable increase in risk identification, analysis, and monitoring.

Regression Analysis

To determine the predictability of technological innovation and risk management practices over the financial performance of banks, the researcher performed a regression analysis (see table 4).

Table 4. Showing Regression Analysis of technological innovation, risk management practices and financial performance

Coefficients						
Model		Unstandardized Coefficients		Standardized	t	Sig.
		B	Std. Error	Coefficients Beta		
1	(Constant)	1.716	.323		5.305	.000
	Technology Innovation	.224	.111	.186	2.008	.046
	Risk Management Practices	.208	.099	.194	2.097	.037
R			.350			
R Squared			.122			
Adjusted R Square			.133			
F			13.653			
Sig.			0.000			

Dependent Variable: Financial Performance

Source: Authors Computation

The above table's results show that risk management procedures significantly predict the bank's financial performance. This suggests that increased risk identification, analysis, and monitoring have a positive influence on bank performance. According to the table, 11.3% of the bank's financial performance is predicted by the two predictor variables (technology innovation and risk management practices) (Adjusted R Square = .113). With a beta value of .194, risk management practices, on the other hand, are a stronger predictor; an increase of one unit in risk management practices is associated with a .194 increase in bank financial performance.

Mediation Effect Of Risk Management On The Relationship Between Technology Innovation And Financial Performance

The findings in Table 5 and Figure 1 demonstrate that the conditions set forth by Baron and Kenny to determine mediation effects have been satisfied. First, a sizable percentage of the variance in financial performance of banks can be attributed to technological innovation ($\beta = 0.320$, $p < 0.01$). Second, a sizable percentage of the variance in risk management techniques can be attributed to technological innovation ($\beta = 0.644$, $p < 0.01$). Third, a considerable amount of the variance in financial performance of banks can be attributed to risk management practices ($\beta = 0.240$, $p < 0.01$). Finally, from $\beta = 0.320$ to $\beta = 0.186$, the absolute impact of technological innovation on financial performance decreased. Since all requirements have been

satisfied, risk management techniques can now be considered a genuine mediator in the association between financial performance and technological innovation. To determine the importance of the mediation effect, an additional measure was implemented. To do this, a MedGraph was used to generate a Sobel z-value. A noteworthy Sobel z-value of 2.0757 ($p < 0.05$) is indicated by the findings in Figure 1 (MedGraph). Figure 1 also demonstrates that the standardized beta (β) for the association between technological innovation and financial performance decreases from $\beta = 0.320$ to $\beta = 0.186$ when risk management practices are implemented. This demonstrates that the association between technological innovation and financial performance is partially mediated by risk management strategies with a 39% ratio index. This suggests that risk management techniques account for 39% of the impact of technological innovation on financial performance, with direct effects accounting for 61%.

Table 5. Mediation test results

Predictor	Model 1: Risk management practices			Model 2: Financial performance		
	B	SE	Beta	B	SE	Beta
Constant	0.898	0.224		1.716	0.323	
Technology Innovation	0.778	0.052	0.644**	0.224	0.111	0.186**
Risk management practices				0.208	0.099	0.194**

Source: Authors Computation

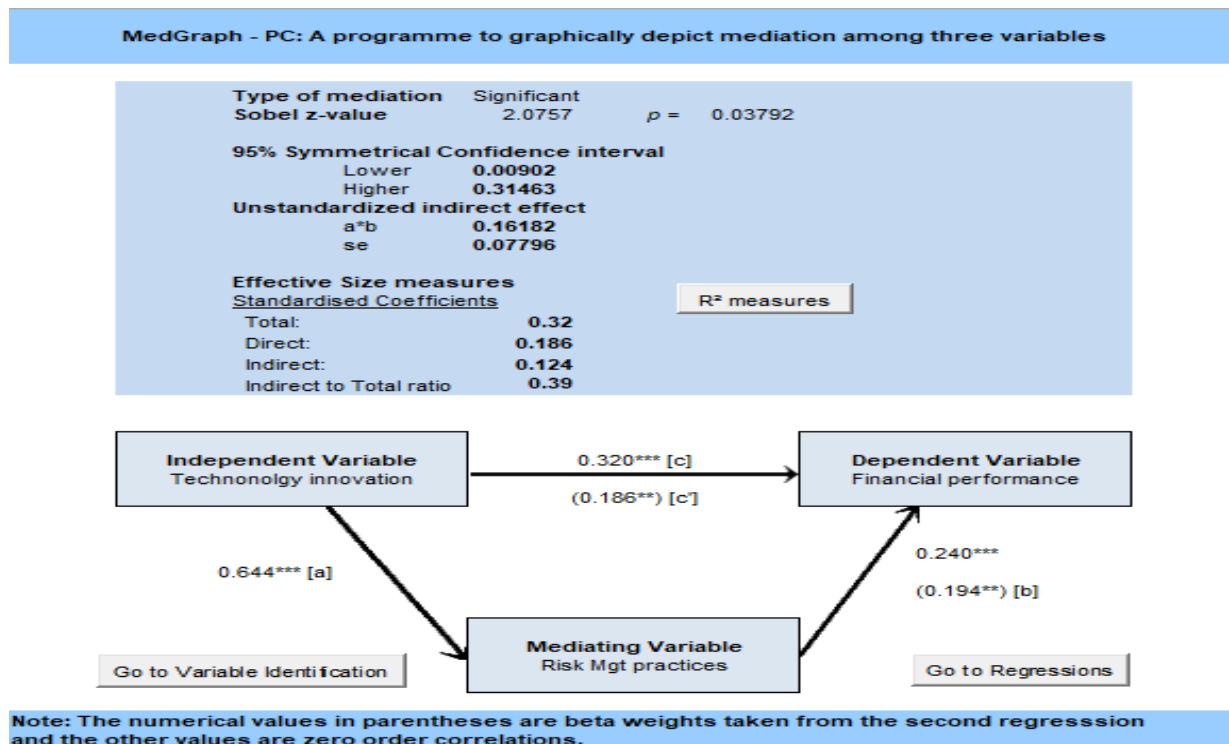


Figure 1: MedGraph-PC: Mediation effect of risk management on the association between technology innovation and financial performance

Source: Authors Computation

Discussion

Technology Innovations and Financial Performance

There is a strong association between financial performance and technological innovation. This hypothesis stated that the bank's financial performance would rise in tandem with an increase in technological innovation and vice versa. This suggests that there is a positive correlation between a notable rise in automated teller machines, internet banking, and mobile banking technologies and a notable improvement in financial performance, which includes bank profitability, liquidity, and solvency. These findings are in line with many previous studies of Chatterjee et al. (2020), who contend that organizational traits and procedures complement technological innovation and that investing in technology innovation reduces the likelihood of success when done alone. Research has demonstrated that when business process reengineering (BPR) initiatives are paired with investments in technology innovation, revenue levels increase (Al-Shammari, 2023). In a similar vein, Fareed et al. (2023) claim that financial technological advancements in a variety of payment methods and systems, including the use of mobile banking, automated teller machines, and electronic banking, have strengthened the banking sector in developing economies like Uganda. As more banks open up, competition in the banking industry may grow as a result of technological advancements. Numerous research studies have demonstrated a positive correlation between financial innovation products and increased bank profitability and efficiency (Lee et al., 2021). According to Chang et al. (2020), technological advancements have a direct impact on managers' decision-making, planning, and selection of goods and services for the banking sector. It has persisted in altering the global structure of banks and their business relationships, as well as the range of cutting-edge tools available to improve the efficiency and caliber of services provided by commercial banks.

Risk Management Practices and Financial Performance

The findings showed a strong positive association between financial performance and risk management techniques. This implied that as risk management procedures are strengthened, the bank's financial performance will follow suit and vice versa. This suggests that a notable increase in bank profitability, liquidity, and solvency is positively correlated with a notable increase in risk identification, analysis, and monitoring. Our research findings are consistent with those of Wuave et al. (2020), who contend that commercial banks cannot be profitable without an effective risk management framework. Furthermore, Purnanandam's (2008) corporate risk management theory is in line with these findings. He praised the need for an appropriate framework of risk management in order to guarantee the survival of a financial institution. According to Theiri & Alareeni (2023), banks that implement sound risk management procedures have a competitive edge in the market and have weathered the financial crisis. Wallis et al. (2020), who hypothesized that managing a risk beforehand is far better than waiting for it to occur, further supported the findings. Thus, it is imperative that financial institutions engage in proactive risk identification, assessment, mitigation, communication, and monitoring of associated risks. There is conflicting evidence from the aforementioned to support the idea that risk management techniques affect financial performance. Consequently, it is probable that the conclusions presented here will prompt additional empirical research on the subject.

Technology Innovations and Risk Management Practices

The results of this study showed a strong correlation between risk management and technological innovation. According to the findings, the bank's risk management will get better when technological innovation increases and vice versa. This suggests that there is a positive correlation between a significant increase in risk

analysis, risk identification, and risk monitoring and a significant decrease in automated teller machines, internet banking, and mobile banking technologies. The researcher asserts that technological innovations are essential for banks to thrive in a fast-paced business environment. Innovation should be ingrained in a bank's DNA. This study's link between technological innovation and financial performance emphasizes even more how crucial it is to combine technological innovation with risk management, realizing that if strategic goals are set without taking business risks into consideration, they may be impeded. Leading businesses incorporate risk management into the process of technological innovation rather than handling it in a vacuum. These results are consistent with the empirical research conducted by Huy et al. (2021), which suggested that technological innovation lengthens risk management processes by facilitating the systematic tracking of issues. It's important to remember that technological innovation can simplify risk-management compliance, which demonstrates its potential influence on risk management. To control banks' appetite for risk, the majority of risk regulators in commercials used paper-based or partially electronic report submissions in the past. In summary, this research offers contextual evidence that supports technological advancements aimed at improving risk management. As such, it offers a rationale for incorporating technological advancements into risk management procedures in commercial banks, which has significant policy and managerial ramifications.

Mediation Effect of Risk Management Practices on the Association between Technology Innovations and Financial Performance

This study established that the relationship between technology innovations and commercial banks' financial performance is mediated by risk management practices. This indicates that the association between technological advancements and financial performance in commercial banks is facilitated by risk management practices. Within the same framework, the research indicates that the bank's financial performance will rise when risk management techniques risk analysis, risk identification, and risk monitoring that accompanies technological innovation is used. This is consistent with earlier research by Chege et al. (2020), which claims that technological innovation affects risk management in an effort to enhance commercial performance. By regulating the threads, the study highlights the significance of managing risk in the organization's strategic management even more. The three main components of information technology's impact on risk management were performance, time, and cost. It was determined that information technology has a beneficial effect on risk management, particularly when it comes to process time optimization as opposed to cost and performance.

Conclusion

It has been made clear here that technological innovation has an impact on commercial banks' risk management procedures. This demonstrates to us that technological advancements are having a significant impact on the internal workings and financial services provided by commercial banks, which in turn affects the banks' financial performance. Our study also reveals how those technological advancements affect risk management. The results of the study demonstrate how important it is for commercial banks to incorporate technological innovations into their risk management procedures since doing so enables them to better address unknowns and position themselves to mitigate them. Financial performance and risk management procedures were found to be related. This implied that the bank's financial performance would decline in tandem with a reduction in risk management procedures. This suggests that a notable increase in bank profitability, liquidity, and solvency is inversely correlated with a notable decrease in risk analysis, identification, and monitoring. This study demonstrated how risk management mediates the relationship between financial performance and technological innovations. This suggests that the bank's financial performance will improve when risk management techniques risk analysis, risk identification, and risk monitoring that is brought about by technological innovation are used.

Practical Implications

Technological innovation and commercial banks' financial performance have a positive association. The management of the bank is advised to perform routine system checks in order to prevent ATM malfunctions, which helps to clear the banking halls of traffic. To make sure that the credit card services are accepted in large stores and that business are adopting new technological advancements, it is advised that management carry out a market study. It is also advised that the bank management make sure that encrypted passwords are used for internet banking in order to prevent sensitive client data from being hacked. The results showed that risk management in commercial banks is impacted by technological innovation. Putting strategies into practice to raise the institutions' ROA-based financial performance is another action. These tactics include increasing margins through non-interest-related activities and making money off of assets. Instead of buying technology just because other banks have it, banks should be goal-oriented and focused on their own needs, utilizing the appropriate technology to accomplish those goals. To minimize or eliminate avoidable expenses associated with implementing e-commerce and online banking, government involvement in maintaining a focused telecommunications industry must be evident. In order to prevent Uganda's banking sector from becoming a landfill for antiquated technology infrastructure, regulatory bodies such as the country's banks must set guidelines that the banks must adhere to. Doing so will spur further technological advancements. Another significant issue impeding the nation's progress in technological innovation is the lack of training and manpower development. In order for our people to obtain the necessary skills directly from the source, the government must establish appropriate IT policies that ensure a significant portion of computers, communication equipment, and other IT infrastructures are manufactured in the nation. Governmental guidelines that will prevent Fraud, money laundering, and Innovation in technology will inevitably bring security risks. The establishment of the legal codes supporting the industry is imperative to counter the legal threat and security posed to e-commerce and net banking. Doing so will facilitate the industry's growth.

Implementing AI and machine learning algorithms can enhance the detection and mitigation of financial risks. These technologies can analyze large volumes of data to identify potential threats and ensure proactive risk management. For instance, automated fraud detection systems can monitor transactions in real-time, flagging suspicious activities and reducing the risk of financial losses. As digital banking relies heavily on technology, it is crucial to have robust cybersecurity frameworks in place. Banks should use encryption, multi-factor authentication, and regular security audits to safeguard against cyber threats. Implementing biometric authentication methods (like fingerprint or facial recognition) can significantly enhance the security of digital banking platforms. The perceived ease of use is a critical factor in the adoption of digital banking services. Banks should focus on creating interfaces that are easy to navigate and understand, reducing the learning curve for customers. Offering a seamless user experience with features like easy fund transfers, bill payments, and account management through a mobile app can improve customer satisfaction and adoption rates. Regular training sessions can ensure that bank staff are proficient in using new digital tools and technologies. This will not only improve operational efficiency but also ensure better customer service. Conducting workshops on the latest digital banking trends and technologies can keep employees up-to-date and capable of assisting customers effectively. Establishing a feedback loop with customers can help identify areas of improvement in digital banking services. Banks should use this feedback to make necessary adjustments and enhancements. Regularly surveying customers about their digital banking experience and implementing suggested improvements can lead to higher customer satisfaction and loyalty. By analyzing customer data, banks can offer tailored financial products and services that meet individual customer needs. This can improve customer engagement and retention. Using customer transaction data to offer personalized investment advice or customized loan offers can enhance the overall customer experience. Banks should run campaigns to promote digital literacy, helping customers understand and effectively use digital banking services. This can include online tutorials, help centers, and customer support. Providing easy-to-follow video tutorials on how to use the bank's mobile app and online services can demystify digital banking for less tech-savvy customers. With the increasing reliance on smartphones, having a comprehensive mobile banking app is essential. Features such as mobile check deposit,

fund transfer, and account monitoring should be standard. Incorporating features like instant loan applications, budgeting tools, and spending analysis into the mobile app can make banking more convenient for customers.

Theoretical Implications

The study provides empirical evidence of how risk management practices mediate the relationship between technological innovation and financial performance in commercial banks. This enriches corporate risk management theory by demonstrating the intricate mechanisms through which risk management influences organizational outcomes. By exploring the role of technological innovation in the financial performance of commercial banks, the study contributes to the advancement of risk management theory. It sheds light on how technological advancements impact risk management practices and subsequently influence financial performance in the banking sector. Incorporating mediation analysis into the examination of risk management practices and financial performance represents a novel contribution to risk management research. This approach allows for a deeper understanding of the underlying processes and mechanisms through which risk management affects financial outcomes, providing valuable insights for both theory and practice. The study expands our understanding of the complex dynamics within the financial sector, particularly in the context of commercial banks. By investigating the interplay between technological innovation, risk management practices, and financial performance, it contributes to a more comprehensive understanding of how banks navigate challenges and capitalize on opportunities in today's digital era. The findings of the study offer theoretical insights that can inform strategic decision-making within commercial banks. By highlighting the mediating role of risk management practices, the study underscores the importance of integrating risk management considerations into the strategic planning process, particularly in the context of technological innovation initiatives. Overall, the study's theoretical contributions enhance our understanding of the relationship between technological innovation, risk management practices, and financial performance in commercial banks, offering valuable insights for both academia and industry practitioners.

Limitation and Future Direction

Only commercial banks in Kampala, Uganda's Central Region were used for this study. Even so, the respondents were chosen for this study based on particular branches. Therefore, the results of this study cannot be used to guide the way in which the variables were examined from the standpoint of banks or other financial institutions in rural Uganda. By choosing not to reply to the questionnaires that were sent to them, a few of the study's targeted participants chose not to provide any information. There is a chance that the non-respondents omitted some important information, which would have introduced response bias into the current study. Because this study used a cross-sectional research design, the interpretation was based on data that was only collected once. As a result, it is impossible to guarantee that the study's findings will remain relevant over an extended period of time because the study did not record changes in the variables over time. Another drawback was that, given that the study was intended for people who are preoccupied at work, some respondents provided biased answers. In order to overcome this restriction, the researcher created anonymous, impartially worded questions with only four options on the Likert scale for respondents to select from. This made sure that the respondents would make a decision and removed any neutral comments about their lack of clarity.

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