Digital Transformation in Zimbabwean Commercial Banks: Harnessing Blockchain Technology for Innovation and Growth

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ABSTRACT

The global banking industry has changed due to the quick development of digital technologies, which forces financial institutions to either innovate or face obsolescence. Commercial banks in Zimbabwe are increasingly looking at digital transformation to boost productivity, enhance customer satisfaction, and spur expansion. Because of its decentralized, transparent, and safe features, blockchain technology presents special chances for commercial banks to cut expenses, simplify processes, and lower risks. To overcome issues, including low trust in financial systems, expensive transaction costs, and inefficiencies in cross-border payments, this study investigates how Zimbabwean banks might use blockchain technology in their digital transformation plans. It also emphasizes how blockchain may improve cybersecurity, facilitate new business models, and increase regulatory compliance. The study adopts a twofold approach in the analysis of results by applying both inferential and descriptive methods. Fundamental findings reveal that while blockchain adoption presents significant benefits such reducing transaction fees and reducing operational cost savings and barriers such as regulatory uncertainty, technological infrastructure gaps, and a lack of technical expertise hinder its widespread implementation. The study recommends that it's important for Zimbabwean commercial banks, policymakers, and stakeholders to harness blockchain technology effectively. These include fostering public-private partnerships, investing in capacity building, and developing clear regulatory frameworks to support innovation. By embracing blockchain, Zimbabwean banks can position themselves at the forefront of digital transformation, driving innovation and sustainable growth in the financial sector.

Keywords: Digital transformation, blockchain technology, Zimbabwean commercial banks, innovation, financial inclusion, cybersecurity, regulatory framework.

INTRODUCTION

Zimbabwean commercial banks face both significant opportunities and challenges in the ongoing transition to digital financial services. While digitalization promises streamlined operations, reduced costs, and enhanced customer experiences (Masinire *et al.*, 2023), the high costs of implementing new technologies pose a substantial hurdle. Fintech partnerships offer one avenue for mitigating these expenses (Masinire *et al.*, 2023), and within the burgeoning fintech landscape, blockchain technology holds particular promise. Although blockchain's transformative potential is recognized globally (Casey et al., 2018; Pal, Tiwari, and Behl, 2021) and its adoption is growing across Africa (Mutede, 2022), its application within the Zimbabwean banking sector remains largely unexplored. This represents a critical gap, as blockchain's inherent security and decentralized nature offer potential solutions to specific challenges facing Zimbabwean banks in the digital age. For example, the lack of trust and transparency in existing systems can hinder financial inclusion, while high transaction costs limit access to financial services for many. Blockchain, with its tamper-proof digital ledger (Yaga et al., 2019), offers a potential solution by increasing transparency and reducing reliance on

intermediaries. This study investigates the strategic integration of blockchain technology into the digital transformation of Zimbabwean commercial banks, specifically addressing the question of how blockchain can enhance security, reduce costs, and improve access to financial services. This research will contribute by providing a framework for successful blockchain implementation in the Zimbabwean context, offering practical guidance to banks seeking to leverage this technology for competitive advantage and financial inclusion.

Background of Blockchain Adoption in Zimbabwe Banking Sector

European commercial banks are undergoing a significant digital transformation, driven by factors such as heightened competition from fintech companies, evolving customer expectations, and increasing regulatory pressure (Seyedjafarrangraz, 2024). Blockchain technology, with its inherent features of immutability, transparency, and enhanced security, presents a compelling opportunity for these institutions to streamline operations, enhance efficiency, and unlock new revenue streams (Swan, 2015). Meanwhile, Africa grants a compelling case for how fintech can address the continent's financial inclusion challenges. Despite a young and rapidly growing population (median age of 19) projected to reach 1.2 billion by 2050, a significant portion remains unbanked or underserved by traditional financial institutions (Boston Consulting Group, 2023). While the World Bank's 2021 report indicates a significant increase in adult bank account ownership in Sub-Saharan Africa, reaching 49%, mobile money adoption has been a key driver in most economies.

Zimbabwe presents a compelling case study for blockchain's potential in enhancing financial services (Mutede, 2022). Reserve Bank of Zimbabwe (RBZ) has been exploring blockchain-based smart contracts to automate regulatory compliance, streamlining processes and potentially reducing operational costs. Mutede (2022) posits that blockchain has emerged as a potential solution to Zimbabwe’s currency crisis by addressing concerns related to trust and confidence. Companies such as Ecocash a leading money provider, launched a blockchain-based remittance service aimed at technology to improve efficiency and reduce costs (Nadkarni & Prugl, 2021).

The Zimbabwe banking sector is undergoing significant transformation, driven by economic forces, digital innovations, and the pervasive influence of the Internet (Global Fintech Index, 2019; IMF, 2024). Zimbabwean banks face challenges such as rising operational costs, increased vulnerability to cyberattacks on centralized systems, and difficulties in maintaining operational transparency (Musoni, Domingo, and Ogah, 2023). These challenges often stem from reliance on manual processes and cumbersome documentation, from account opening to international payments (Huria, 2019). This often involves costly intermediaries and lengthy processing times, hindering efficiency and customer satisfaction (Kabanda, 2021). To address these challenges, banks are actively exploring innovative solutions to enhance customer service, improve operational efficiency, and ensure transparency for both customers and regulators (Deloitte, 2024). Blockchain technology emerges as a promising solution with its inherent characteristics: eliminating intermediaries, maintaining an immutable record of transactions, and facilitating real-time transaction execution (World Economic Forum, 2024). By leveraging blockchain, banks can significantly reduce transaction turnaround times, minimize manual intervention, and consequently enhance customer service and satisfaction (Deloitte, 2017). While the technology holds immense promise, it is still evolving, and various regulatory and legal hurdles remain to be addressed. Against this background, this study aims to comprehensively assess the opportunities and challenges associated with the strategic integration of blockchain technology within the digital transformation journeys of Zimbabwean commercial banks.

LITERATURE REVIEW

Definition of Blockchain Technology

According to Yaga et al. (2019), Blockchains are digital records of transactions, secured using cryptography, that are shared across a network. These transactions are bundled into "blocks," each of which is cryptographically connected to the one before it, making any tampering easily detectable. This linking also makes it increasingly difficult to alter older blocks as new ones are added. Before a new block is added, it's

validated and agreed upon by the network. These new blocks are then copied across all versions of the ledger, and any discrepancies are automatically resolved according to pre-set rules.

In banking, this technology can be used for a variety of purposes. For example, it can streamline cross-border payments by reducing the need for intermediaries and speeding up processing times (Eyo-Udo et al.,2024). It can also improve Know Your Customer (KYC) processes by creating a secure and shared record of customer identities, making it easier for banks to verify customer information (Schlatt et al.,2022). Additionally, blockchain can be used to create digital currencies, or Central Bank Digital Currencies (CBDCs), which could potentially make payments more efficient and inclusive (Sethaput and Innet, 2023) However, it's important to note that blockchain is still a relatively new technology, and its widespread adoption in banking faces challenges.

Theoretical framework

The study's theoretical framework includes the Technology Acceptance Model (TAM) and the Technology-Organization-Environment (TOE). The Technology Acceptance Model emphasizes the perceived usefulness (PU) and perceived ease of use (PEOU) to use technology in the Zimbabwean banking sector to remain competitive and efficient. Moreover, the Technology-Organization-Environment (TOE) framework posits that successful technology adoption hinges on carefully considering three key contexts, such as technological and organizational factors. Commercial banks in Zimbabwe need to consider the prevailing economic environment and the availability of qualified personnel.

Technology Acceptance Model (TAM)

Davis F.D. (1989) developed the Technology Acceptance Model (TAM), which aims to predict and explain the adoption and usage of information technology. According to TAM, perceived usefulness (PU) and perceived ease of use (PEOU) are the primary determinants of an individual's intention to use technology (Davis 1989). These constructs significantly influence subsequent technology usage behaviour (Martín-García et al. 2022). TAM provides a valuable framework for understanding the factors that drive technology adoption and usage (Venkatesh,2003). This framework can be effectively applied to investigate stakeholders' attitudes and perceptions regarding the implementation of blockchain technology within the Zimbabwean banking sector. TAM builds upon the Theory of Reasoned Action (TRA) proposed by Fishbein and Ajzen (1975). TRA posits that an individual's intention to behave is influenced by their attitude towards the behaviour and subjective norms (Ajzen and Fishbein, 1975). Davis (1989) extended TRA to specifically address IT adoption, emphasizing the pivotal role of PU and PEOU as key determinants of technology acceptance.

In Zimbabwe's banking sector, stakeholders are likely to assess the usability of digital supply chain technologies by considering factors like user interface design, required training, and the accessibility of technical support (Kayikci *et al.*, 2022). Furthermore, their intention to adopt blockchain technologies will be influenced by their comprehension of the technology's features and benefits (Garg et al., 2020). Successful implementation of blockchain in Zimbabwean banking will ultimately depend on factors such as infrastructure availability, funding, and managerial support (Kayikci et al., 2022).

The Technology-Organization-Environment (TOE) Theory

The Technology-Organization-Environment (TOE) framework, developed by Tornatzky and Fleischer (1990), provides a valuable lens for understanding the complex interplay of factors that influence the adoption of technological innovations within organizations. This framework posits that successful technology adoption hinges on a careful consideration of three key contexts. Firstly, technological factors, including the technology's inherent characteristics such as complexity, compatibility, and relative advantage (Rogers, 1995), significantly influence its adoption. Secondly, organizational factors, such as internal resources, culture, and leadership support (Damanpour, 1991), play a crucial role in facilitating or hindering technology adoption within an organization. Finally, environmental factors, encompassing external influences such as industry trends, competitive pressures, and government regulations (Miles & Snow, 1978), exert considerable influence on an organization's ability and willingness to adopt new technologies.

The rise of the digital economy has significantly impacted the financial sector, necessitating a digital transformation for commercial banks to remain competitive. This digital transformation involves leveraging technology to enhance operations, introduce innovative products and services, and drive innovation (Jayawardena et al., 2023; Liu et al., 2021). Research by Zuo et al. (2023) highlights that the advent of digital finance has accelerated the strategic transition of commercial banks toward a digital business model, leading to improved operational efficiency. Furthermore, emerging technologies have facilitated the development of innovative product and service models, further enhancing efficiency (Barham et al., 2020).

Opportunities Presented by Blockchain Technology in Banking

Commercial banks in Zimbabwe can leverage opportunities that are presented by blockchain technology. Martino (2019) analyzed this duality, recognizing blockchain as a disruptive force that can create new business avenues while simultaneously posing risks to existing operations. Martino's study suggests that blockchain has the potential to significantly enhance the efficiency of banking processes, leading to improved products and services, particularly in lending, payments, and capital markets. Several key opportunities are emerging:

Enhanced Security

Blockchain's distributed ledger technology offers enhanced security through transparency and immutability, making fraudulent activities more difficult to conceal (Sankar et al., 2022). Its cryptographic algorithms provide robust protection against cyberattacks, significantly reducing the risk of data breaches and unauthorized access (Wylde et al., 2022). Rathore (2019) observes that blockchain's decentralized structure enhances its resilience against cyberattacks and unauthorized data modifications. By eliminating reliance on a central authority and employing robust cryptographic algorithms, blockchain safeguards data, providing increased assurance in the protection of sensitive information. Ahmad and David (2024) further emphasize that blockchain enhances security by distributing data across a network of nodes, creating an immutable and transparent record of transactions. This decentralized structure mitigates risks associated with centralized systems while cryptographic algorithms and consensus mechanisms ensure data integrity. Blockchain facilitates secure data sharing, strengthens identity verification, and enhances compliance through immutable audit trails, contributing to more resilient market infrastructures (Ahmad and David, 2024). However, it is crucial to consider regulatory requirements surrounding data privacy and protection to ensure compliance (Han et al., 2023).

Cross-Border Payments

Blockchain has the potential to revolutionize cross-border payments. A World Bank report (2018) estimated that blockchain-based solutions could save Zimbabwe up to $90 million annually by significantly reducing remittance costs. By facilitating direct peer-to-peer transactions, blockchain technology can minimize intermediaries, reducing transaction fees and settlement times (Al-Saedi & Almaliki, 2023). The instantaneous settlement capabilities of blockchain can also significantly accelerate cross-border payment processes, enhancing liquidity management for banks (Agarwal et al., 2023). However, compliance with international regulations, such as AML and KYC standards, remains critical for successful implementation (Hashem et al., 2023).

Financial Inclusion

Schuetz and Venkatesh (2020) explored blockchain's impact on financial inclusion in India, suggesting that it can address barriers like limited geographical access, high costs, and unsuitable banking products. They concluded that blockchain can connect rural communities to local and global supply chains, overcoming challenges that have hindered previous financial inclusion efforts. Manyerere (2020) emphasizes blockchain's potential to enhance financial inclusion in Zimbabwe, where a significant portion of the population remains unbanked. By facilitating mobile banking services, blockchain can extend financial access to remote and underserved communities (Wei et al., 2020). Blockchain-based digital identity solutions offer secure verification mechanisms, enabling individuals without traditional identification to access financial services.

However, challenges like limited infrastructure and low digital literacy in rural areas necessitate targeted education and awareness programs (Sankar et al., 2022).

Smart Contracts

Smart contracts offer several advantages over traditional contracts. Executed and secured within the blockchain, they reduce transaction risk, lower administrative costs, and improve business process efficiency (Zheng et al., 2020). For example, smart contracts can automate loan disbursements based on pre-set conditions, streamlining processes and cutting operational costs (Mahtani, 2022). They also enable the automated execution of trade finance agreements, reducing paperwork and manual errors. Taherdoost (2023) emphasizes that the decentralized, self-executing, and verifiable nature of smart contracts allows encoded business rules to be enforced within a peer-to-peer network, eliminating the need for a central authority. Despite this potential, challenges remain, including limited data processing capacity, a lack of robust management tools and development languages, and insufficient vulnerability scanning techniques (Beck et al., 2018). Concerns also exist around maintainability, security vulnerabilities, and the need for further development of the legal framework governing smart contracts (Beck et al., 2018).

Supply Chain Finance

Blockchain technology offers significant potential for enhancing supply chain finance. Ioannou and Demirel (2022) emphasize its ability to reduce inefficiencies and increase transparency among stakeholders. This is corroborated by Parmoodeh et al. (2023), who found that blockchain's transparent and immutable records enhance traceability and accountability, effectively mitigating fraud and counterfeiting. However, widespread adoption and seamless integration with existing supply chain management systems hinge on the development and implementation of interoperability standards (Mahtani, 2022).

Challenges of Blockchain Implementation in Banking

Despite the potential benefits of blockchain technology, commercial banks face significant challenges in its adoption, particularly in contexts like Zimbabwe, due to regulatory uncertainty and compliance requirements (Matskiv et al., 2023). This is echoed by Bai, Liu, and Yeo (2022), whose case study of a Chinese state-owned enterprise revealed technological, operational, and other hurdles to blockchain implementation. These hurdles span several key areas:

Technological Challenges

Several technological barriers impede blockchain adoption. Bai, Liu, and Yeo (2022) identified framework selection, cross-chain interoperability, scalability, resilience, and data governance as key technological challenges. In 2017, the landscape of blockchain platforms was diverse, with options like Bitcoin, the Enterprise Ethereum Alliance (EEA), Quorum, and Hyperledger, each offering distinct functionalities (Bai, Liu, and Yeo, 2022). While Bitcoin, the original cryptocurrency blockchain, provides a public, double-spend-proof environment (Bandara et al., 2023), its limited transaction speed and lack of smart contract support restrict its applicability. Choosing the right framework requires careful consideration of specific application needs. Bai, Liu, and Yeo (2022) encountered difficulties in this selection process, as blockchain implementation in areas like supply chains was still nascent, lacking a universally accepted standard or widely integrated framework. Predicting the dominant framework was challenging, given the potential for newer frameworks to emerge and displace existing ones.

Hashimzai and Ahmadzai (2024) observed that popular systems like Bitcoin and Ethereum lack the necessary throughput, a point echoed by Alam et al. (2021), who emphasize the need for platforms capable of reliably handling these high volumes. Chang et al. (2020) further illustrate this disparity, noting the stark difference between traditional financial systems like Visa (24,000 transactions per second) and PayPal (193 transactions per second) compared to Ethereum and Bitcoin (20 transactions per second). This fundamental constraint stems from limited block sizes, forcing miners to prioritize high-fee transactions and often delaying or neglecting smaller ones. Effectively integrating blockchain into banking requires bridging the gap between existing

legacy systems and these new technologies, a crucial step for realizing its potential. Solutions like layer-2 protocols or sharding, as suggested by Cocco, Pinna, and Marchesi (2017), may offer pathways to address these scalability issues.

Dicuonzo et al. (2021) identified security, privacy, and cultural acceptance as key concerns for banks considering blockchain during the COVID-19 pandemic. Hashem et al. (2023) reinforce these concerns, suggesting that anxieties surrounding data privacy and cybersecurity may deter wider adoption until regulatory clarity is established. While blockchain's transparency is beneficial for transaction verification (Javaid et al., 2022), it also raises privacy concerns due to the public nature of potentially sensitive client data (Hashimzai and Ahmadzai, 2024). Banks must balance transparency with customer privacy, potentially through techniques like zero-knowledge proofs and private blockchain networks (Konkin and Zapechnikov, 2021).

Regulatory Hurdles

Parmoodeh et al. (2023) highlight that ambiguous or nonexistent regulations surrounding blockchain in banking create uncertainty, inhibiting investment and innovation. Compliance with Anti-Money Laundering (AML) and Know Your Customer (KYC) regulations on blockchain platforms presents unique challenges due to pseudonymity and decentralization (Mahtani, 2022). The immature regulatory environment also affects organizations' willingness to adopt blockchain (Bai, Liu, and Yeo, 2022). Proactive engagement with regulators is essential to advocate for supportive frameworks and address regulatory concerns (Lombardi et al., 2022).

Organizational Challenges

Blockchain implementation can lead to job displacement due to automation (Bai, Liu, and Yeo, 2022). However, it also requires significant investment in resources and expertise, including staff training and acquiring specialized talent (Mahtani, 2022). Bridging the skills gap necessitates investment in training programs and educational initiatives (Shcherbakov et al., 2020), and collaborations with universities and technical institutions can help develop a talent pipeline (Matskiv et al., 2023). Furthermore, blockchain implementation requires adjustments to established financial processes and often necessitates modifications or replacements of existing information management systems, particularly those handling external interactions (Bai, Liu, and Yeo, 2022). This necessitates retraining employees, leading to significant training expenses and a potentially lengthy learning curve. Existing investments in traditional systems also create sunk costs, resulting in a considerable run-in period for new blockchain-based systems.

Operational Challenges

The complex and interconnected ecosystem of the banking sector presents operational challenges (Hashimzai and Ahmadzai, 2024). While blockchain platforms can operate as independent ledgers (Bhatia, 2020), this isolation can be problematic for banks. Interoperability between different ledgers, including legacy systems, is crucial for seamless transactions and data sharing (Sankar et al, 2022). Establishing common protocols and interoperability standards is essential (Lombardi et al., 2022), but overcoming the technical, regulatory, and governance challenges associated with this is crucial (Al-Saedi and Almaliki, 2023). Implementing standardization and interoperability frameworks can facilitate the integration of blockchain with existing systems (Duy et al., 2018).

According to Chang et al (2020), while Visa handles 24,000 transactions per second, PayPal handles 193 transactions per second, whereas Ethereum and Bitcoin can only handle 20 transactions per second. It indicates that the requirement to conduct millions of transactions quickly cannot be met. The reason is due to the limited capacity of blocks, which causes miners to frequently delay minor transactions over those with relatively high fees. The amount of computing power required to operate blockchain is rapidly expanding. The infrastructure supporting Bitcoin uses a significant amount of electricity. The amount of power that is needed for a single Bitcoin transaction is equal to one terawatt-hour.

METHODOLOGY

This study adopts a mixed-method approach, which blends both quantitative and qualitative data. Damayanov (2023) posits that mixed methods allow for a more thorough exploration of a research framework. Secondary data was analyzed through document analysis, case studies of blockchain implementations, and industry trends analysis. The study identifies both opportunities and challenges. Meanwhile, the study also collected primary data using convenience sampling technique across the banking sector. A validated questionnaire was used to since much of the information sought needed a considered response and reference to records and collected in a standardized way. Interviews were also conducted on a small number of key respondents to collect comprehensive facts to enable proper analysis of a problem. A representative sample of 150 respondents was selected from commercial bank management, representatives of banking sector (BAZ), RBZ and the Ministry of Finance and Economic Development using a descriptive research design. Consequently, descriptive research provided valuable insights, a detailed description, and a solid foundation for further research. Its ability to provide in-depth understanding and serve as a stepping stone for future research made it a valuable and applicable method for this study (Nyathi & Chikwala, 2024).

The study adopts a twin approach in the analysis of data by using both descriptive and inferential methods. It starts by looking at inferential statistics and then focuses on descriptive measures. A multiple regression is used to model the relationship between level of investment in blockchain R&D and transaction fees, volume of transactions processed via blockchain, operational cost savings and staff productivity. In this test the change in investment in blockchain R&D (I) is regressed against transaction fees (Tf), volume of transactions processed via blockchain (TC), operational cost savings (CS) and staff productivity (SP) in the following model at 5%.

$$I = \beta_0 + \beta_1 Tf + \beta_2 TC + \beta_3 CS + \beta_4 SP + \mu \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots 1$$

$H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$ [there is no relationship between incremental investment in the use blockchain R &D and volume of transactions processed via blockchain, operational cost savings and staff productivity.

H_1: Not all slope coefficients are simultaneously zero [there is a relationship between investment in blockchain R&D and at least one of the determinant factors.]

RESULTS AND DISCUSSION

Inferential results

Table 1: Model Summary

Multiple R	R Square	Adjusted R Square
0.958	0.919	0.882

The results indicate that there is a valid relationship between the relationship between level of investment in blockchain R&D and transaction fees, volume of transactions processed via blockchain, operational cost savings and staff productivity. Since the p value is less that 5% we conclude that the model as a whole is significant and valid. Tables 2 and 3 below show the ANOVA table and the standardized coefficients for the independent variables.

The study shows that transactional fees and operational cost savings are very strong predictors of the level of investment in blockchain R&D with a significance of 0.000 whilst volume of transactions and staff productivity show a valid but weak relationship with level of investment in blockchain R&D.

Table 2: Anova

	Sum of Squares	df	Mean Square	F	Sig.
Regression	31.015	10	3.031	25.835	.000
Residual	2.685	22	.122		
Total	33.000	32			

Table 3: Coefficient

	Beta	Std Error	df	F	Sig
Transaction fees	0.465	0.098	2	22.494	0.000
Volume of transactions	0.165	0.077	3	14.635	0.001
Operational cost savings	-0.291	0.076	2	10.583	0.000
Staff productivity	0.125	0.080	2	4.634	0.07

Transaction fees has a beta of 0.465 with a p value of 0.000 confirming the importance of adopting new technology to cut transaction fees for banking activities. This result justifies the general sentiment that the adoption of blockchain technology tremendously cut transaction fees as transactions are streamlined.

Volume of transactions has a beta of 0.165 with a p-value of 0,001 significant at 5%. Its significance was driven by fact that blockchain initiative lower transactions fees which lower banking clients to increase transactional activities on the platform.

Meanwhile, operational cost savings posted a negative beta of -0,291 as well as a strong p – value of 0,000 indicating that the adoption of blockchain technology streamlined operational cost savings through streamlining processes, increasing efficiency and reducing reconciliation costs. Majority of banks in Zimbabwe reported that the technology has also improved their profitability margins through increased revenue streams, improved risk management as well as enhancing customer experience.

Staff productivity was beta of 0,125 with a significance of 0,07. The researchers conclude that in most developing countries such as Zimbabwe adoption of blockchain technology is evolving and the banking sector still requires guidelines to support adoptions. Moreso, the banking sector could face skills gap. Therefore for blockchain technology to be fully incorporated there is need for investments in training and education

Descriptive results

The study will use the thematic approach to establish themes and analyze and interpret the data. Data was collected using semi-structured interviews. The study targeted bank managers, customer liaison officers, BAZ representatives, the Ministry of Finance & Economic Development, and RBZ officials. For banks to remain competitive and offer world-class services and products, there is a need for the adoption of client best practices such as blockchain technology.

Opportunities Presented to Commercial Banks by Implementing Blockchain Technology

The inherent decentralized nature of blockchain, along with its cryptographic algorithms, significantly boosts security and transparency in financial transactions. This makes the banking experience more dependable and secure for customers. As **Participant P1** noted, "*improved traceability through a blockchain-based asset management system led to a 15% increase in customer satisfaction and confidence for Steward Bank*, a Zimbabwean institution*"*. This aligns with Wylde et al. (2022), who found that blockchain's robust cryptographic protection significantly reduces cyberattack risks and data breaches. **Participant P7** from the Bankers Association of Zimbabwe highlighted a substantial financial benefit, stating that "*financial institutions*

could save up to USD 31 billion by 2024 by preventing fraud through blockchain-based transaction verification". This substantial cost saving and enhanced trust are supported by Sankar et al. (2022) and Ahmad and David (2024), who emphasize that blockchain's distributed ledger technology enhances security through its transparency and immutability, making fraudulent activities more difficult to conceal. Widespread adoption could lead to significant reductions in fraud-related losses and a notable increase in client trust.

Blockchain technology offers significant opportunities to streamline banking operations and achieve substantial cost reductions. **Participant P5** emphasized blockchain's transformative potential in trade finance, noting that "*by providing a secure and transparent platform, it enables more effective transactions. Specifically, joining networks like the blockchain-based Marco Polo Network allowed banks to expedite trade operations, reducing the letter-of-credit issuance period from ten days to one"*. These findings are consistent with Alam et al. (2023), who demonstrated blockchain's ability to facilitate peer-to-peer connections, and Al-Saedi and Almaliki (2023), who found it minimizes intermediaries, thereby reducing transaction fees and settlement times.

Participant P3 highlighted blockchain's potential to revolutionize customer onboarding and compliance by streamlining Know Your Customer (KYC) procedures. "*Using blockchain for KYC can cut compliance expenses by as much as 50% and reduce the time needed for client onboarding from weeks to days, significantly increasing customer acquisition rates"*.

Participant P10 underscored blockchain's potential to lower transaction costs and accelerate financial services, thereby increasing banking effectiveness and accessibility. This is particularly impactful for cross-border transactions, where blockchain offers a more cost-effective alternative to conventional methods. For instance, while the World Bank (2018) reported average remittance costs of 6.8%, blockchain technologies could potentially reduce this to less than 3%. This aligns with Schuetz and Venkatesh (2020) and Wei et al. (2020), whose studies in India showed that blockchain can address barriers like limited geographical access and high costs, connecting rural and underserved communities to financial systems.

Blockchain also facilitates the development of novel financial products and services, creating new revenue streams for commercial banks. **Participant P2** noted that "*blockchain can facilitate the development of smart contracts and DeFi systems, creating new revenue streams. This offering has increased loan revenues by fifteen percent by attracting new clients".* This finding aligns with Mahtani (2022), who demonstrated that smart contracts can automate loan disbursements based on pre-set conditions, streamlining processes and reducing operational costs.

The digital transformation brought by blockchain, particularly through cryptocurrencies, can bolster the banking industry in Zimbabwe, especially as the country faces liquidity challenges. Cryptocurrencies can be used for external payments, as indicated by companies like BeForward accepting Bitcoins. **Participant P53** acknowledged the bright future for digital currencies but also highlighted the inherent risk due to their decentralized nature and lack of regulatory authority. The Reserve Bank of Zimbabwe (RBZ) further postulates that blockchain technology can enhance digital transactions in the local economy. A key development is the RBZ's collaboration with Uhuru Innovative Solutions, leveraging the Stellar blockchain for a WhatsApp-based payment solution called Uhuru Wallet. This initiative offers significant opportunities for financial inclusion and efficient cross-border transactions, particularly for unbanked Zimbabweans and undocumented migrants. Subject to KYC verification, users can make diverse payments and access a secure and potentially cost-effective remittance channel for the estimated three million Zimbabweans in South Africa (MPS, 2025). The platform's underlying blockchain technology provides enhanced transparency and real-time monitoring capabilities for regulators, ensuring security and fostering trust

Challenges faced by Zimbabwe's Commercial Banks in implementing Blockchain Technology

Figure 3 below illustrates the various challenges encountered by commercial banks when implementing blockchain technology. A significant 20% of respondents identified both technological and knowledge gaps and regulatory complexities and requirements as major impediments, respectively, highlighting the struggle banks face in acquiring the necessary expertise and navigating the existing regulatory frameworks, which may

not be adequately equipped to handle the unique aspects of blockchain. A considerable proportion of commercial banks (17.78%) also reported increased competition as a major challenge. Limited access to resources and finance poses a critical challenge for 14.44% of commercial banks. Finally, while less prominent, brain drain (6.67%) and cultural and language barriers (4.44%) also presented challenges.

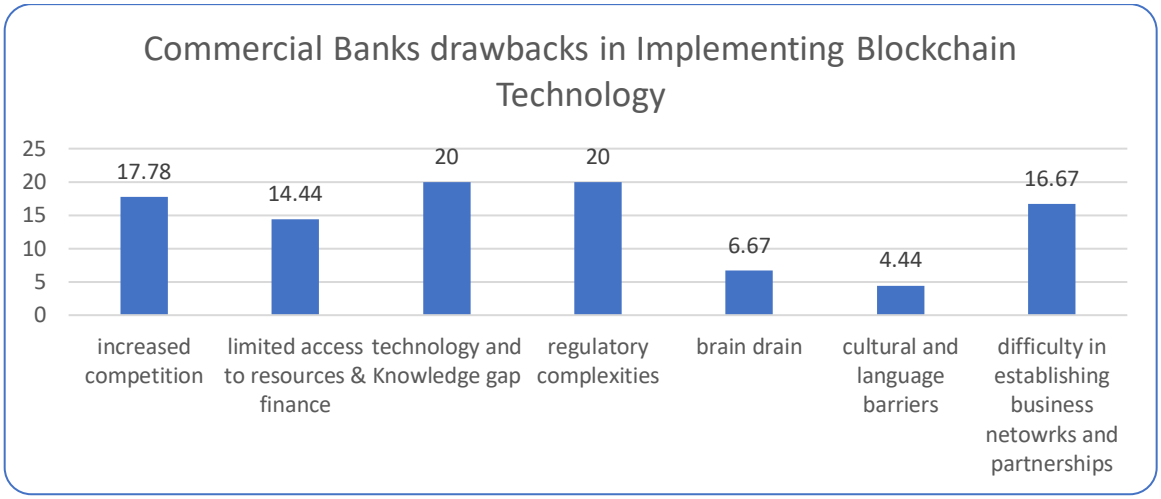

Figure 2: **Challenges experienced by Commercial Banks in Zimbabwe as they Implement Blockchain Technology.**

Source: Primary Survey, 2024

A primary challenge identified is the lack of appropriate skills and technical know-how within local banks. "*The rapid pace of technological change makes it difficult for these institutions to continuously upgrade equipment and systems"*, as highlighted by **Participant P30**. This necessitates upskilling existing employees or hiring new talent, but domestic banks often lack the financial resources for adequate training and development opportunities, a finding consistent with Mahtani (2022). Furthermore, there is a critical misalignment between the skills produced by the local education system and the specialized demands of emerging technologies such as blockchain. This results in a significant talent gap, impeding banks' ability to effectively utilize these technologies and attract professionals in areas like blockchain development, cybersecurity, and data analytics. *"The country's prolonged economic underperformance has exacerbated this issue, contributing to brain drain and a shortage of banking technocrats"*, which **Participant P50** noted leads to sluggish blockchain implementation due to a lack of skilled personnel and well-defined business networks.

The absence of a comprehensive legal framework governing blockchain technology presents a significant challenge to its adoption. This lack of explicit guidance from regulatory bodies, particularly the Reserve Bank of Zimbabwe (RBZ), creates considerable ambiguity. **Participant P24** specifically cited the RBZ's 2018 decree forbidding financial institutions from handling cryptocurrency, which confused the permissible use of blockchain-based solutions. This uncertainty aligns with Bai, Liu, and Yeo (2022), who emphasize that an immature regulatory environment significantly affects an organization's willingness to adopt blockchain. The RBZ's 2017 circular, issued by Registrar Norman Mataruka, imposed a complete ban on cryptocurrency transactions for local financial institutions, citing concerns about illicit activities and their non-legal tender status.

Beyond outright prohibitions, banks face considerable regulatory challenges in adhering to existing Know Your Customer (KYC) and Anti-Money Laundering (AML) requirements. **Participant P8** explained that, *"blockchain's decentralized and pseudonymous characteristics complicate the enforcement of these crucial legal obligations, especially as Zimbabwe complies with FATF standards"*. This concern is consistent with Mahtani (2022), who notes the unique challenges of AML and KYC compliance on blockchain platforms. While blockchain offers streamlining benefits for KYC, its successful implementation hinges on addressing these regulatory complexities and establishing clear frameworks that navigate pseudonymity and decentralization. Recognizing this complexity, the RBZ has adopted a collaborative approach, evidenced by

the formation of a National Fintech Steering Committee and an Interagency Fintech Working Group in 2019, indicating a commitment to a coordinated regulatory framework for emerging financial technologies.

Local commercial banks also grapple with inadequate physical and digital infrastructure, such as unreliable internet access and insufficient electrical systems, which are essential for the efficient operation of blockchain networks. This deficiency creates substantial barriers to adopting innovative financial technologies.

Moreover, the study reveals that the majority of commercial banks face significant challenges in accessing capital, largely due to country-specific risks and a non-performing economy. **Participant P17** alluded to obstacles in securing financing from funders who have a preference for providing capital to foreign enterprises over domestic banks due to liquidity risks. **Participant P32** confirmed that *"foreign-owned banks in Zimbabwe have easier access to capital compared to local banks"*. This disparity means commercial banks without foreign holdings often face less favorable loan terms, hindering their growth and competitiveness, as noted by Thompson et al. (2015).

The Zimbabwean banking sector faces increased competition from foreign firms, which often possess superior technology and financial resources. **Participant P9** noted that *"the greater efficiency and productivity of foreign firms pressure local banks to innovate and improve"*. This intense competition, highlighted by Thompson and Zang (2015) and OECD (2015), has led to local banks losing market share and being forced to adjust pricing, often resulting in reduced profit margins. **Participant P34** indicated a shift to niche markets and specialized products for differentiation, while **Participant P22** revealed that *"the need to compete primarily on price makes it difficult to invest in quality improvements, technology upgrades, and expansion"*.

Finally, commercial banks are experiencing difficulties in establishing robust business networks and partnerships, alongside enduring cultural and language barriers, all of which impede the adoption of new, efficient technologies. These systemic challenges, compounded by the economic climate, underscore the critical need for banks to address these foundational issues to accelerate technological advancement.

CONCLUSION

In conclusion, the blockchain technology adoption path is at a key juncture, with both enormous opportunities and significant hurdles. The revolutionary potential of new digital technologies like blockchain to advance financial inclusion and economic prosperity requires coordinated and deliberate initiatives from all stakeholders (Arner et al., 2022). Policymakers, financial institutions, and communities must collaborate to overcome infrastructural constraints and regulatory uncertainty. By embracing adaptable regulatory frameworks, investing in digital infrastructure, promoting financial literacy, fostering international partnerships, and supporting innovation, Africa may position itself as a leader in the global digital financial ecosystem. The road ahead demands a collaborative commitment to realizing the full potential of blockchain technology for the continent's sustainable economic development and financial inclusion. Henceforth, because of the opportunities present by blockchain technology, the study makes the following recommendations that will overturn the challenges that are brought about by the model.

1. To achieve speedier procedures in digital banking, banks must spend more on sturdy and dependable systems to minimize the number of failed transactions and transactional mistakes in ATMs.
2. Banks must develop an application that can be utilized to strengthen digital banking while being safe and private to improve operations, availability, and accessibility.
3. There is an additional requirement to improve ICT skills so that technology may be welcomed. ICT skills may be influenced through a combined effort with educational institutions, with banks training persons, and cooperating in the evolving world of financial technology.
4. The consequences of these results are significant for politicians, financial institutions, and others interested in Africa's economic growth. Policymakers must actively participate in international conversations, pursuing regulatory harmonization that balances innovation and risk reduction. Financial institutions must embrace digital currencies' revolutionary potential, seeking strategic alliances and new solutions to meet African-specific concerns. Stakeholders, including local communities, companies,

and educational institutions, play an important role in increasing trust, understanding, and adoption of digital currencies.

5. Policymakers should prioritize the creation of adaptable regulatory frameworks that give both clarity and flexibility. These frameworks should promote innovation, safeguard customers, and handle issues like fraud and illegal activity. Collaboration with global regulatory authorities and industry stakeholders can help create regulatory standards that address Africa's particular issues and potential. Governments, in partnership with private sector companies and international organizations, should prioritize investments in digital infrastructure.
6. Improving internet connectivity and cell network coverage is critical to guaranteeing widespread acceptance of digital currencies, especially in distant and disadvantaged areas. Strategic programs that promote technology literacy can enable communities to fully engage in the digital financial ecosystem. Financial institutions, governments, and community organizations should launch comprehensive financial literacy and awareness initiatives.
7. Educating the public on the benefits, hazards, and practical uses of digital currencies leads to a more knowledgeable and receptive user base. Tailoring educational programs to meet cultural subtleties and language variety guarantees that the material reaches all parts of society.
8. African governments and financial institutions should engage in international cooperation and cross-border projects. Collaboration with global organizations may give useful insights, facilitate information sharing, and help to build best practices. Strengthening relations with adjacent nations and regional partners makes it easier to integrate digital currencies into cross-border transactions and trade settlements.

Future Research

According to the data, accessibility to digital banking is only considered for people who are regarded as physically healthy in society. Research should be conducted to investigate the effects of digital banking accessibility among people with impairments. Since blockchain technology is decentralized, it can guarantee that accessibility features are integrated into digital financial services' basic architecture, reducing the likelihood of modifications or omissions. Processes may be automated with smart contracts, which also guarantee continuous use of accessibility features. A smart contract may, for instance, give audio explanations or automatically change text sizes in response to user preferences or impairments that are identified. Sensitive financial information may be safeguarded by blockchain's security features, allowing those with disabilities to access digital banking services without fear of fraud or data breaches. Regardless of the bank or device they use, blockchain can make it easier for users with impairments to access their accounts and services by facilitating interoperability across various digital banking systems.

Future research could also explore specific use cases of blockchain-based remittance platforms in diverse geographical contexts. Investigating the adoption rates and impact on financial inclusion within specific rural communities would provide valuable insights into the real-world effectiveness of these technologies. Additionally, examining the regulatory frameworks and infrastructure requirements necessary for successful implementation would contribute to a more comprehensive understanding of blockchain's potential to bridge financial access gaps

REFERENCES

1. Agarwal, N., Wongthongtham, P., Khairwal, N. and Coutinho, K., 2023. Blockchain application to financial market clearing and settlement systems. Journal of Risk and Financial Management, 16(10), p.452.
2. Ahmad, N. and David, J., 2024. Leveraging Blockchain Technology for Enhanced Data Security in Financial Institutions: A Shield Against Cyber Attacks and Financial Market Disruptions.
3. Ajzen, I. and Fishbein, M., 1975. A Bayesian analysis of attribution processes. Psychological Bulletin, 82(2), p.261.
4. Alam, S., Shuaib, M., Khan, W.Z., Garg, S., Kaddoum, G., Hossain, M.S. and Zikria, Y.B., 2021. Blockchain-based initiatives: current state and challenges. Computer Networks, 198, p.108395.

5. Arner, D.W., Castellano, G.G. and Selga, E.K., 2022. Financial Data Governance. *Hastings LJ*, *74*, p.235.
6. Bai, Y., Liu, Y. and Yeo, W.M., 2022. Supply chain finance: What are the challenges in the adoption of blockchain technology? Journal of Digital Economy, 1(3), pp.153-165.
7. Bandara, E., Liang, X., Shetty, S., Mukkamala, R., Foytik, P., Ranasinghe, N. and De Zoysa, K., 2023. Octopus: privacy-preserving peer-to-peer transactions system with InterPlanetary file system (IPFS). International Journal of Information Security, 22(3), pp.591-609.
8. Barham, H., Dabic, M., Daim, T. and Shifrer, D., 2020. The role of management support for the implementation of open innovation practices in firms. *Technology in Society*, *63*, p.101282.
9. Beck, R., Müller-Bloch, C. and King, J.L., 2018. Governance in the blockchain economy: A framework and research agenda. *Journal of the Association for Information Systems*, *19*(10), p.1.
10. Bhatia, R., 2020, October. Interoperability solutions for blockchain. In 2020 international conference on smart technologies in computing, electrical and electronics (ICSTCEE) (pp. 381-385). IEEE.
11. Boston Consulting Group, 2023. Unlocking the FinTech Potential https://web-assets.bcg.com/ce/d8/c0f576bc42968d376aba70ce8136/unlocking-the-fintech-potential-in-africa.pdf
12. Casey, M., Crane, J., Gensler, G., Johnson, S. and Narula, N., 2018. The impact of blockchain technology on finance: A catalyst for change.
13. Chang, V., Baudier, P., Zhang, H., Xu, Q., Zhang, J. and Arami, M., 2020. How Blockchain can impact financial services–The overview, challenges, and recommendations from expert interviewees. Technological forecasting and social change, 158, p.120166.
14. Cocco, L., Pinna, A. and Marchesi, M., 2017. Banking on blockchain: Costs savings thanks to blockchain technology. Future Internet, 9(3), p.25.
15. Damanpour, F., 1991. Global banking: developments in the market structure and activities of foreign banks in the United States. Columbia Journal of World Business, 26(3), pp.58-70.
16. Davis, F.D., 1989. Technology acceptance model: TAM. Al-Suqri, MN, Al-Aufi, AS: Information Seeking Behavior and Technology Adoption, 205(219), p.5.
17. Deloitte Global Banking Outlook 2024. https://www2.deloitte.com/us/en/insights/industry/financial-services/financial-services-industry-outlooks/banking-industry-outlook-2024.html
18. Deloitte, (2024). 2024 banking and capital markets outlook. https://www2.deloitte.com/us/en/insights/industry/financial-services/financial-services-industry-outlooks/banking-industry-outlook-2024.html
19. Deloitte,(2017).Blockchaininbanking.chromeextension://efaidnbmnnnibpcajpcglclefindmkaj/https://www2.deloitte.com/content/dam/Deloitte/in/Documents/strategy/in-strategy-innovation-blockchain-in-banking-noexp.pdf
20. Dicuonzo, G., Donofrio, F., Fusco, A. and Dell'Atti, V., 2021. Blockchain technology: Opportunities and challenges for small and large banks during COVID-19. International Journal of Innovation and Technology Management, 18(04), p.2140001.
21. Duy, P.T., Hien, D.T.T., Hien, D.H. and Pham, V.H., 2018, December. A survey on opportunities and challenges of Blockchain technology adoption for revolutionary innovation. In Proceedings of the 9th International Symposium on Information and Communication Technology (pp. 200-207).
22. Eyo-Udo, N.L., Agho, M.O., Onukwulu, E.C., Sule, A.K., Azubuike, C., Nigeria, L. and Nigeria, P., 2024. Advances in Blockchain Solutions for Secure and Efficient Cross-Border Payment Systems. *International Journal of Research and Innovation in Applied Science*, *9*(12), pp.536-563.
23. Garg, P., Gupta, B., Chauhan, A.K., Sivarajah, U., Gupta, S. and Modgil, S., 2021. Measuring the perceived benefits of implementing blockchain technology in the banking sector. *Technological forecasting and social change*, *163*, p.120407.
24. Global Fintech Index, (2019**),** Digital Transformation Core to Boosting Zimbabwe's Economy, Improving Services
25. Han, H., Shiwakoti, R.K., Jarvis, R., Mordi, C. and Botchie, D., 2023. Accounting and auditing with blockchain technology and artificial Intelligence: A literature review. *International Journal of Accounting Information Systems*, *48*, p.100598.
26. Hashem, R.E.E.D.R., Mubarak, A.R.I. and Abu-Musa, A.A.E.S., 2023. The impact of blockchain technology on audit process quality: an empirical study on the banking sector. *International Journal of Auditing and Accounting Studies*, *5*(1), pp.87-118.

27. Hashimzai, I.A. and Ahmadzai, M.Z., 2024. Navigating the Integration of Blockchain Technology in Banking: Opportunities and Challenges. International Journal Software Engineering and Computer Science (IJSECS), 4(2), pp.665-679. https://www.weforum.org/stories/2024/01/blockchain-change-world-finance-stablecoins-internet/ https://www.worldbank.org/en/news/press-release/2021/05/27/digital-transformation-core-to-boosting-zimbabwe-s-economy-improving-services
28. Ioannou, I. and Demirel, G., 2022. Blockchain and supply chain finance: a critical literature review at the intersection of operations, finance, and law. Journal of Banking and Financial Technology, 6(1), pp.83-107.
29. Javaid, M., Haleem, A., Singh, R.P., Suman, R. and Khan, S., 2022. A review of Blockchain Technology applications for financial services. BenchCouncil Transactions on Benchmarks, Standards and Evaluations, 2(3), p.100073.
30. Jayawardena, C., Ahmad, A., Valeri, M. and Jaharadak, A.A., 2023. Technology acceptance antecedents in digital transformation in the hospitality industry. *International Journal of Hospitality Management*, *108*, p.103350.
31. JPMorgan Chase: https://www.jpmorgan.com/kinexys/labs
32. Kabanda, G., 2021. Cybersecurity risk management plan for a blockchain application model. *Trans Eng Comput Sci*, *2*(1), p.221.
33. Kayikci, Y., Gozacan-Chase, N., Rejeb, A. and Mathiyazhagan, K., 2022. Critical success factors for implementing blockchain-based circular supply chain. *Business strategy and the environment*, *31*(7), pp.3595-3615.
34. Konkin, A. and Zapechnikov, S., 2021. Privacy methods and zero-knowledge poof for corporate blockchain. Procedia Computer Science, 190, pp.471-478.
35. Liang, X., Konstantinou, C., Shetty, S., Bandara, E. and Sun, R., 2023. Decentralizing cyber-physical systems for resilience: An innovative case study from a cybersecurity perspective. Computers & Security, 124, p.102953.
36. Lombardi, R., de Villiers, C., Moscariello, N. and Pizzo, M., 2022. The disruption of blockchain in auditing–a systematic literature review and an agenda for future research. *Accounting, Auditing & Accountability Journal*, *35*(7), pp.1534-1565.
37. Mahtani, U.S., 2022. Fraudulent practices and blockchain accounting systems. *Journal of Accounting, Ethics & Public Policy, JAEPP*, *23*(1), pp.97-97.
38. Martín-García, A.V., Redolat, R. and Pinazo-Hernandis, S., 2022. Factors influencing intention to technological use in older adults. The TAM model application. Research on Aging, 44(7-8), pp.573-588.
39. Martino, P., 2019. Blockchain technology: Challenges and opportunities for banks. International Journal of Financial Innovation in Banking, 2(4), pp.314-333.
40. Masinire, E., Dzimba, E. and van der Poll, J.A., 2023, July. Digital Transformation and its Impact on Customer Service in Traditional Banks: A Case Study of a Zimbabwean Commercial Bank. In 2023 Congress in Computer Science, Computer Engineering, & Applied Computing (CSCE) (pp. 685-692). IEEE.
41. Matskiv, H., Smirnova, I., Malikova, A., Puhachenko, O. and Dubinina, M., 2023. The Application of Blockchain Technology in Accounting and Auditing: Experience of Ukraine and Kazakhstan. Financial & Credit Activity: Problems of Theory & Practice, 1(48).
42. Musoni, M., Domingo, E. and Ogah, E., 2023. Digital ID systems in Africa: Challenges, risks and opportunities.
43. Mutede, A., A Case of Zimbabwe.
44. Nadkarni, S. and Prügl, R., 2021. Digital transformation: a review, synthesis, and opportunities for future research. Management Review Quarterly, 71, pp.233-341.
45. Nyathi, L.D. and Chikwala, P., 2024. Implications of Foreign Direct Investment on SME Growth in Zimbabwe: A Case Study of Bulawayo Province.
46. Pal, A., Tiwari, C.K. and Behl, A., 2021. Blockchain technology in financial services: a comprehensive review of the literature. Journal of Global Operations and Strategic Sourcing, 14(1), pp.61-80.
47. Parmoodeh, A.M., Ndiweni, E. and Barghathi, Y., 2023. An exploratory study of the perceptions of auditors on the impact of Blockchain technology in the United Arab Emirates. *International Journal of Auditing*, *27*(1), pp.24-44.

48. Rathore, B., 2019. Blockchain Revolutionizing Marketing: Harnessing the Power of Distributed Ledgers for Transparent, Secure, and Efficient Marketing Practices. International Journal of New Media Studies: International Peer Reviewed Scholarly Indexed Journal, 6(2), pp.34-42.
49. Ream, J., Chu, Y. and Schatsky, D., 2016. Upgrading blockchains: Smart contract use cases in industry. Retrieved December, 12, p.2017.
50. Sankar, J.G., David, A. and Kumar, C.G., 2022. Adaptation of Blockchain Technology In HRM. *Available* at SSRN, 4515408.
51. Schuetz, S. and Venkatesh, V., 2020. Blockchain, adoption, and financial inclusion in India: Research opportunities. International journal of information management, 52, p.101936.
52. Seyedjafarrangraz, F., 2024. Navigating digital transformation in banking: unraveling the nexus of capabilities, technologies, and regulatory realities.
53. Shcherbakov, I., 2022. Smart contracts in e-commerce became a common thing.
54. Schlatt, V., Sedlmeir, J., Feulner, S. and Urbach, N., 2022. Designing a framework for digital KYC processes built on blockchain-based self-sovereign identity. Information & Management, 59(7), p.103553.
55. Swan, M., 2015. Blockchain: Blueprint for a new economy. " O'Reilly Media, Inc.".
56. Sethaput, V. and Innet, S., 2023. Blockchain application for central bank digital currencies (CBDC). Cluster Computing, 26(4), pp.2183-2197.
57. Taherdoost, H., 2023. Smart contracts in blockchain technology: A critical review. Information, 14(2), p.117.
58. Thompson, P. and Zang, W., 2015. Foreign direct investment and the SME sector. *International Journal of Entrepreneurial Behavior & Research*, *21*(1), pp.50-75.
59. Venkatesh, V., Morris, M.G., Davis, G.B. and Davis, F.D., 2003. User acceptance of information technology: Toward a unified view. MIS Quarterly, pp.425-478.
60. World Bank. (2021). *The Global Findex Database 2021: Financial Inclusion, Digital Payments, and Resilience in the Age of COVID-19*. World Bank https://openknowledge.worldbank.org/bitstream/handle/10986/37578/9781464818974.pdf
61. World Economic Forum, (2024), Blockchain is in from the cold, and stablecoins are set to change the financial system forever.
62. Wylde, V., Rawindaran, N., Lawrence, J., Balasubramanian, R., Prakash, E., Jayal, A., Khan, I., Hewage, C. and Platts, J., 2022. Cybersecurity, data privacy, and blockchain: A review. SN computer science, 3(2), p.127.
63. Yaga, D., Mell, P., Roby, N. and Scarfone, K., 2019. Blockchain technology overview. arXiv preprint arXiv:1906.11078.
64. Zheng, Z., Xie, S., Dai, H.N., Chen, W., Chen, X., Weng, J. and Imran, M., 2020. An overview on smart contracts: Challenges, advances, and platforms. Future Generation Computer Systems, 105, pp.475-491.
65. Zuo, L., Li, H. and Xia, X., 2023. An empirical analysis of the impact of digital finance on the efficiency of commercial banks. *Sustainability*, *15*(5), p.4667.