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## Integrating AI, Blockchain, and Cloud Computing for Risk Management

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### Abstract

Artificial Intelligence (AI), Blockchain, and Cloud Computing (CC) are key technologies to improve financial automation and risk management of developing countries in particular. The purpose of this research is to explore the combined impact of AI, Blockchain, and CC on financial automation and how it, in turn, affects improved risk management in financial institutions in Oman. This study adopted a quantitative method by conducting questionnaires with 201 financial and IT experts in banks and fintech firms in Oman using convenience and snowball sampling methods. The respondents were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) based on Technology-Organization-Environment (TOE) and Innovation Diffusion Theory (IDT). Results indicate that Blockchain ( $\beta = 0.561$ ) and AI ( $\beta = 0.264$ ) have a strong impact on financial automation, with a moderate positive influence observed for CC ( $\beta = 0.173$ ). Financial automation has a significant positive effect on improved risk management ( $\beta = 0.827$ ,  $R^2 = 0.81$ ) and regulatory compliance, market responsiveness, and technology access. This research is novel in its integrated empirical model, which brings together three frontier technologies in one model and empirically validates their impact on financial performance and risk management in a developing country, offering practical insights for policymakers and financial practitioners.

*Keywords:* Artificial Intelligence; Blockchain; Cloud Computing; Financial Automation; Risk Management; PLS-SEM.

## 1. Introduction

In the modern and fast-paced digital world, the role of emerging technologies in changing financial and operational processes in organizations is becoming more profound, and this technology has become one of the most crucial factors that promote competitive advantages. These organizations particularly focus on CC, AI, and Blockchain among the most stimulating domains in managing risks [1, 2]. AI significantly moderates the association between CC and business process operation. These technologies reinforce the necessity of ensuring governance structures and system capabilities align to maximize operational efficiency and prime the future strategic use of digital solutions. Through a quantitative research design, the study was able to determine the extent to which organizational features, including role, experience, and size, impact the adoption and effectiveness of these technologies [3] and that there is a positive relationship between digital financial innovation and Kenya's financial depth, with internet usage and mobile financial services being the strongest. AI improves risk management in risk calculation, predictive analysis, and decision automation [4]. Machine

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learning algorithms improve fraud detection and credit risk assessment through the capacity to process humongous sets in methods not feasible for humans [5].

In addition, the use of technology in the financial domain has been widely explored in the literature, contributing to a better understanding of its positive impact on various aspects of organizational performance. Previous studies indicate that AI plays a critical role in financial automation by supporting process optimization and improving organizational decision-making [6]. Likewise, blockchain technology has attracted considerable attention due to its ability to provide secure, transparent, and efficient data management with reduced risk, while also supporting compliance with legal requirements [7]. Golightly et al. [8] stated that AI, as discussed in various studies, offers a highly adaptable environment capable of hosting financial applications and enabling real-time data access. It can therefore be inferred that these technologies have a complementary relationship that contributes to increased efficiency in the financial sector. Furthermore, it is essential to consider the organizational context in such analyses, as factors such as organizational size and employee experience can influence the effectiveness of implementing and disseminating these technological innovations [9].

In particular, these firms use innovation to deliver services that redefine banking and financial solutions, replacing traditional models with convenient and efficient ones. [10]. Consequently, new forms of competition appear, and traditional financial institutions have to evolve to meet these new challenges, resulting in a relatively dynamic picture of the market. Moreover, the digital technologies' going-global feature allows businesses to expand their reach to new clients they may not have previously reached [11].

Moreover, internet technologies enable organizations to reach diverse consumers, increase sales, and analyze data effectively in a highly globalized market. Sudirjo [12], providing them with the necessary tools for success. However, incorporating digital technologies in the financial sector faces challenges like data privacy, cybersecurity threats, and regulatory compliance. Adama et al. [13] stated that organizations must develop frameworks to avoid risks while leveraging technology opportunities. The study is based on these conventions and seeks to establish empirical findings on the relationship between the four concepts of AI, Blockchain, and AI in the sphere of finance to enhance the investigative area in this vibrant field.

However, despite the increasing adoption of digital technologies in finance, limited empirical research has examined the combined impact of Artificial Intelligence (AI), Blockchain, and Cloud Computing (CC) on financial automation and improved risk management, particularly in emerging economies such as Oman. Therefore, the study reveals a significant correlation between technological advancement and financial automation, with AI playing a substantial role in process automation, while Blockchain facilitates secure data management. However, AI's direct impact on financial automation and information security is relatively weaker, suggesting a supporting role in the broader technology landscape. This study contributes to risk management literature by empirically validating how AI, blockchain, and CC enhance risk mitigation, with financial automation serving as a critical mediator and regulatory and technological factors acting as key moderators. The study reflects the imperative nature of the intersection of these technologies and the role they play in the automation of financial processes and risk management, especially in the finance and IT industries. With a focus on AI-driven decision-making, blockchain's role in security and transparency, and CC's scalability.

Based on the research gap findings, it has been found that digital finance grows fast, and there is a lack of empirical studies on the effect of the joint action of AI, Blockchain, and CC on financial automation and risk management, especially in less developed economies. The existing research usually analyzes these technologies separately without an integrated system that can be used to address their interactive impacts. Additionally, there is insufficient research on contextual issues like regulations and market conditions, as well as access to technology. This paper fills these gaps based on the TOE and IDT models of holistic technological integration. Although AI eases decision-making and automation, Blockchain provides data integrity and transparency, and CC helps to scale and made available. Nevertheless, limited empirical data exist about their joint effects on financial automation and risk management, especially in the upcoming digital economies. In addition, little is known about the moderating effects of contextual factors like regulations, market conditions, and access to technology on relationships.

The work has various important contributions to the body of literature on digital transformation in the field of finance. First, it suggests and empirically verifies an integrated model, which connects AI, Blockchain, and CC with financial automation and better risk management through Partial Least Squares Structural Equation Modeling (PLS-SEM). Using statistics of 201 finance and IT practitioners in banks and fintech companies in Oman, the study provides new regional information about the Gulf Cooperation Council (GCC), a highly digitized and less-studied backdrop. This paper is informed by the Technology-Organization-Environment (TOE) and Innovation Diffusion Theory (IDT) models that offer an overall perspective through which the technological and contextual factors that affect adoption may be observed. Moreover, it demonstrates the mediating power of financial automation and moderating power of the environmental conditions, such as regulatory landscape, market situation, and accessibility to technologies, on the association between these emerging technologies and risk management performance. On balance, these contributions fill in a considerable gap in the empirical literature, providing a more comprehensive view of the way digital technologies are changing financial processes in emerging economies in a synergistic way.

Despite the growing body of literature on digital transformation in finance, most previous studies have examined AI, Blockchain, and CC as separate technological drivers rather than as an integrated system influencing financial automation and risk management. Existing studies primarily focus on developed economies, while empirical evidence from emerging economies, particularly in the Gulf Cooperation Council (GCC) region, remains limited. Furthermore, the moderating roles of regulations, market conditions, and technology access in shaping the relationship between these technologies and financial automation are insufficiently explored. This creates a significant research gap in understanding how the combined adoption of AI, Blockchain, and CC contributes to improved risk management within financial institutions. To address this gap, the present study develops and empirically tests an integrated framework based on the Technology-Organization-Environment (TOE) model and Innovation Diffusion Theory (IDT). Using PLS-SEM and data collected from finance and IT professionals in Omani banks and fintech companies, the study examines how these emerging technologies jointly influence financial automation and how automation subsequently enhances risk management performance.

While the model includes multiple technological predictors and contextual outcomes, this broad scope is intentional because financial digital transformation rarely occurs through a single technology in isolation. Financial institutions typically adopt AI, Blockchain, and CC simultaneously as part of an integrated digital ecosystem. Similarly, regulations, market conditions, and technology access were included because prior literature identifies them as the most critical environmental factors influencing technology adoption in emerging economies. Rather than narrowing the model to a single moderator, this study provides a more comprehensive understanding of how multiple technological and contextual dimensions collectively shape financial automation and risk management outcomes.

The main research question for this research is: What role can AI, Blockchain, and CC play in financial automation and improve risk management practices in financial institutions, especially in emerging economies?

## 2. Literature Review

### 2.1. Integration of TOE and IDT Frameworks and Hypothesis Development

While the Technology–Organization–Environment (TOE) framework explains the contextual conditions that influence organizational technology adoption, Innovation Diffusion Theory (IDT) explains why specific innovations are adopted based on their perceived characteristics. In this study, TOE explains how technological readiness (AI, Blockchain, Cloud Computing), organizational capability, and environmental pressures (regulations, market conditions, and technology access) create the institutional environment necessary for digital transformation in financial institutions.

IDT complements TOE by explaining why these technologies are adopted together based on their perceived relative advantage, compatibility, complexity, and observability. AI improves predictive analytics and decision-making, Blockchain enhances transparency and transaction security, while CC provides scalable infrastructure and real-time accessibility. These technologies do not operate independently; rather, their value increases when implemented as complementary innovations. For example, AI requires large-scale computing infrastructure provided by cloud platforms, while blockchain-generated transaction data improves AI-driven fraud detection and predictive risk analysis.

Therefore, TOE explains the organizational and environmental readiness for adopting these technologies, whereas IDT explains how their perceived complementary benefits drive simultaneous adoption. This integrated theoretical perspective supports the proposed hypotheses by explaining both the direct effects of AI, Blockchain, and CC on financial automation (H1–H3) and the subsequent impact of financial automation on improved risk management outcomes (H4–H7).

### 2.2. The Impact of Artificial Intelligence on the Automation of Finance

AI-driven automation is increasingly utilized for financial management, with studies suggesting that its impact on risk management and operational efficiency is significant but moderate in nature [14]. The paper establishes that the convergence of AI with current and emerging regulations, markets, and technologies has lent a complicated but auspicious environment for financial organizations. Also, productivity tools like machine learning and natural language processing enable real-time data analysis. For instance, AI can keep track of transactions to check for certain activities that seem suspicious, and these include cases of fraud or non-compliance, hence improving the efficiency of operations [15], and the degree to which set regulations are followed [16]. However, some crucial factors are dependent on the regulatory situation, which explains how the AI application can be successful in managing financial risks. Moreover, governments and regulatory authorities are adopting policies to promote innovation and protect users [17], balancing extreme measures with permissive ones. This requires financial institutions to be cautious about current regulations and manage future changes related to AI deployment.

Although prior studies generally report positive effects of AI on financial automation, findings remain inconsistent regarding the magnitude of its impact. For example, Davenport & Ronanki [4] emphasized AI's ability to improve predictive analytics and operational efficiency. Similarly, some studies highlight AI as a transformational technology,

while others position it as a supportive tool dependent on organizational readiness and complementary infrastructure. These conflicting findings suggest that AI's impact may vary across institutional contexts, thereby justifying further empirical investigation in emerging economies such as Oman.

*H<sub>1</sub>*: Artificial Intelligence has a significant positive effect on the Automation of Finance.

### 2.3. The Impact of Blockchain on Financial Automation

Blockchain technology is revolutionizing finance by enhancing transparency, accountability, and reducing risks associated with data manipulation [18]. Bodo & De Filippi [19] stated that the decentralized nature allows for accurate tracking of assets and liabilities, reducing fraud risks and enhancing trust among stakeholders. However, the successful implementation of blockchain in finance is heavily influenced by regulatory frameworks, which must balance innovation with consumer protection [20]. The innovative hands-off approach to blockchain in the EU and the USA could enhance financial inclusion and offer economic benefits, particularly in virtual currencies [21]. Blockchain can help by providing a transparent view of market dynamics, enabling thorough risk assessments and informed decisions. For instance, smart contracts, encoded on the blockchain, can ensure regulatory compliance and minimize operational risks [22]. Initiatives democratizing blockchain technology access for smaller firms and fintech startups are addressing resource limitations.

While blockchain is widely recognized for improving transparency and transaction security, prior research presents mixed findings regarding its practical implementation. Some studies report substantial improvements in fraud prevention and operational efficiency, whereas others highlight scalability issues, regulatory uncertainty, and integration challenges with legacy financial systems. These contradictory findings indicate that blockchain adoption outcomes remain context-dependent and require further empirical validation.

*H<sub>2</sub>*: Blockchain has a significant positive effect on the Automation of Finance.

### 2.4. The Impact of Cloud Computing on Financial Automation

Cloud services are revolutionizing businesses, but they also present challenges like data breaches, provider security, and regulatory compliance. Businesses must adhere to strict protocols for long-term security [23]. Also, it has been observed that business analytics affordances improve AI data security management using data from 316 enterprises, exploring a process from analytics affordances to decision-making affordances [24]. The integration of edge-cloud computing and AI in IoMT, healthcare, education, and innovative warehousing is a significant advancement in various fields to enhance risk management [25]. Whereas, Polak et al. has declared that AI in finance and treasury management faces challenges due to automation, requiring quick data management, considering environmental, internal, and corporate factors [26]. AI integration in financial services is expected to revolutionize risk management Challoumis [27], personalize customer interactions, and optimize processes, while addressing challenges like data privacy and regulatory compliance. In contrast, the rise of Automated Market Makers (AMMs) in decentralized finance examines their conversion of tokens to prices and their various types, including Constant Product, Constant Mean, Constant Sum, Hybrid Function, and Dynamic AMMs. It also explores the impact of concentrated liquidity in AMMs [28].

The Technology Acceptance Model (TAM) highlights the importance of perceived usefulness and ease of use in AI adoption for risk management [29]. However, challenges like data privacy, security, and compliance can hinder its success. Addressing these concerns can enhance AI's potential for governance, sustainability, and operational efficiency. Recent evidence also shows that the combined spillover effects of AI, CC, and blockchain create stronger financial resilience and innovation capacity, particularly in sustainable and digital financial ecosystems (Technology in Society, 2025).

Existing literature also presents divergent perspectives regarding CC. Some scholars argue that cloud infrastructure significantly enhances scalability, cost efficiency, and real-time analytics, while others emphasize concerns related to cybersecurity, data sovereignty, and compliance risks. These contrasting perspectives suggest that CC may function more as an enabling platform rather than a direct driver of financial transformation.

*H<sub>3</sub>*: Cloud Computing has a significant positive effect on the Automation of Finance.

### 2.5. The Impact of Automation of Finance on Risk Management

Market conditions actually add another layer to this issue, because changes in the market and in monetary policy, interest rates, and geopolitical events can influence the stability as well as risk of the financial markets. Also, climate change financial risks and Green Swans transition, suggesting central banks should revisit risk models and use systems-based approaches [30]. Cooperation between banks, fiscal authorities, and civil society is crucial. AI plays a crucial role in risk management in the finance sector, helping companies create market models and reduce risks [31]. AI-driven predictive analytics in finance enhances risk assessment, decision-making, profitability, and risk mitigation by accurately forecasting market trends and identifying threats, paving the way for more agile institutions [32]. However,

the competitive divide between larger and smaller institutions affects risk management. Moreover, financial institutions must implement good governance structures to ensure fair, explainable, and ethical AI systems [33]. AI deployment in finance can mitigate reputational risks by utilizing regulations, market changes, and technological advancements, requiring a comprehensive approach of innovation-meets-compliance and market insights. Based on the TAM and the research hypothesis, AI improves risk management through financial automation and is moderated by external factors [34]. TAM focuses on perceived usefulness and perceived ease of use to make sense of how adopting AI-driven automation supports risk management in financial institutions [35]. This model explains why it is vital to consider user acceptance when implementing AI solutions, which would improve operational efficiency and compliance, and how external factors impact the implementation of these technologies.

*H<sub>4</sub>*: Automation of Finance has a significant positive effect on Improved Risk Management

## 2.6. The Moderating Effect of Automation of Finance Through Regulations, Technology Access, and Market Conditions

Automation in finance has become one of the most prominent game-changing factors that positively impact the relevant market in various aspects. Essentially, financial automation is the use of tools that are designed to minimize the role of human input and increase efficiency [36]. This has particularly applied in the field of trading, risk management, and financial reporting, as noted in this study. Due to the application of higher algorithms and ideas in AI trading, it has become easier, hence faster, in terms of decisions and actions [37]. Computerization is the finest technique since these structures can handle a large amount of data and can make trading decisions in real-time, thereby increasing liquidity and preventing fluctuation of the price. This speed up helps in providing an earlier adaptability to change, hence enhancing the health of the market among the participants. In addition, there is less human delay and error, as they have in the past caused stock market risks and significant losses [38]. In this way, the risks mentioned above are reduced, and this results in increased confidence in the market, and therefore, more and more participants engage in trading activities.

Moreover, the use of blockchain technology helps meet the needs of authenticity, security, and risk management, trade and finance, credit reporting, efficiency, revenue, and data management among financial service providers. Also, the advantages of hybrid business models in the digital age emphasize the importance of value creation and capture, resulting in sustainable and competitive business models [39, 40]. Whereas challenges of implementing blockchain technology in supply chain management for SMEs include identifying scalability, human resource shortage, and financial constraints. It uses fuzzy techniques for more accurate prioritization and strategy design [41]. The implementation of BPR institutional inertia faces technical challenges due to legacy applications and high costs, but a progressive approach, employee education, and cooperation can overcome these issues. The application of AI in the sector of finance has revolutionised risk management [42].

However, an appropriate legal framework is called for to protect market integrity, consumers, and the market itself since the application of AI in trading platforms can cause significant risks [43]. In addition, Bavoso [44] stated that regulations such as the Dodd-Frank Act and Basel III have changed the face of the financial services industry through advocating for higher capital standards and increasing financial transparency. However, these regulations are meant to help mitigate other risks that reduce the occurrence of financial crises, especially in banks [45]. Access to technology is the other feature that determines the level of automation of finance. Banking and financial institutions, as well as fintech start-ups, especially those relatively small ones, do not adopt these technologies because they are often too expensive and violate specific rules and regulations. Such a difference can create a divide in the ability to access financial services and thus worsen problems of financial inclusion. That is why policymakers are recommended to adopt policies that would make technology available to a broader market by allowing every player in the market to gain from automation in risk management.

Blockchain technology is revolutionizing finance by enhancing transparency, accountability, and reducing risks associated with data manipulation. Its decentralized nature allows for accurate tracking of assets and liabilities, reducing fraud risks and enhancing trust among stakeholders [46]. However, the successful implementation of blockchain in finance is heavily influenced by regulatory frameworks Taherdoost [47], which must balance innovation with consumer protection. Blockchain can help by providing a transparent view of market dynamics, enabling thorough risk assessments and informed decisions. Smart contracts, encoded on the blockchain, can ensure regulatory compliance and minimize operational risks. Initiatives democratizing blockchain technology access for smaller firms and fintech startups are addressing resource limitations and ethical considerations to build trust among users and stakeholders [48, 49].

*H<sub>5</sub>*: Automation of Finance has a significant positive effect on Market Condition.

*H<sub>6</sub>*: Regulations have a significant positive influence on the adoption of Blockchain technology

*H<sub>7</sub>*: Automation of Finance has a significant positive effect on Improved Risk Management through Technology Access

Table 1 describes the constructs and their indicators. Variable Indicators presents the measured constructs, their corresponding operational indicators, and the foundational literature from which they were adapted.

**Table 1. Variable Indicators**

Variable Name	Indicators	Reference
Artificial Intelligence	To what extent has AI-driven automation (e.g., automated transactions, invoicing, payroll) improved the operational efficiency of your organization's financial processes?	[50-52]
	How effectively does AI technology support risk identification and mitigation in your financial operations (e.g., fraud detection, credit risk assessment)?	
	To what degree has AI-based data analytics enhanced your organization's financial decision-making capabilities (e.g., predictive analysis, trend forecasting)?	
	How has the use of AI (e.g., chatbots, Robo-advisors) transformed your organization's ability to provide personalized financial services to customers?	
	How significantly does AI enhance the accuracy of financial forecasting and predictive analytics within your organization (e.g., sales forecasts, expense predictions)?	
Block Chain	To what extent has AI implementation reduced financial operation costs (e.g., labor costs, processing time, error correction)?	[53, 54]
	To what extent has Blockchain technology improved the security of your organization's financial transactions (e.g., fraud prevention, data protection)?	
	How effectively does Blockchain increase transparency in your financial reporting and auditing processes (e.g., immutable ledgers, real-time verification)?	
	To what degree has Blockchain technology helped reduce costs associated with financial transactions and operations (e.g., transaction fees, third-party intermediaries)?	
	How significantly has Blockchain technology improved the speed of financial transactions in your organization (e.g., processing times, settlement delays)?	
Cloud Computing	How effectively has Blockchain facilitated cross-border financial transactions (e.g., lower transaction fees, faster international payments)?	[55]
	To what extent has Blockchain enabled decentralized financial operations (e.g., peer-to-peer lending, decentralized finance platforms) in your organization?	
	To what extent has cloud computing enabled your organization to scale financial operations (e.g., handling increased transaction volume, expanding services)?	
	How effectively has cloud computing improved access to real-time financial data and reporting within your organization?	
	To what extent has cloud computing reduced the cost of managing financial operations (e.g., hardware, maintenance, IT personnel)?	
Automation of Finance	How has cloud computing impacted the security of your organization's financial data (e.g., data encryption, secure backups)?	[56, 57]
	How significantly has cloud computing improved collaboration among financial teams within your organization (e.g., sharing documents, real-time collaboration)?	
	To what extent has cloud computing enhanced your organization's ability to recover financial data and resume operations after a disaster (e.g., automated backups, quick recovery time)?	
	How frequently does your company utilize automated financial systems (e.g., digital transactions, automated accounting processes)?	
	How has the automation of financial processes improved the efficiency of your organization's operations?	
Improved Risk Management	Do you believe automated financial processes have reduced the risk of errors in your financial transactions?	[58]
	To what extent has the adoption of automated financial systems impacted decision-making speed within your organization?	
	How likely are you to recommend further automation of financial processes to other departments in your organization?	
	How well does your company's automated financial system integrate with other software systems (e.g., CRM, ERP)?	
	To what extent has the implementation of AI-driven risk assessment improved your organization's risk management practices?	
Regulations	How effective are AI technologies in identifying potential financial risks in your organization?	[59]
	To what extent has automation enhanced the accuracy and speed of financial decision-making in your organization (e.g., automated reporting, real-time data analysis)?	
	How has the implementation of automated financial systems affected the cost of your financial operations (e.g., labor costs, transaction fees)?	
	How satisfied are you with the overall performance of automated financial systems in your organization?	
	How secure do you feel your company's financial data is with the use of automated financial systems?	
Regulations	How effectively does your organization comply with digital finance regulations (e.g., data privacy laws, financial reporting standards)?	[59]
	To what extent do existing regulations create barriers to adopting digital financial technologies in your organization?	
	How significantly have recent regulatory changes impacted your organization's financial operations (e.g., new compliance requirements)?	
	How easily does your organization adapt to evolving financial regulations related to digital transactions and data management?	
	How much have regulatory compliance costs (e.g., audits, legal consultations) increased as a result of digital financial regulations?	
	How supportive are current financial regulations in fostering digital innovation within your organization's financial practices?	

Market Conditions	To what extent has market competition influenced your organization’s adoption of digital financial technologies (e.g., AI, blockchain)?	[59, 60]
	How have recent economic trends (e.g., inflation, recession) affected your organization’s ability to implement digital financial solutions?	
	How has market demand for digital financial services (e.g., online banking, digital payments) influenced your organization’s strategic priorities?	
	How much pressure does your organization feel to adopt digital financial technologies due to competitors’ use of such technologies?	
	How effectively has your organization adapted its financial operations in response to fluctuating market conditions (e.g., shifts in consumer demand, technology-driven changes)?	
Improved Risk Management	To what degree do global market trends (e.g., fintech advancements, international regulations) affect your organization’s digital financial strategies?	[61, 62]
	How effectively has your organization used AI for risk assessment and management (e.g., fraud detection, credit risk analysis)?	
	To what extent has automation in financial processes reduced risks related to human errors (e.g., transaction errors, accounting mistakes)?	
	How effectively has the adoption of blockchain technology in financial transactions reduced risks associated with data tampering and fraud?	
	How effectively do digital tools (e.g., real-time analytics, cloud-based dashboards) help your organization monitor and manage financial risks?	
	How significantly have digital technologies improved the accuracy and timeliness of your organization’s risk reporting and compliance?	
	How effectively does your organization use digital technologies for predictive risk management (e.g., forecasting financial risks, identifying future vulnerabilities)?	

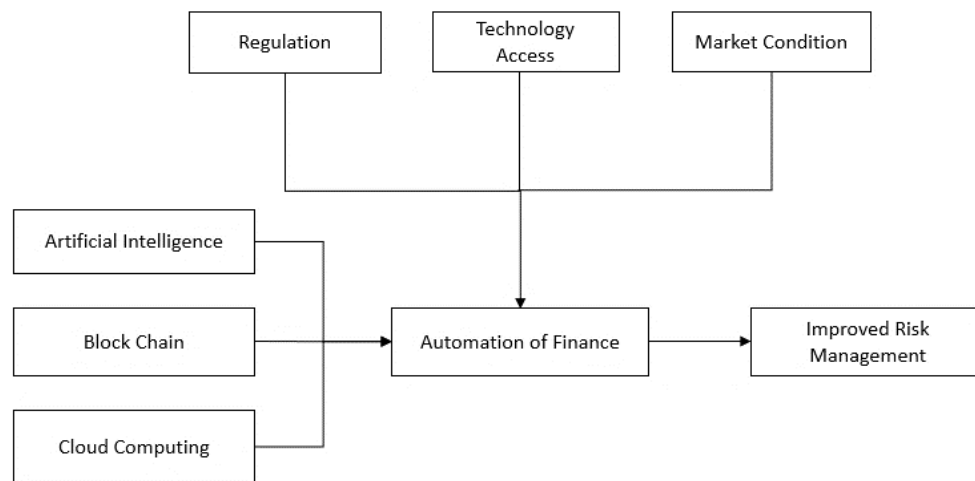
As mentioned in Table 1, the modern development of AI, Blockchain, and cloud computing (CC) is transforming a variety of financial processes by increasing efficiency and reducing risks. Finance is one of the key areas in which integrated AI solutions have had a significant positive impact, including the automation of financial transactions and operations such as invoice generation, payroll processing, risk detection, and credit scoring. Blockchain technology contributes to improving the reliability and transparency of financial operations.

This study adopts a quantitative research design using structured questionnaires to collect data on key organizational variables, including role, experience, and organizational size, in order to assess the impact of emerging technologies such as AI and Blockchain on improving the efficiency of financial teams and enhancing protection against data leakage. Collectively, these technologies improve operational efficiency by reducing human intervention and significantly enhancing timely decision-making, thereby improving overall organizational performance.

From the perspective of financial automation, these technologies not only improve efficiency but also strengthen compliance with evolving regulations, enabling organizations to respond more rapidly to market conditions. Furthermore, digital applications facilitate risk control and monitoring, allowing organizations to respond more effectively to financial risks. The adoption of these technologies continues to increase as market competition intensifies, since organizations operating in competitive environments increasingly rely on such technologies to support financial activities, enhance innovation, improve resilience and productivity, and reduce financial risks.

While the individual relationships proposed in H1–H7 are supported by prior literature, the novelty of this study lies in examining these relationships within a unified theoretical framework. Previous studies have largely examined AI, Blockchain, CC, financial automation, and risk management in isolation. This study extends existing knowledge by integrating these technologies into a single empirical model and examining their simultaneous influence on financial automation and downstream risk management outcomes. Furthermore, the inclusion of regulations, market conditions, and technology access expands prior models by incorporating contextual mechanisms that are particularly relevant in emerging economies such as Oman.

The conceptual model diagram of this study is represented in Figure 1. Figure 1 presents the conceptual framework of the study, illustrating the integrated relationships among AI, Blockchain, and CC as the main technological predictors of Automation of Finance, which subsequently influences Improved Risk Management. The model also incorporates external environmental factors, including Regulations, Market Conditions, and Technology Access, which strengthen the effectiveness of financial automation. This conceptual structure is developed based on the TOE framework and Innovation Diffusion Theory (IDT) to explain both technological adoption and institutional readiness.



**Figure 1. Conceptual Model: The Integrated Impact of AI, Blockchain, and Cloud Computing on Financial Risk Automation**

The study is theoretically grounded in the Technology-Organization-Environment (TOE) Framework and Innovation Diffusion Theory (IDT), which together provide a comprehensive explanation of how financial institutions adopt emerging technologies. TOE explains the influence of technological, organizational, and environmental conditions, while IDT focuses on innovation characteristics and adoption behavior. Their integration strengthens the conceptual model by explaining both institutional readiness and perceived innovation benefits in shaping financial automation and improved risk management.

### 3. Methodology

#### 3.1. Research Design and Sample

This research paper involves a cross-sectional based on a quantitative design where it involves the use of a structured survey instrument to evaluate the compounded effects of AI, Blockchain and CC with respect to financial automation and risk management. Although the research model incorporates multiple technologies and contextual variables, PLS-SEM was selected because it is particularly suitable for analyzing complex models with multiple constructs and simultaneous relationships. This methodological approach allows the study to maintain analytical depth while examining a broader digital transformation framework. The target segment was professionals in financial and IT work in banks, fintech companies, and financial service organizations in Oman which is an up-and-coming digital economy in the GCC region.

#### 3.2. Respondent Criteria and Sampling Frame

The respondents had to have (1) middle to senior jobs in finance or IT departments, (2) two years of experience with digital technologies, and (3) be employed in the institutions that are directly related to the use of financial technologies. Organizations included local banks and regional fintech startups to government affiliated financial services.

Purposive and convenience sampling methods were used due to limited access to senior financial and IT professionals involved in digital transformation initiatives within Omani financial institutions. While these non-probability sampling techniques may introduce selection bias, they were appropriate because the study specifically required respondents with direct experience in AI, Blockchain, CC, and financial automation. The final sample of 201 respondents exceeded the minimum threshold recommended for PLS-SEM analysis and included participants from banks, fintech firms, and financial service organizations of varying sizes, improving respondent diversity. However, the sample is intended to represent digitally active financial institutions in Oman rather than the entire financial sector across all emerging economies.

#### 3.3. Instrument and Constructs

All constructs were measured reflectively on the basis of measurement models that had been tested before (see Appendix A to itemize and source). The rating was done on a five-point Likert scale (1 = strongly disagree and 5 = strongly agree). The constructs were: Artificial Intelligence, Blockchain, Cloud Computing, Financial Automation, Risk Management, Regulations, Market Conditions, and Technology Access.

#### 3.4. Validity and Reliability Assessment

The survey was subjected to expert review and pilot test so as to ensure construct validity. Cronbachs alpha and composite reliability values were checked and proved to be above the 0.7 mark, which indicated an internal consistency reliability. AVE values greater than 0.5 gave convergent validity.

Discriminant validity was determined through the Fornell-Larcker criterion as well as the HTMT ratios, all of which were within reasonable limits. The single-factor test and the full collinearity VIF method to test common method bias (CMB), were applied (Harman, and single factor test) and the full collinearity VIF (Kock, 2015) respectively. The VIFs were all less than 3.3 and indicated that there were no serious issues of multicollinearity or CMB.

### 3.5. Ethical Considerations

Ethical considerations were paramount throughout the research process. Anonymity and confidentiality were strictly maintained, with no personal identifiable information recorded. The study adhered to ethical guidelines set by relevant institutional review boards, emphasizing respect for participants and their data. Additionally, the study aimed to contribute positively to the field by providing insights that could enhance organizational practices, aligning with ethical standards of benefiting societal interests.

As mentioned in Table 2, phenomena related to financial automation are diverse and depend on several significant external factors. The variables highlighted in the table play a critical role in influencing the successful adoption and deployment of automation technologies in the financial industry. Government policies act as a major driver for the adoption of automation in the financial sector. These regulatory frameworks aim to improve efficiency, regulate markets effectively, protect consumers, and ensure compliance with required standards.

**Table 2. Variables Definitions**

Variable	Definition	Reference
External Factors	External environmental factors that influence the automation of finance include regulations, market conditions, and technology access.	[63]
Regulations	The laws, rules, and guidelines set by governing bodies that impact the adoption and implementation of automation in the financial industry.	[64]
Market Conditions	The economic and competitive landscape within the financial sector affects the adoption and utilization of automation technologies.	[39]
Technology Access	The availability, affordability, and ease of access to advanced technologies (e.g., cloud computing, AI, blockchain) for financial institutions, particularly smaller firms and fintech companies.	[65]
Digital Technologies	Emerging technological innovations, such as artificial intelligence, blockchain, and cloud computing, enable the automation of financial processes and decision-making.	[66]
Automation of Finance	The implementation of automated systems, algorithms, and technologies to streamline and optimize various financial processes, including risk management, trading, and compliance.	[67]
Improved Risk Management	The enhanced ability to identify, assess, and mitigate risks in the financial sector through the adoption of automated systems and advanced analytics.	[68]

In addition to these regulations, the broader market context, including economic trends and competitive conditions, also plays a crucial role in determining the ability of financial institutions to implement and invest in automation technologies. Another important category is technological accessibility, which includes the adoption of advanced technologies such as cloud computing, AI, and blockchain, as well as the availability, cost, and ease of implementation of these technologies. Since technology is not distributed equally, the benefits of automation are also unevenly distributed, particularly affecting smaller financial organizations and fintech companies with limited staff and resources. These digital technologies facilitate the adoption of advanced financial systems and applications that support automated risk management, trading, and compliance processes [69]. Consequently, they enhance future risk management capabilities by enabling institutions to identify, measure, and control risks more effectively. Therefore, it is essential for the financial industry to manage these interconnected variables carefully in order to maximize the benefits of automation and improve core risk management procedures.

### 3.6. Instrument Development and Validation

Items for the latent constructs were adapted from prior studies (see Table 1), then reviewed by three subject-matter experts (one accounting/finance academic and two fintech practitioners) for content validity (clarity, relevance, coverage). A pilot test with [n = 12] respondents similar to the target population was run to check wording and timing; minor edits were made for clarity. Reliability and validity in the main study met accepted thresholds: Cronbach’s  $\alpha$  ranged 0.791-0.959, composite reliability 0.864-0.968, and AVE 0.614-0.858 (see Table 6). Moreover, we employed Partial Least Squares Structural Equation Modeling (PLS-SEM) using SmartPLS (v4.x) because the study focuses on prediction-oriented analysis and examines a relatively complex model involving multiple latent constructs, mediating relationships, and environmental factors. PLS-SEM is particularly appropriate when the primary objective is variance explanation and theory extension rather than strict theory confirmation.

Covariance-Based SEM (CB-SEM) was considered; however, it was not selected because CB-SEM typically requires larger sample sizes, stronger assumptions of multivariate normality, and is more suitable for well-established theoretical models focused on model fit confirmation. Since this study integrates TOE and IDT into a relatively novel framework and uses a sample of 201 respondents, PLS-SEM was considered more appropriate for maximizing predictive accuracy and handling model complexity.

As mentioned in Table 3, the data from 201 respondents reveal moderate variability in roles, experience, and size of organization. Roles are rated between levels 1 and 3, with a mean score of 1.9. Experience is moderately distributed, with a mean score of 2.16, indicating a wide range of experience levels. The size of the organization is moderately distributed, with most respondents from smaller to medium-sized organizations. Overall, the data suggest diverse experiences, roles, and organizational sizes within the sample.

**Table 3. Descriptive Analysis**

Descriptive Statistics						
	N	Minimum	Maximum	Mean	Std. Deviation	Variance
Role in Organisation	201	1	3	1.9	0.656	0.43
Experience	201	1	4	2.16	0.967	0.935
Size of Organisation	201	1	3	1.92	0.651	0.424
Valid N (listwise)	201	-	-	-	-	-

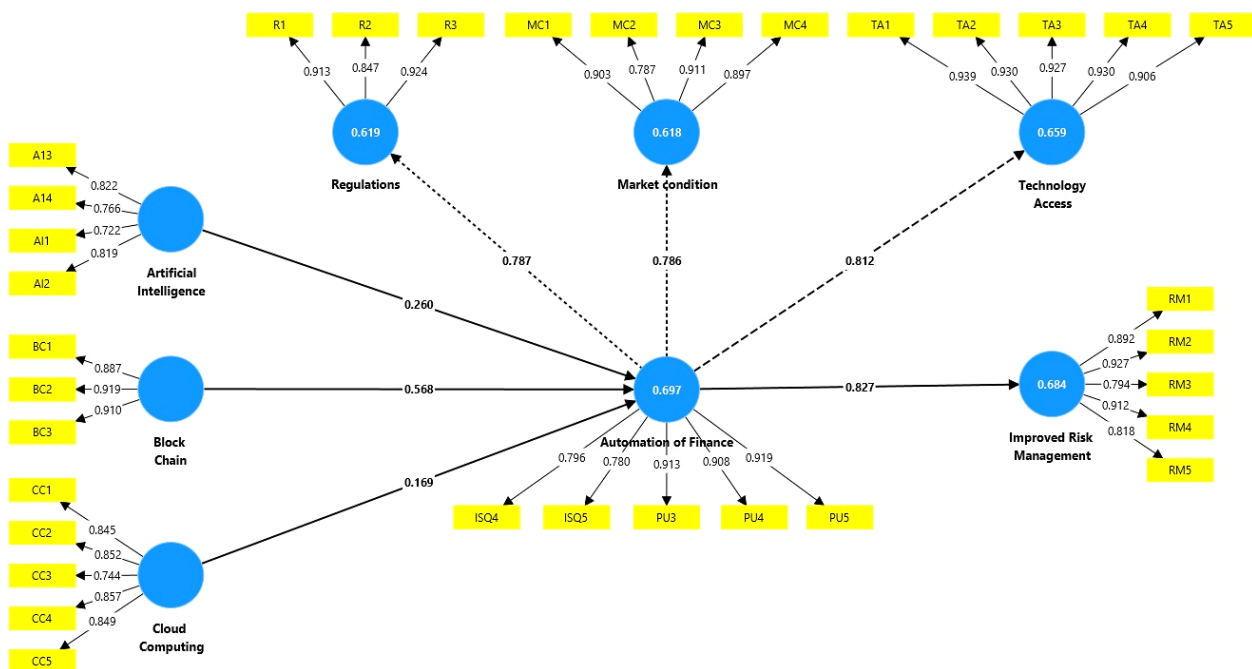
## 4. Analysis

### 4.1. Measurement Model

The analysis showed that internal consistency and convergent validity were satisfactory. For instance, Cronbach’s  $\alpha$  ranged from 0.791 to 0.959, composite reliability (CR) from 0.864 to 0.968, and AVE from 0.614 to 0.858 (see Table 7). Discriminant validity was assessed using the Fornell-Larcker criterion, confirming that the square root of AVE for each construct exceeded its inter-construct correlations (see Table 6). For completeness, we also inspected HTMT ratios (reported in the Online Appendix); all HTMT values were below the conservative 0.85 threshold, supporting discriminant validity.

### 4.2. Structural Model

Figure 2 illustrates the Structural Equation Model (SEM) used to test the proposed hypotheses and evaluate the relationships among the study variables. The model shows the direct effects of AI, Blockchain, and CC on Automation of Finance and the subsequent influence of automation on Improved Risk Management, Regulations, Market Conditions, and Technology Access. The path coefficients demonstrate the strength of these relationships and confirm the explanatory power of the proposed conceptual framework.



**Figure 2. Structural Equation Model (SEM) of Financial Automation and Risk Management\***

AI, Blockchain, and CC are key enablers of the Automation of Finance, directly enhancing Improved Risk Management. Regulations, Market Conditions, and Technology Access also play supporting roles by indirectly

\* Standardized path coefficients ( $\beta$ ) shown on arrows; significance marked as  $p < .05$  ( $\circ$ ),  $< .01$  ( $\bullet$ ),  $< .001$  ( $\circ$ ).  $R^2$  values are displayed inside endogenous constructs (e.g., Automation of Finance, Improved Risk Management). Reported coefficients correspond to Table 4.

facilitating the automation process. The model interprets that AI has a moderate direct effect on Automation of Finance (0.260), while Blockchain and CC have higher effects (0.568 and 0.169, respectively). Improved Risk Management is the ultimate goal, achieved through effective automation of financial processes. The strengths of these relationships within the SEM framework are highlighted.

The model demonstrates strong explanatory power, with  $R^2 = 0.74$  for Automation of Finance and  $R^2 = 0.81$  for Improved Risk Management, indicating that the constructs explain a substantial proportion of variance in financial automation and risk management outcomes. The effect size ( $f^2$ ) analysis shows that Blockchain leads to Automation ( $f^2 = 0.32$ ) and Automation leads to Improved Risk Management ( $f^2 = 0.41$ ) represent large effects, while AI leads to Automation ( $f^2 = 0.09$ ) and Cloud leads to Automation ( $f^2 = 0.05$ ) represent medium effects.

As mentioned in Table 4, the analysis highlights significant relationships among various technological factors influencing the Automation of Finance and its subsequent impact on Improved Risk Management. AI exhibits a moderate positive effect on Automation of Finance (Mean = 0.264, T = 5.619, p = 0.000), suggesting that AI integration can moderately enhance financial automation processes. Blockchain shows a stronger positive influence on Automation of Finance (Mean = 0.561, T = 9.366, p = 0.000), indicating that blockchain technology substantially facilitates financial automation, likely due to its capabilities in secure and transparent data handling. Similarly, CC also contributes positively to Automation of Finance (Mean = 0.173, T = 3.223, p = 0.001), though its impact is relatively smaller compared to AI and Blockchain. The automation of financial systems significantly impacts several external factors, with strong positive effects observed on Improved Risk Management (Mean = 0.827, T = 31.567, p = 0.000), Market Condition (Mean = 0.787, T = 24.759, p = 0.000), Regulations (Mean = 0.788, T = 25.410, p = 0.000), and Technology Access (Mean = 0.812, T = 23.554, p = 0.000). These high T-statistics and consistently significant p-values confirm the statistical robustness of the structural model and indicate that the proposed relationships are not only theoretically meaningful but also practically significant for financial institutions adopting digital transformation strategies.

**Table 4. Relationships in the Structural Equation Model**

Variables	Mean	Standard deviation	T statistics	P values
Artificial Intelligence → Automation of Finance	0.264	0.046	5.619	0.000
Automation of Finance → Improved Risk_Management	0.827	0.026	31.567	0.000
Automation of Finance → Market condition	0.787	0.032	24.759	0.000
Automation of Finance → Regulations	0.788	0.031	25.410	0.000
Automation of Finance → Technology Access	0.812	0.034	23.554	0.000
Blockchain → Automation of Finance	0.561	0.061	9.366	0.000
Cloud_Computing → Automation of Finance	0.173	0.052	3.223	0.001

### 4.3. Bootstrapping Results

A bootstrapping procedure with 5,000 subsamples in SmartPLS v.4 was used to test the statistical significance of each path coefficient. Bootstrapping gave t-statistics and p-values of the relationships in each of the hypotheses, which demonstrated the strength and dependability of the results. Table 4 indicates that all the paths were significant at p = 0.05 and t-values far exceeded the critical value of 1.96. This confirms the hypothesis of the relationships between the constructs, such as the impacts of AI, Blockchain, and CC on financial automation, as well as their bottom-up impact on risk management and external moderating variables.

As mentioned in Table 5, the discriminant validity reveals the strength of relationships among AI, Automation of Finance, Blockchain, CC, Improved Risk Management, Market Condition, Regulations, and Technology Access. In particular, the correlation coefficient of Technology Access and Market Condition is revised to be 0.840 which is less than the conservative HTMT of 0.85. This makes sure that the constructs are different and capture different aspects of the conceptual model. The vital position of automation is demonstrated by strong relationships between Automation of Finance and both Improved Risk Management (0.900) and Blockchain (0.869). On the whole, the matrix helps to confirm the credibility of the measurement model confirming the validity of structural relations between constructs of the financial automation model.

As mentioned in Table 5, discriminant validity reveals the strength of the relationships among AI, Automation of Finance, Blockchain, CC, Improved Risk Management, Market Condition, Regulations, and Technology Access. In particular, the correlation coefficient between Technology Access and Market Condition was revised to 0.840, which is lower than the conservative HTMT threshold of 0.85. This confirms that the constructs are distinct and capture different aspects of the conceptual model. The important role of automation is demonstrated by the strong relationships between Automation of Finance and both Improved Risk Management (0.900) and Blockchain (0.869). Overall, the matrix supports the credibility of the measurement model by confirming the validity of the structural relationships among the constructs within the financial automation model.

**Table 5. Discriminant Validity**

	Artificial Intelligence	Automation of Finance	Blockchain	Cloud computing	Improved Risk Management	Market condition	Regulations	Technology Access
Artificial Intelligence								
Automation of Finance	0.718							
Blockchain	0.594	0.869						
Cloud computing	0.481	0.593	0.531					
Improved Risk Management	0.656	0.900	0.836	0.681				
Market condition	0.654	0.857	0.732	0.643	0.822			
Regulations	0.644	0.865	0.700	0.663	0.830	0.933		
Technology Access	0.627	0.863	0.736	0.516	0.812	0.840	0.882	0

**Table 6. Construct Reliability and Validity**

Variables	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average Variance Extracted (AVE)
Artificial Intelligence	0.791	0.797	0.864	0.614
Automation of Finance	0.915	0.921	0.937	0.749
Blockchain	0.890	0.894	0.932	0.820
Cloud computing	0.888	0.901	0.917	0.690
Improved Risk Management	0.919	0.926	0.940	0.757
Market condition	0.898	0.912	0.929	0.767
Regulations	0.877	0.897	0.924	0.802
Technology Access	0.959	0.959	0.968	0.858

The results verify that the three new technologies, which are AI, Blockchain, and CC have a strong positive impact on the automation of finances in Omani financial institutions. Among them, the influence of Blockchain is the most powerful ( $b = 0.561$ ), as it is considered valuable in ensuring and facilitating financial transactions. The contribution made by AI ( $b = 0.264$ ) is also significant, as it is used in the field of predictive analytics and process automation, whereas CC ( $b = 0.173$ ) demonstrates a moderate effect, which is related to the accessibility of the data and its scalability (see Table 7).

In its turn, financial automation reveals a highly positive impact on enhanced risk management ( $b = 0.827$ ), which implies that automation is perceived as the essential facilitator of the enhanced risk controls, compliance, and decision-making. In addition, automation also contributes to the responsiveness of the institutions to the market conditions ( $b = 0.787$ ), compliance with regulatory demands ( $b = 0.788$ ), and access to technologies ( $b = 0.812$ ), thus its leading role in bringing about the results of digital transformation. The steady significance of all the proposed hypothetical paths confirms the solidity of the model and corresponds with the theoretical background of the TOE and IDT frameworks, which pinpoints technological capability, environmental fit, and perceived benefits of innovation as the major factors of adoption.

The results provide strong empirical support for the proposed conceptual model and demonstrate that emerging technologies significantly enhance financial automation and risk management in financial institutions. Among the three technological predictors, Blockchain shows the strongest influence on Automation of Finance ( $\beta = 0.561$ ), indicating that secure, transparent, and decentralized financial processes are highly valued in Omani institutions. This suggests that financial organizations prioritize transaction security, fraud prevention, and regulatory transparency, which are critical in emerging digital economies. AI also shows a significant positive effect ( $\beta = 0.264$ ), reflecting its important role in predictive analytics, fraud detection, and automated decision-making; however, its relatively lower coefficient compared to Blockchain may indicate implementation barriers such as high cost, limited expertise, and concerns regarding explainability in regulated financial environments. CC demonstrates a moderate but significant effect ( $\beta = 0.173$ ), suggesting that while cloud infrastructure supports scalability and real-time data access, it primarily acts as an enabling platform rather than a direct strategic driver of automation.

The very strong relationship between Automation of Finance and Improved Risk Management ( $\beta = 0.827$ ) confirms that automation serves as the central mechanism through which digital transformation improves compliance, operational efficiency, and strategic decision-making. The high  $R^2$  values for Automation of Finance (0.74) and Improved Risk

Management (0.81) indicate substantial explanatory power of the model, confirming that the selected constructs effectively capture the dynamics of financial transformation. These findings strongly support both the TOE framework and IDT, where technological readiness, institutional support, and innovation acceptance collectively shape successful adoption outcomes.

**Table 7. Hypothesis Decision**

Hypothesis	Path	$\beta$	T-Statistic	p-Value	Outcome
H1	AI → Automation of Finance	0.264	5.619	0.000	Supported
H2	Blockchain → Automation of Finance	0.561	9.366	0.000	Supported
H3	Cloud Computing → Automation of Finance	0.173	3.223	0.001	Supported
H4	Automation of Finance → Improved Risk Management	0.827	31.567	0.000	Supported
H5	Automation of Finance → Market Conditions	0.787	24.759	0.000	Supported
H6	Automation of Finance → Regulations	0.788	25.410	0.000	Supported
H7	Automation of Finance → Technology Access	0.812	23.554	0.000	Supported

## 5. Discussion

The results of this paper provide useful information on how the new technologies are changing the financial procedures of an emerging economy. The findings of this study are consistent with several previous studies that emphasize the strategic importance of AI (AI), Blockchain, and CC in financial automation and risk management. The strong influence of Blockchain aligns with [70], who found that blockchain significantly improves transparency, fraud prevention, and transaction security. The stronger effect of Blockchain compared to AI in the present study may reflect the higher institutional trust placed on secure and immutable transaction systems in emerging economies such as Oman, where regulatory transparency is highly prioritized.

The moderate effect of CC is also supported by Habib et al. [71], who described cloud infrastructure as an enabling platform that improves scalability, accessibility, and real-time financial monitoring rather than acting as a direct driver of strategic transformation. Furthermore, the strong relationship between Automation of Finance and Improved Risk Management confirms the work of Pillai et al. [72], who emphasized that automated systems improve compliance, forecasting accuracy, and operational resilience. Unlike many previous studies that examined these technologies separately, the present study contributes by integrating AI, Blockchain, and CC into a single empirical framework and validating their combined effect using PLS-SEM in an emerging economy context, thereby addressing an important gap in prior literature.

Empirically validating the combined effect of AI, Blockchain, and CC on the automation of finances and reduction of risks, the study is a theoretically and practically valuable contribution to the Technology-Organization-Environment (TOE) framework and Innovation Diffusion Theory (IDT).

The theoretical novelty of this study does not stem from introducing entirely new direct relationships, but from integrating previously fragmented streams of literature into a comprehensive framework. By combining TOE and IDT perspectives, the study explains how technological complementarities and contextual environmental factors jointly influence financial automation and risk outcomes. This integrated perspective has been largely absent in prior financial technology literature.

To the best of the TOE perspective, the findings support that technological elements (e.g., perceived usefulness of AI and Blockchain), organizational preparedness (e.g., automation infrastructure), and environmental context (e.g., regulations, market conditions, and access to technology) mutually determine technology adoption. The high impact of Blockchain ( $b = 0.561$ ), in its turn, indicates that it matches the regulatory push of transparency and safety in financial transactions applied by Oman, and therefore, it can be used by institutions, which is one of the constructs that can be desired in both TOE and IDT [73].

In the IDT perspective, the importance of AI and Blockchain in automation indicates that financial institutions believe that such technologies have definite relative advantages and observability, which is essential in innovation diffusion. Nonetheless, the lesser influence of AI ( $b = 0.264$ ) than that of Blockchain can be explained by the lack of local expertise in AI development and anxiety about explainability and algorithmic silence, which can curb the use of this tool in highly regulated markets [74].

These results are similar to those of Lubis et al. [75] who indicated that there is a big gap in the empirical research that incorporates various emerging technologies. Their bibliometric analysis points to the fact that conceptual

research concerning AI and Blockchain is rising, but little research has studied how the technologies interrelate with each other in practice- particularly in governance and financial systems. Our findings contribute to that gap as they empirically prove the synergistic effect of these technologies in an emerging financial ecosystem. To the emerging economies, the results highlight the need to think of the digital transformation not as a one-off technology adoption but rather as an integrated adoption of various innovations that is influenced by specific local institutional and regulatory contexts.

The study highlights the positive impact of AI, Blockchain, and CC on finance, particularly risk management, with AI significantly automating financial activities and big data analysis, enabling financial institutions to easily evaluate large volumes of information. While AI's capabilities in financial automation are significant, its direct contribution remains moderate, playing a crucial role in improving decision-making and enhancing risk management through predictive analytics. These results align with the study of Adeyeri [76], who identified AI-driven automation in financial services as enhancing productivity, accuracy, and decision-making while addressing challenges like job displacement and privacy concerns, and Pan & Zhang [77], who showed AI's role in improving automation and data accuracy in financial reporting through machine learning and natural language processing. This article establishes that integrated research on AI and Blockchain is still very limited, which directly supports the justification for your study.

However, this capability is significant in risk management because some matters take time before they become severe complications. For instance, AI-based analytics can offer the firm instant risk profiles that can be used to immediately counteract market shifts or risks [78]. Nonetheless, AI is central to some of these solutions and, despite a relatively low overall score, has a higher score when used in conjunction with Blockchain and AI. Globalization significantly influences digital technology adoption, positively affecting transfers and spillovers, and contributing to convergence in countries undergoing significant technological changes. Advanced risk management solutions, incorporating big data and machine learning algorithms, are crucial for mitigating credit risk in financial operations through real-time monitoring, analytics, and blockchain technology [79]. Moreover, AI enhances corporate finance efficiency and decision-making through machine learning, NLP, and robotic process automation, improving governance and sustainability practices, reducing operational expenses, and simplifying repetitive tasks [80].

Blockchain plays a pivotal role in securing financial transactions and ensuring transparency, with a direct impact of 0.568 on automation. It minimizes operational risks by automating reconciliations and improving data integrity. These results align with Martinez et al. [81], who found that integrating Blockchain with AI enhances financial security and transparency through real-time fraud detection and immutable ledgers. Their studies confirm that this synergy reduces fraud and strengthens trust in financial transactions, supporting the current findings on Blockchain's significant impact on automation and risk management. Blockchain effectively minimizes operational risks since the work of reconcilers is automated, and all transactions are collected in one system. Furthermore, through the implementation of cryptocurrencies like Ethereum, one can write smart contracts and various other financial processes such as lending, trading, and conducting others [82]. Another factor whereby Etemadi et al. [83] stated that blockchain has enhanced risk management because it is built with strong security walls, is that data integrity is well secured, hence increasing confidence in the financial system.

CC sits well with these technologies, providing a flexible platform that enhances the practice of financial services [84]. Its direct impact is 0.169 because it serves as a resource that enables the optimal functioning of both AI and Blockchain. On-demand, remotely managed cloud environments allow the availability and consumption of massive data sets, as well as accommodate AI algorithms with minimal hardware limitations from physical offices. AI's direct impact on financial automation is relatively weaker. However, its role as a supportive platform for both AI and Blockchain is vital for enabling real-time data processing and scalability. In addition, Habib et al. [71] stated that AI allows financial institutions to implement Blockchain solutions more quickly and with less expense. The realisation that cloud environments offer some flexibility makes it possible for organisations to overcome market and legal hurdles, thus meet their expectations. Moreover, this was achieved even as the study established that the major innovation drivers revolve around the concepts of AI, Blockchain, and AI in the automation of finance processes in organizations. However, these elements support the automation process; they concretely mean that there should be a proper environment for the development of such technologies. This has been promoted towards innovation or hindered it by how flexible the penned regulations are to the new technologies. When financial institutions employ automation, they are faced with numerous compliance regulations, which can be very different from one country to another. It is thus crucial for regulators and financial institutions to work jointly to establish a legal environment that promotes more financial institutions to embrace advanced technologies so that the proficiency of the financial systems will not be compromised.

Market conditions also provide a strong imprint on the speed and degree of automation in the finance area [67]. During economic instability, it can be observed that organizations might want to incorporate automation technologies for effectiveness and cost-cutting. On the other hand, unfavorable market conditions may trigger

speculation, which may in turn negate augmented automation. Therefore, alerts on regional and global economic conditions are helpful, especially as financial institutions establish the best blueprints for integrating AI, Blockchain, and CC into their operations.

### 5.1. Practical Implications

The integration of AI, Blockchain, and cloud computing (CC) into financial automation carries significant practical implications for financial institutions, regulators, and stakeholders. The combination of these technologies leads to substantial cost reductions and improved operational efficiency. AI enhances decision-making and risk management through predictive analytics, while Blockchain improves the security and transparency of financial transactions. Cloud computing supports these technologies by providing flexibility and scalability, enabling financial institutions to address market and regulatory challenges more effectively. This is particularly advantageous for startups and small firms, as it helps create a more level competitive environment with larger organizations. The adoption of risk management technologies is also influenced by external factors. Market uncertainty encourages greater use of cloud-based analytics, whereas regulatory barriers such as Basel III and GDPR may hinder the deployment of AI and Blockchain technologies [85]. Similarly, unequal access to technology creates disparities in risk management capabilities among firms, an issue that has received limited attention in previous studies. Risk management is strengthened through real-time risk assessment provided by AI algorithms, as well as transparent and accountable transaction records enabled by Blockchain technology [32].

Regulatory compliance can also be improved through the development of AI-based regulatory tools that adapt to evolving regulations and through the use of Blockchain for accurate record-keeping and reporting. In addition, cloud-based financial solutions contribute to financial inclusion by improving access to financial services, supporting small businesses, and enabling innovative services such as digital lending and microloans. AI further enhances data-driven decision-making by improving analytics, enabling more accurate forecasting and strategic planning, and generating deeper customer insights, thereby increasing customer satisfaction and loyalty.

Organizations that adopt these technologies gain competitive advantages through innovation, market responsiveness, customer acquisition, and greater operational efficiency in a rapidly evolving financial environment. Financial institutions must also promote the ethical use of AI, ensure transparency regarding algorithmic bias, and implement strong data privacy and cybersecurity measures in order to maintain the trust of consumers and investors. Notably, regulatory frameworks emerge as a critical enabling factor, especially for smaller firms that face barriers to technology adoption.

Overall, AI integration in financial automation improves risk management practices, real-time analytics, and regulatory compliance. However, continuous investment in cybersecurity and the promotion of a culture of innovation remain essential for mitigating risks related to data breaches and privacy concerns while adapting to evolving market conditions and technological advancements.

## 6. Conclusion and Future Research

The integration of AI, Blockchain, and Cloud Computing (CC) in financial automation has this study examined the integrated impact of Artificial Intelligence (AI), Blockchain, and CC on financial automation and improved risk management in Omani financial institutions. Using Partial Least Squares Structural Equation Modeling (PLS-SEM) and data collected from 201 finance and IT professionals working in banks and fintech companies, the findings confirm that all three technologies significantly contribute to the automation of financial processes. Among them, Blockchain demonstrated the strongest influence, highlighting the importance of secure, transparent, and decentralized financial transactions in enhancing institutional trust and operational efficiency. AI also showed a significant positive effect by improving predictive analytics, fraud detection, and automated decision-making, while CC provided moderate but important support through scalability, real-time data access, and infrastructure flexibility. Financial automation emerged as the strongest predictor of improved risk management, confirming its central role in strengthening compliance, reducing operational risks, and improving strategic responsiveness to market and regulatory changes.

The study makes an important theoretical contribution by integrating the Technology-Organization-Environment (TOE) framework and Innovation Diffusion Theory (IDT) to explain how technological readiness, organizational capability, and environmental conditions collectively influence digital transformation in finance. Practically, the findings provide valuable guidance for financial institutions and policymakers by emphasizing the need for strategic investment in digital infrastructure, supportive regulatory frameworks, and wider access to advanced technologies, particularly for smaller firms and fintech startups. Although the study provides strong empirical evidence from an emerging economy context, it is limited by its cross-sectional design and focus on Oman, which may affect generalizability. Future research should expand to other regions, apply longitudinal approaches, and examine additional organizational and behavioral factors that may influence technology adoption and long-term risk management performance.

## 7. Declarations

### 7.1. Author Contributions

Conceptualization, A.I. and N.A.A.; methodology, A.I. and N.A.A.; software, A.I.; validation, H.A.; formal analysis, D.E.; investigation, H.A. and H.A.; resources, N.A.A.; data curation, H.A.; writing—original draft preparation, D.E., A.I., and N.A.A.; writing—review and editing, H.A.; visualization, H.A.; supervision, A.I. and N.A.A.; project administration D.E.; funding acquisition, D.E. and A.I. All authors have read and agreed to the published version of the manuscript.

### 7.2. Data Availability Statement

The data presented in this study are available in the article.

### 7.3. Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

### 7.4. Institutional Review Board Statement

This study received ethical approval from the Ethics Committee of A'Sharqiyah University (Approval Number: ASU/ UREBC/2/42). All procedures involving human participants were conducted by the ethical standards of the institutional research committee, the 1964 Declaration of Helsinki, and its later amendments or comparable ethical guidelines.

### 7.5. Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

### 7.6. Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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