The Mediating Effect of Financial Literacy on Blockchain Technology Application and Financial Risk: Insight from Ghanaian Professionals towards Policy Recommendations

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ABSTRACT

This study explores the mediating effect of financial literacy on the relationship between blockchain technology application and financial risk among financial institution professionals in Ghana. Utilizing a correlational research design, data were collected from a sample of 336 professionals through a self-constructed Likert-scale questionnaire. The analysis was conducted using path analysis and mediation techniques. The findings reveal that financial literacy significantly mediates the relationship between blockchain technology application and financial risk. Specifically, the indirect effect of blockchain technology application on financial risk through financial literacy was significant, accounting for 26.0% of the total effect. The direct effect of blockchain technology application on financial risk also remained significant, highlighting the independent contribution of blockchain technology application in reducing financial risk. These results underscore the importance of financial literacy in enhancing the effectiveness of blockchain technology application in mitigating financial risks. The study emphasizes the need for comprehensive financial literacy programs to maximize the benefits of technological advancements in the financial sector. Empirical evidence from related literature supports the findings, indicating that higher financial literacy enables better utilization of blockchain technology application, thereby reducing financial risk. The research provides valuable insights for policymakers and educational institutions aiming to improve financial literacy and leverage blockchain technology application for financial risk management.

Keywords: Blockchain Technology Application, Financial Literacy, Financial Risk, Mediation Analysis, Financial Institutions
JEL Classifications: G21, G32, G41, O33, I22, M15

1. INTRODUCTION

Financial risk remains a critical concern in Ghana, impacting individuals, businesses, and overall economic stability. This risk, characterized by uncertainties and potential losses in financial transactions, necessitates robust solutions to enhance financial security and resilience (Cantah et al., 2023; Agyemang et al., 2020). In this context, blockchain technology application and financial literacy are proposed as emerging promising tools to mitigate financial risk.

Blockchain technology application, known for its decentralized and transparent nature, offers significant potential to reduce financial

risk by enhancing the security and traceability of transactions (Radziwill, 2018; Cui, 2021). By eliminating intermediaries and providing immutable records, blockchain can reduce fraud, lower transaction costs, and increase trust in financial systems. Recent studies suggest that blockchain implementation can streamline processes in various sectors, including banking, supply chain, and public services, thereby mitigating financial risks associated with inefficiencies and corruption (Mhlanga, 2023).

Blockchain technology applications have emerged as a transformative force in the financial industry, offering innovative solutions to mitigate financial risk. Countries around the globe

are increasingly adopting blockchain to enhance transparency, security, and efficiency in financial transactions. For instance, Estonia has integrated blockchain into its e-residency program and financial services, ensuring secure identity management and reducing fraud (Sullivan and Burger 2017). Similarly, Switzerland, known for its progressive regulatory environment, has positioned itself as a hub for blockchain innovation. The Swiss financial sector leverages blockchain to streamline processes and enhance trust through initiatives like the Crypto Valley in Zug (Hileman and Rauchs, 2017).

In Asia, Singapore has become a leader in blockchain adoption within its financial industry. The Monetary Authority of Singapore (MAS) has implemented Project Ubin, which explores the use of blockchain for clearing and settlement of payments and securities, aiming to reduce risks and improve efficiency (Monetary Authority of Singapore, 2020). The United States also recognizes the potential of blockchain to reduce financial risk. Major financial institutions, including JPMorgan Chase, have developed blockchain platforms like Quorum to enhance transaction transparency and security (Zhang et al., 2019). Moreover, the Australian Securities Exchange (ASX) has replaced its CHESS system with a blockchain-based platform to improve settlement processes and reduce operational risk (Australian Securities Exchange, 2020). These examples demonstrate how blockchain technology applications are being utilized across various financial industries to address financial risks, ensuring more secure, transparent, and efficient financial ecosystems globally. The widespread adoption and innovation in blockchain underscore its critical role in shaping the future of financial risk management.

As polluted by Lusardi and Mitchell, (2014) despite the potential benefits of blockchain technology applications consisting of transparency, decentralization, and secure features, its effectiveness in reducing financial risk elements of market risk, credit risk, liquidity risk, operational risk in Ghana may be contingent upon the population's financial literacy levels. Financial literacy, which is the ability to understand and effectively use various financial skills, is crucial for individuals to make informed decisions and leverage modern technologies (Grohmann et al., 2018). Higher financial literacy levels enable individuals to better comprehend the functionalities of blockchain technology applications, thus maximizing its risk-reducing benefits (Klapper and Lusardi, 2019; Stolper and Walter, 2017).

However, financial literacy in Ghana remains relatively low, posing a challenge to the widespread adoption and effective use of blockchain technology application (Mavilia and Pisani, 2019). This gap underscores the need for targeted educational initiatives to improve financial literacy, thereby empowering more Ghanaians to utilize blockchain technology application effectively to manage financial risks.

This study aims to explore the mediating effect of financial literacy on the relationship between blockchain technology application and financial risk in Ghana. By examining how financial literacy influences the utilization of blockchain technology application in mitigating financial risk, this research seeks to provide insights that can inform policy, and educational interventions aimed at enhancing financial security in developing economies like Ghana.

The study seeks to address the following research question and null hypothesis:
1. Does financial Literacy significantly mediate the relationship between blockchain technology application and financial risk?
2. H_0: Financial literacy does not significantly mediate the relationship between blockchain technology application and financial risk.

This hypothesis explores whether financial literacy plays a crucial role in influencing how the application of blockchain technology impacts financial risk. If financial literacy significantly mediates this relationship, it suggests that the effectiveness of blockchain technology in managing or mitigating financial risk depends on the level of financial literacy individuals possess. In this hypothesis, the relationship between blockchain technology and financial risk is not considered direct. Instead, it is hypothesized that blockchain technology's impact on financial risk is contingent upon financial literacy.

2. REVIEW OF RELATED LITERATURE

2.1. Financial Risk
Returns on investment are often associated with increased financial risk. Savings and investment programs vary in their risk and reward characteristics. The distinctions include the convenience with which investors can access their money when needed, the rate of growth, and the degree of safety with which their money grows. (Kothai Andal and Padma, 2019). A critical underlying principle is that a trade-off between risk and return is established in finance, as bigger predicted earnings are typically only achieved by taking more significant risks.

In financial literature, numerous studies have been conducted to determine or measure risk. These studies investigate whether the financial risks of companies can be determined using predetermined financial variables or ratios (such as the Altman Z score or Springate S score) or whether the financial ratios are below the critical values for bankrupt companies (Kiraci, 2019).

Financial risk, encompassing uncertainties and potential financial losses, is a fundamental concern for individuals, businesses, and economies. The concept of financial risk is multifaceted, involving several types, including market risk, credit risk, liquidity risk, and operational risk (Jorion, 2007). Understanding and managing financial risk is crucial for maintaining financial stability and achieving long-term economic goals.

Financial risk can be broadly categorized into several types. Market risk refers to the potential losses due to changes in market prices, such as interest rates, stock prices, and exchange rates (Hull, 2018). Credit risk involves the risk of loss arising from a borrower's failure to repay a loan or meet contractual obligations (Duffie and Singleton, 2012). Liquidity risk is associated with the inability to quickly convert assets into cash without significant loss in value (Brunnermeier and Pedersen, 2009). Operational risk

encompasses losses resulting from inadequate or failed internal processes, people, and systems, or external events (Roncalli, 2020). Several factors influence financial risk, including macroeconomic conditions, industry characteristics, and firm-specific factors. Macroeconomic variables such as inflation, interest rates, and economic growth significantly impact financial risk (Saunders and Cornett, 2011). Industry characteristics, including competition intensity and regulatory environment, also play a crucial role in determining financial risk levels (Acharya, et al., 2009). Firm-specific factors, such as financial leverage, management quality, and operational efficiency, directly affect a company's risk profile (Altman, 1968).

Effective financial risk management involves identifying, assessing, and mitigating financial risks through various strategies. One common approach is diversification, which involves spreading investments across different assets to reduce exposure to any single risk (Markowitz, 1952). Hedging is another widely used strategy, involving the use of financial instruments such as derivatives to offset potential losses (Hull, 2018). Implementing robust internal controls and risk management frameworks is essential for managing operational risks (Basel Committee on Banking Supervision, 2006).

Risk assessment models, such as Value at Risk (VaR) and Credit Value at Risk (CVaR), are critical tools for quantifying and managing financial risks (Scheller and Auer, 2018). VaR measures the maximum potential loss over a specified period at a given confidence level, while CVaR provides an estimate of potential losses beyond the VaR threshold (Duffie and Singleton, 2012). The management of financial risk in developing economies presents unique challenges due to factors such as economic volatility, weaker regulatory frameworks, and lower levels of financial literacy. In these contexts, enhancing financial literacy and leveraging financial technologies can play a significant role in mitigating financial risks (Lusardi and Mitchell, 2014). Financial literacy enables individuals to make informed financial decisions and better understand risk management tools (Hastings et al., 2013).

Financial risk encompasses various frameworks that explain the uncertainties and potential losses associated with financial decision-making. It is grounded in several key concepts, including market risk, credit risk, liquidity risk, and operational risk, which collectively contribute to a comprehensive understanding of financial risk management (Jorion, 2006; Jorion, 2007).

Market risk, or systematic risk, refers to the potential for losses due to changes in market prices, such as stock prices, interest rates, and exchange rates. This type of risk is influenced by macroeconomic factors that affect the entire market (Hull, 2018). The Capital Asset Pricing Model (CAPM) is a fundamental theory in finance that helps in understanding market risk by describing the relationship between systematic risk and expected return on assets (Sharpe, 1964). Credit risk involves the possibility of a loss resulting from a borrower's failure to repay a loan or meet contractual obligations. The Merton Model, based on the Black-Scholes option pricing theory, provides a structural approach to credit risk by modeling a firm's equity as a call option on its assets (Merton, 1974). This model helps in assessing the likelihood of default and the potential loss given default (LGD).

Liquidity risk is the risk that an entity will not be able to meet its short-term financial obligations due to an inability to liquidate assets quickly without significant loss in value. The liquidity-adjusted Value at Risk (VaR) framework extends traditional VaR models by incorporating liquidity considerations, thus providing a more comprehensive risk assessment (Brunnermeier and Pedersen, 2008). Operational risk encompasses losses from inadequate or failed internal processes, people, and systems, or external events. The Basel II framework defines and categorizes operational risk, providing guidelines for its measurement and management (Gleeson, 2012).

2.2. Financial Literacy
Understanding fundamental financial concepts is crucial for individuals to make informed decisions regarding saving, investing, borrowing, and other financial matters. In an era where complex financial products are widely accessible, financial literacy becomes indispensable. The cost of financial ignorance is substantial, as consumers lacking fundamental financial knowledge tend to incur greater transaction fees, higher debt, and elevated loan interest rates (Lusardi and Tufano, 2015). Additionally, they are prone to borrowing more and saving less (Stango and Zinman, 2009).

Financial literacy offers several advantages, positively influencing retirement planning and savings (Behrman et al., 2012). Furthermore, financially knowledgeable investors are more likely to diversify their portfolios, thereby mitigating risks (Abreu and Mendes, 2020). However, in the media, financial literacy and financial knowledge are often used interchangeably. While financial knowledge is necessary for financial literacy, the latter involves the application of this knowledge in decision-making (Huston, 2012). Effective measurement of financial literacy should therefore assess not only the possession of financial knowledge but also the ability to apply it (Huston, 2012).

Financial education plays a pivotal role in enhancing financial literacy. Tools such as calculators and financial software can assist individuals with limited arithmetic skills, underscoring the importance of focusing on practical skills in personal finance (Huston, 2012). Financial literacy, a component of human capital, can significantly improve economic well-being. However, it is influenced by other factors, including behavioral biases, self-control issues, and familial influences (Huston, 2012).

Demographic factors also affect financial literacy levels. For instance, gender, education, income, and age are significant determinants. Globally, financial literacy rates are higher among men (35%) compared to women (30%), a disparity present in both developed and developing economies (Klapper and Lusardi 2019; Lusardi and Mitchell, 2014). In developed economies, financial literacy tends to increase with age but declines after the age of 50 (Klapper and Lusardi 2019).

Financial literacy encompasses both objective and subjective measures. Objective financial literacy refers to the actual understanding of financial concepts, whereas subjective financial literacy pertains to individuals' self-assessment of their financial knowledge (Robb et al., 2015). Objective financial literacy is negatively related to cryptocurrency use, while subjective financial literacy may have a positive or no significant relationship with cryptocurrency utilization (Zhao and Zhang, 2021; Aggarwal and Gupta, 2020; Arias-Oliva et al., 2019).

The integration of blockchain technology application necessitates the restructuring of business models, governance, and workflows (Li and Mardani, 2023; Sreckovic and Windsperger, 2019). Blockchain can also be utilized for financial education through gamification, as illustrated by the digital transformation of the Monopoly board game. This approach can convey essential financial concepts such as cash flow management, asset balancing, and price focus to players (Yau and Wong, 2021).

2.3. Blockchain Technology Application

The term "blockchain" was first introduced by Stuart Haber and W. Scott Stornetta in 1991 when they proposed a model incorporating certificates into an encrypted record, known as a block, to prevent tampering with digital documents and create a decentralized database (Moradi et al., 2019). This foundational concept has evolved significantly, with blockchain technology application gaining prominence in 2008 when Satoshi Nakamoto introduced Bitcoin, a revolutionary digital currency designed to enable direct, peer-to-peer payments without the need for intermediaries.

Bitcoin's primary goal was to establish a system for conducting internet transactions globally without a central authority, a breakthrough that was first actualized with the establishment of Mt. Gox in February 2011, the first BTC-to-fiat currency exchange platform (Wątorek et al., 2021). Blockchain technology application, the underlying infrastructure of Bitcoin, has since been recognized for its potential to enhance security and privacy across various domains, including the Internet of Things (IoT) ecosystem (Miraz and Ali, 2020).

Blockchain's decentralized and transparent nature offers significant benefits for financial risk management. It enables secure and immutable logging, tracing, signing, and sharing of certificates, which can mitigate risks associated with fraud and data manipulation (Jaatun et al., 2020). Despite these advantages, blockchain is not a panacea for all transactional issues; it is best viewed as a valuable tool within a broader IT toolbox (Jaatun et al., 2020).

Blockchains are data files containing records of past transactions and the creation of new blocks, forming a continuous chain where each block builds upon the previous one (Wątorek et al., 2021). This structure underpins Distributed Ledger Technology (DLT), which combines cryptographic techniques with consensus protocols like Proof of Work (PoW) or Proof of Stake (PoS) to maintain an immutable ledger (Lisi et al., 2021).

The "worldwide ledger" concept described by Tapscott and Tapscott (2016) encapsulates the broad applications of blockchain beyond financial transactions, including legal document storage, healthcare data management, and decentralized autonomous organizations. The decentralization provided by blockchain ensures service availability, reduces failure risk, and enhances trust through distributed consensus mechanisms (Hewa et al., 2021). In this context, consensus is typically achieved when more than 50% of network participants validate a transaction, ensuring accuracy and security (Hewa et al., 2021).

Smart contracts, an integral feature of blockchain technology application, automate and enforce agreements through self-executory and immutable code, thus addressing numerous inefficiencies in the financial industry (Hewa et al., 2021). These contracts codify business rules and execute predefined processes transparently, enhancing trust and operational efficiency (Ante, 2021). Different platforms like Ethereum have been developed to cater to specific industry needs, incorporating essential elements such as decentralized ledgers and consensus layers to ensure secure and efficient operations (Ante, 2021).

Mining, the process that sustains blockchain functionality, involves solving complex puzzles to validate transactions, for which miners are rewarded, typically in cryptocurrencies. This mechanism ensures transparency and provides proof of work, fostering confidence among participants in the blockchain network (Wątorek et al., 2021).

2.4. Blockchain Technology Application and Financial Literacy

Yau and Wong (2021) illustrated the transformative potential of integrating gamification with blockchain technology in enhancing financial literacy education. Their study, part of a broader 3-year cross-disciplinary initiative, aimed to elevate global financial literacy, particularly in developing regions. The research demonstrated that leveraging advanced technological approaches could create cost-effective and engaging educational tools, which significantly improve financial management skills and knowledge among the public. This underscores the critical role that modern technologies can play in revolutionizing financial literacy education, making it more accessible and interactive.

In a related study, Hasan et al. (2021) investigated the impact of financial literacy on financial inclusion in rural Bangladesh. By applying logistic regression, probit regression, and complementary log-log regression models, they analyzed the correlation between individuals' financial knowledge and their access to financial products and services. The findings highlighted that improved financial literacy markedly enhances access to financial services, with significant influences observed from variables such as occupation, income level, and understanding of basic banking operations. This research suggests that comprehensive financial education is essential in advancing financial inclusion, which is vital for poverty reduction and economic growth in developing regions.

Collectively, these studies highlight the crucial intersection of innovative technology and financial literacy in promoting financial inclusion. They emphasize the importance of tailored educational programs and technological integration in improving financial understanding and access, which are key drivers of economic development and individual financial empowerment. The direction forward involves further exploration of how blockchain technology and gamification can be utilized to create more effective financial education tools, thereby fostering greater financial literacy and inclusion globally.

2.5. Financial Risk and Blockchain Technology Application

Almashaqbeh et al. (2022) focused on understanding the role of blockchain technology application in mitigating financial risks associated with cryptocurrencies, particularly those arising from regulatory challenges and cyber-attacks. Their study highlights the effectiveness of algorithm-based learning and peer-to-peer frameworks in reducing these risks, thereby strengthening the relationship between blockchain technology application and financial risk management. This research contributes to the conceptualization of blockchain's potential in enhancing the security and reliability of digital transactions.

Faccia and Mosteanu (2019) explored how blockchain could revolutionize accounting practices by transitioning from a double-entry to a triple-entry system. This transition is expected to reduce errors and fraud, illustrating blockchain's capacity to enforce stricter compliance and accuracy in financial reporting. Their findings suggest that blockchain technology application can integrate advanced verification and automated systems (e.g., using smart contracts) to ensure continual adherence to accounting standards, thus significantly reducing financial fraud and risk.

Aketch et al. (2021) investigated the impact of blockchain technology application on financial market performance in Kenya, employing an explanatory research design with a stratified random sampling method across 42 commercial banks. Their research revealed significant positive correlations between blockchain adoption and numerous factors, including government policy, internet infrastructure, transaction costs, and risk analysis. These correlations suggest that blockchain technology application not only supports financial market infrastructures but also enhances their efficiency and security.

These studies collectively illustrate the transformative potential of blockchain technology application across different sectors of finance and risk management. They underscore the importance of integrating innovative technological solutions like blockchain to address and mitigate prevalent financial risks effectively. The lessons learned from these studies guide further exploration and adoption of blockchain to foster a more secure and efficient financial landscape.

2.6. Financial Literacy and Financial Risk

Amonhaemanon (2022) explored the relationship between financial literacy and financial risk behaviors, among informal laborers in Southern Thailand. The study found that higher perceived financial literacy often correlates with increased financial risk behavior. This suggests that while individuals may believe they are making informed financial decisions, their understanding may also embolden riskier behaviors, particularly in vulnerable populations where financial literacy may not fully address the complexities of risk management. This highlights the need for financial education programs to include components that address financial risk tolerance aspects of financial decision-making.

Conversely, Madinga et al. (2022) demonstrated that improved financial literacy, when paired with a proper understanding of financial risks, can lead to higher financial satisfaction. Their research indicates that individuals with better financial literacy tend to have a higher risk tolerance, which, when managed effectively, contributes to greater financial satisfaction. This underscores the importance of financial education that not only imparts knowledge but also equips individuals to navigate financial risks confidently and effectively.

Additionally, studies like those by Andarsari and Ningtyas (2019) and Urban et al. (2020) show that financial literacy can lead to better financial risk behavior management and outcomes, such as improved credit scores and better financial management among entrepreneurs and young adults. However, the research by Maman and Rosenhek (2019) and Berry et al. (2018) critique financial education programs for often oversimplifying financial risk, suggesting that these programs need to be more nuanced to account for the complexities of individual financial behaviors and the broader economic context. Financial literacy has the potential to both positively and negatively influence financial risk, depending on how well it is understood and applied by individuals. Therefore, financial education programs must be comprehensive, contextually relevant, and capable of addressing the psychological and behavioral aspects of financial decision-making to ensure that financial literacy leads to prudent risk management and overall financial well-being.

2.7. Theoretical Framework

This research aims to provide a robust theoretical framework that explains user acceptance and the impactful role of financial literacy in navigating the complexities of modern financial technologies. This approach deepens the academic exploration of technology adoption and offers practical insights for enhancing user engagement and reducing financial risks in the fintech sector (Venkatesh and Bala, 2008). The foundational theory underpinning this study is the Technology Acceptance Model (TAM), introduced by F. D. Davis in 1989. TAM posits that user acceptance of new technologies is primarily influenced by two factors: perceived usefulness and perceived ease of use. According to this model, individuals are more likely to adopt and utilize a technology if they believe it will enhance their job performance (perceived usefulness) and if they find it user-friendly (perceived ease of use) (Davis, 1986).

In the context of financial technologies like blockchain, TAM is particularly relevant. These technologies represent significant advancements in the financial sector but come with complexities that can be daunting for users. Financial literacy plays a crucial role

in this context by helping users form informed opinions and guide their perceptions of these technologies. A deeper understanding of financial literacy can significantly mitigate the risks associated with new financial technologies by enhancing the user's ability to effectively evaluate their usefulness and ease of use (Lusardi and Mitchell, 2014).

Further theories supporting the variables in this study include concepts from behavioral finance, such as risk tolerance and the psychology of financial decision-making, which help explain how individuals make financial choices in the context of new and potentially risky technologies like blockchain (Kahneman and Tversky, 1979). Behavioral finance also contributes to the understanding of financial risk by examining how psychological factors and cognitive biases influence financial decision-making. Prospect Theory, developed by Kahneman and Tversky (1979), highlights how individuals perceive gains and losses asymmetrically, often leading to risk-averse behavior in the face of potential gains and risk-seeking behavior when facing potential losses. These theories contribute to a comprehensive understanding of how individuals interact with new financial technologies, shaping their overall acceptance and integration into financial management practices (Thaler, 2015).

2.8. Research Paradigm

The research conceptual paradigm is as shown in Figure 1. It also depicts the mediation design of the study based on the variables.

3. METHODOLOGY

This study utilized a correlational research design and mediation analysis to explore how financial literacy mediates the relationship between blockchain technology application and financial risk. The focus was on active financial institution workers who schooled at the Chartered Institute of Bankers in Ghana. A random sampling technique was employed to select 336 respondents from a total population of 2500, as of April 2023, as illustrated in Table 1. The sample size was determined using the Taro Yamane sample size calculator. As Human-Subject research, the researchers employed ethical considerations as approved by Valley View University Institutional Review Board in the cross-sectional data collection. Respondent filled informed consent forms and researchers observed anonymity and confidentiality of the respondents' data.

The respondents completed a self-constructed, cross-sectional survey questionnaire using a 7-point Likert scale to assess their perceptions of blockchain technology applications and financial

literacy. The financial risk variables were measured using the average data from the Bank of Ghana over a 5-year period (2019-2023) for sectoral financial institutions as shown in Table 1. This includes key indicators such as Non-Performing Loans (NPLs), Capital Adequacy Ratios (CAR), Liquidity Ratios, and Credit Risk Exposure. The variables were measured as quantitative or continuous variables, treating the equal interval Likert-scale data accordingly. The large sample size (n = 336) permitted the violation of normality test assumptions, consistent with the Central Limit Theorem (Fischer, 2010; Pallant, 2020; Boone and Boone, 2012).

The Likert-scale survey research instrument was validated through a pilot study involving 60 respondents, who were subsequently excluded from the main study. Exploratory Factor Analysis (EFA) was employed, demonstrating good validity with a Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy of 0.607 and a significant Bartlett's Test of Sphericity (χ^2 = inf, df = 2628, P < 0.001). The explained variance was 53.5%, using an Oblimin rotation with factor loadings below 0.3 hidden. According to Streiner (1994), an explained variance of at least 50% is considered acceptable for constructs or instruments.

The reliability of the instruments was assessed using Cronbach's Alpha, as detailed in Table 2. It was interpreted according to George and Mallery's (2003) rule of thumb, ">0.9 – Excellent, >0.8 – Good" 8 – Good, >0.7 – Acceptable, >0.6 – Questionable, >0.5 – Unsatisfactory, and 0.5 – Unacceptable" (p. 231).

4. RESULTS AND DISCUSSION

A series of regressions were conducted to determine the mediation effects based on the research question and hypothesis, focusing on indirect effects, significance (Sobel, 1982), and the percentage of mediation or mediation proportion in estimating the proportion of exposure effect on the outcome explained by a mediating variable (Buse et al., 2020). The analysis adhered strictly to the rule of thumb prescribed by Baron and Kenny (1986) for mediation analysis.

According to Baron and Kenny (1986), a variable function as a mediator when it meets the following criteria as shown in Figure 2: There is a significant relationship between variations in the independent variable and variations in the presumed mediator (Path a). There is a significant relationship between variations in the mediator and variations in the dependent variable (Path b). When controlling for Paths a and b, a previously significant
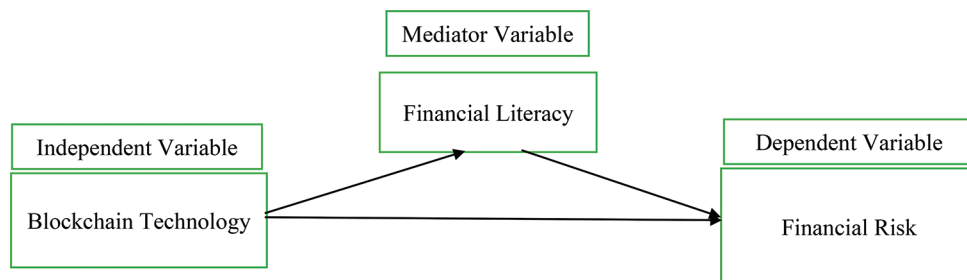
Figure 1: The conceptual framework

Table 1: Population and sample size

Selected type of financial institution	Number of financial institution staff	Sampled retrieved questionnaire
Commercial banks	1000	111
Microfinance	100	74
Savings and loans	800	84
Rural and community banks	500	42
Finance and leasing companies	100	25
Total population	2,500	336

Table 2: Reliability of research instrument

Variables	Items	Cronbach alpha score	Verbal interpretation
Blockchain technology application	11	0.711	Acceptable
Financial literacy	11	0.803	Good

Figure 2: Mediation diagram
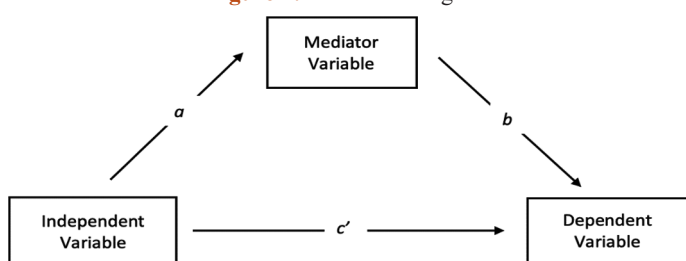
relationship between the independent and dependent variables becomes non-significant, with the most robust evidence of mediation observed when Path c equals zero. This concept is illustrated in Figure 2, which shows:

Path a: The relationship between the independent variable (blockchain technology application) and the mediator (financial literacy).

Path b: The relationship between the mediator (financial literacy) and the dependent variable (financial risk).

Path c: The direct relationship between the independent and dependent variables, which is expected to diminish or become non-significant when the mediator is included in the analysis.

In this study, mediation is confirmed by satisfying three key conditions. The independent variable (blockchain technology application) should significantly impact the mediator (financial literacy), as indicated in the first equation. The independent variable should significantly influence the dependent variable (financial risk). The mediator should significantly influence the dependent variable, as depicted in the third equation. When these conditions are met, the impact of the independent variable on the dependent variable is expected to be diminished in the third equation compared to the second equation, indicating partial mediation. Full mediation is achieved when the influence of the independent variable is rendered insignificant when the mediator is controlled.

In addressing the research question, the path estimates further elucidated the relationships between the variables as shown in

Table 3 and Figure 3. The path from blockchain technology application to financial literacy (a) had an estimate of 0.114, with an SE of 0.0337 and a 95% CI from 0.0481 to 0.1801. This path estimate was small and positively significant (Z = 3.39, P < 0.001). The path from financial literacy to financial risk (b) had an estimate of 0.481, with an SE of 0.0658 and a 95% CI from 0.3524 to 0.6105. This path estimate was moderate and positively significant (Z = 7.31, P < 0.001). The direct path from blockchain technology application to financial risk (c) had an estimate of −0.156, with an SE of 0.0413 and a 95% CI from −0.2370 to −0.0750, which was small and negatively significant (Z = −3.78, P < 0.001).

As shown in Table 4 and Figure 3 the mediation analysis revealed significant indirect and direct effects of blockchain technology application on financial risk, mediated by financial literacy. The indirect effect (a × b) was 0.0549, with a standard error (SE) of 0.0179 and a 95% confidence interval (CI) ranging from 0.0199 to 0.0900. This effect was statistically significant (Z = 3.07, P = 0.002), accounting for 26.0% of the total effect. The direct effect (c) of blockchain technology application on financial risk was −0.1560, with an SE of 0.0413 and a 95% CI from −0.2370 to −0.0750. This effect was also statistically significant (Z = −3.78, P < 0.001), explaining 74.0% of the total effect. The total effect (c + a × b) of blockchain technology application on financial risk was −0.1011, with an SE of 0.0437 and a 95% CI from −0.1868 to −0.0153. This total effect was significant (Z = −2.31, P = 0.021), indicating that the combined direct and indirect effects fully accounted for the relationship between blockchain technology application and financial risk. Therefore, the study rejects the null hypothesis that financial literacy does not mediate the association of blockchain technology application and financial risk.

The interpretation of the mediation analysis shows that financial literacy *partially* mediates the relationship between blockchain technology application and financial risk. Specifically, while blockchain technology application directly reduces financial risk (significant negative direct effect), it also enhances financial literacy, which in turn significantly reduces financial risk. The significant indirect effect suggests that improving financial literacy can amplify the beneficial impact of blockchain technology application on reducing financial risk. The results indicate that financial literacy is a crucial mediator in understanding how blockchain technology application influences financial risk. The findings support the notion that financial literacy can enhance the effectiveness of blockchain technology application in mitigating financial risks, highlighting the importance of educational initiatives to improve financial literacy as a strategy to leverage technological advancements in the financial sector.

The results of this study, which showed that financial literacy significantly mediates the relationship between blockchain technology application and financial risk, are well-supported by the reviewed literature and empirical studies. The findings align with the understanding that higher financial literacy enables individuals to effectively utilize blockchain technology application to mitigate financial risks (Lusardi and Mitchell, 2014; Almashaqbeh et al. 2022; Grohmann et al., 2018). The empirical studies by Yau and Wong (2021), Madinga et al. (2022), and

Table 3: Path estimates

| Independent variable	Direct effect	Dependent variable	Label	Estimate	SE	95% CI		Z	P
						Lower	Upper		
Blockchain technology application	→	Financial literacy	a	0.114	0.0337	0.0481	0.1801	3.39	<0.001
Financial literacy	→	Financial risk	b	0.481	0.0658	0.3524	0.6105	7.31	<0.001
Blockchain technology application	→	Financial risk	c	−0.156	0.0413	−0.2370	−0.0750	−3.78	<0.001

CI: Confidence interval, SE: Standard error

Table 4: Mediation estimates

Effect	Label	Estimate	SE	95% CI		Z	P	Percentage mediation
				Lower	Upper			
Indirect	a×b	0.0549	0.0179	0.0199	0.0900	3.07	0.002	26.0
Direct	c	−0.1560	0.0413	−0.2370	−0.0750	−3.78	<0.001	74.0
Total	c+a × b	−0.1011	0.0437	−0.1868	−0.0153	−2.31	0.021	100.0

CI: Confidence interval, SE: Standard error

Figure 3: Path diagram
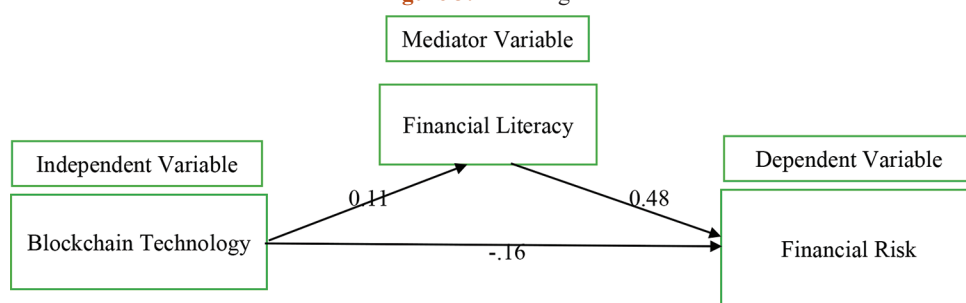
Hasan et al. (2021) further corroborate that enhanced financial literacy can significantly improve financial decision-making and risk management.

5. CONCLUSION AND RECOMMENDATIONS

This study aimed to investigate the mediating effect of financial literacy on the relationship between blockchain technology application and financial risk among financial institution professionals in Ghana. The findings provide significant insights into how financial literacy can enhance the effectiveness of blockchain technology application in mitigating financial risk. The mediation analysis revealed that financial literacy significantly mediates the relationship between blockchain technology application and financial risk. The indirect effect of blockchain technology application on financial risk through financial literacy was significant, accounting for 26.0% of the total effect. This suggests that improving financial literacy can amplify the positive impact of blockchain technology application on reducing financial risk. Moreover, the direct effect of blockchain technology application on financial risk remained significant, indicating that blockchain technology application independently contributes to reducing financial risk. The path estimates further supported these findings, showing significant positive relationships between blockchain technology application and financial literacy, and between financial literacy and financial risk. The significant negative direct path from blockchain technology application to financial risk underscores the technology's potential to enhance financial stability by reducing risks.

These results highlight the crucial role of financial literacy in the effective adoption and utilization of blockchain technology applications. Enhancing financial literacy can help individuals better understand and leverage blockchain technology applications, thereby mitigating financial risks. This underscores the importance of educational initiatives aimed at improving financial literacy as a strategic approach to maximizing the benefits of technological advancements in the financial sector. The study provides robust evidence that financial literacy not only mediates but also enhances the relationship between blockchain technology application and financial risk. This insight is vital for policymakers and educational institutions focusing on financial education and technological integration in financial systems. Future research could further explore the specific educational strategies that most effectively improve financial literacy and support the adoption of blockchain technology application in various financial contexts.

5.1. Policy Recommendations
Based on the findings of the study on the mediating effect of financial literacy on the relationship between blockchain technology application and financial risk among financial institution professionals in Ghana, the following policy recommendations are proposed:
1. Financial institutions should provide ongoing training and professional development opportunities for their employees to enhance their financial literacy. This can include workshops, seminars, and online courses focusing on the latest financial technologies and risk management strategies.
2. Policymakers should establish clear regulatory frameworks that support the adoption of blockchain technology applications

in the financial sector. This includes creating guidelines for the implementation and use of blockchain to ensure security, transparency, and compliance with international standards.

3. Governments and financial regulators should provide incentives for financial institutions to adopt blockchain technology applications. This can include tax benefits, grants, or subsidies for research and development in blockchain applications.

4. Launch nationwide campaigns to raise awareness about the importance of financial literacy. These campaigns should use various media platforms, including social media, to reach a broad audience. The content should highlight the benefits of financial literacy in managing personal finances and utilizing financial technologies.

5. Develop public education initiatives to inform citizens about blockchain technology application and its potential benefits and risks. This can help demystify the technology and encourage more individuals to adopt and utilize blockchain-based solutions.

6. Encourage collaborations between government agencies, educational institutions, and private sector organizations to develop and implement financial literacy and blockchain education programs. These partnerships can leverage the strengths of each stakeholder to create more effective and comprehensive initiatives.

7. Financial institutions should collaborate with fintech companies and blockchain developers to create user-friendly platforms and applications that enhance financial risk management. This collaboration can lead to innovative solutions that are accessible to a wider population.

8. Conduct regular assessments to measure the financial literacy levels of the population. This data can help policymakers identify gaps and areas for improvement in existing financial literacy programs.

9. Evaluate the impact of blockchain technology application adoption on financial risk management within financial institutions. This can involve monitoring key performance indicators related to financial stability, transaction security, and fraud reduction.

By implementing these policy recommendations, Ghana can enhance the financial literacy of its citizens, promote the adoption of blockchain technology application, and ultimately reduce financial risk. These measures will contribute to the overall economic stability and growth of the country.

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