ZAMBIA INFORMATION COMMUNICATION TECHNOLOGY (ICT) JOURNAL
Volume 6 (Issue 1) (2022) Pages 52-60

Blockchain Technology and its Implication for the Financial Sector in Zambia

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Abstract
Blockchain is the technology that underlies Crypto Currencies and it is poised to revolutionise current existing business processes and models. Its impact is being felt in many spheres of the financial industry in many jurisdictions around the world. Transactions on the blockchain are validated by a network of participating nodes using proof of work or proof of stake algorithms. Security of the data is guaranteed by the application of cryptographic hash functions. The technology has the characteristic of delivering very secure, transparent and innovative financial products. This study presents a systematic literature review of blockchain technologies and their potential application in the financial sector with the view of identifying open challenges and opportunities that it can address in the Zambian Financial Sector Context. The focus of the study was limited to the finance, banking, insurance, tax, mortgages and fintech sectors. The findings of the research showed that the Zambian financial sector can benefit from applying blockchain in its operations. Key benefits to be derived include tamper-proof customer identity validation, guaranteed security and trust, reduction of operational costs, elimination of third parties in transaction processes, reduced financial risks and reliable data sharing and verification.

Keywords: Blockchain, Distributed Ledger, Oracles, Non Fungible Tokens, Smart Contracts

I. INTRODUCTION

Blockchain technology is poised to revolutionise existing business models and business processes by producing software systems that will provide a single point of truth and transparency for all participating members of the network and its impact is being felt in many spheres of the financial industry [1]. Blockchain Technology is a digital ledger that is decentralised and dispersed. It can be used as a ledger for recording financial transactions or anything that has value for example identities for movable and non-movable assets [2]. The technology was first brought to the attention of the world in a paper that was done by Satoshi Nakamoto in 2008 titled "Bitcoin: A Peer-to-Peer Electronic Cash System". Nakamoto solved the problem of guaranteeing trust of data that is stored in a distributed storage considering that the data can be tempered by many participating parties [3]. Transactions on the blockchain are validated by a network of participating nodes using proof of work or proof of stake algorithms and they are secured by cryptographic hash functions. A transaction that has been added to the blockchain cannot be altered but can be transparently viewed by all participants [4]. This research attempts to answer the following questions:

1. What applications or potential applications of blockchain have been reported in peer-reviewed journals?
2. What innovative potential opportunities has blockchain created in the financial sector?
3. Can the Zambian financial sector benefit from potential opportunities created by Blockchain Technologies?

The study has been necessitated in order to explore open challenges in the Zambian financial sector that can be addressed by the adoption of blockchain technologies in their operations.

II. OPEN CHALLENGES

The Office of the Auditor general's core mandate is to audit all government institutions, parastatal organizations, statutory boards, donor-funded agencies and any other institutions in which public resources have been invested [5]

Year in and year out, the Auditor Generals' reports are laden with adverse reports of misappropriation and misapplication of public funds [6][7].

Many Commercial Banks in Zambia are faced with the challenge of charging high transaction fees to finance their operational costs. This has resulted in many Zambian citizens failing to access banking services from the mainstream commercial banks, leaving many citizens unbanked [8].

Claim processing is one of the major challenges in the insurance industry in Zambia. The key challenge is the amount of time it takes to process claims because of the amount of paperwork and stakeholders involved. Another problem pertains to fraud that sometimes takes place in the claim Process [9]. In addition, Climate related risks have also created a challenge in the agricultural insurance industry in terms of compensating losses [10].

Tax compliance by a taxpayer is a fundamental problem that the Zambia Revenue Authority (ZRA) grapples with regularly. Among the factors leading to non compliance include complex filling procedures [11]. In addition, Firms commit tax fraud that results in low tax revenue collection [12].

The Zambian mortgage sector is beset with complex procedures involving third parties that lead to high costs when accessing loans. In addition, poor record maintenance has led to increased inefficiencies in service delivery. Furthermore, the sector is beset with legal problems of borrowing against customary tenured land [13].

The Fintech industry has assisted in bringing on board the unbanked population through the provision of innovative financial products facilitated by high mobile phone penetration

[14]. However, the reliance on third parties has inhibited them from offering very affordable transaction fees to the Zambian population [15]. In addition, they are also affected by the high number of frauds, more especially for mobile money fintech operators [14].

III. RELATED WORKS

Ali [16] predicted the significant role that blockchain technology was going to play in the financial sector. The findings showed that users would manage their transactions better in the absence of third parties by leveraging smart solutions. However, it was noted that scalability and interoperability were still a challenge but would eventually be overcome.

Chang [17] investigated the impact and revolution of Blockchain and Fintech in the financial services industry. The research found that blockchain technology without a doubt could provide competitive and imaginative technological solutions that will impact the commercial and financial infrastructure of the industry in the future. It was also discovered that knowledge hiding that could hinder blockchain development and adoption was widespread among companies.

Barrett [18] explored the intention of the South African investment organisations in adopting blockchain technology by exploring use cases in the financial services sector. Semi-structured interviews with participants from eight different organisations in the financial services industry were conducted. The findings revealed that several use cases were identified with smart contracts and registering of securities.

Mavilla [19] illustrated the main characteristics of blockchain technology and focused on the areas where the technology could be used in developing countries in Africa to attain financial inclusion based on the Global Findex 2017 data, the World Bank Survey on financial inclusion. The research revealed that blockchain had the potential to create a financial system that could provide a lot of opportunities for investment in new technologies that would guarantee full access for all. The research also revealed the plans by the South African Reserve Bank to create a fintech project to be run on a blockchain platform to achieve financial inclusion for all.

Knezevic [20] researched the impact that blockchain had on the financial services sector. The research hypothesised that the technology had an impact on the financial sector and it had the potential to radically change the sector and other dependent sectors as well. The results showed that the technology had a massive impact on the sector with the possibility of substantially changing the sector in the medium and long term and that businesses were discovering the power of the technology to leverage the benefits of the fourth technological revolution.

TABLE I: Summary of Related Works

Author	Contribution
Ali [16]	Blockchain can manage financial transactions better than third parties
Chang [17]	Blockchain provides competitive and imaginative technological solutions that impact financial and commercial infrastructure
Barrett [18]	Smart contracts have several use cases in the financial services sector
Mavilla [19]	Blockchain has potential to create financial systems that provide opportunities for investments in new technologies to guarantee full financial access to all
Knezevic [20]	Blockchain has ability to change the financial sector in the long to medium term to leverage benefits of the fourth industrial revolution(4IR)

IV. CONTRIBUTION OF THE STUDY

This study contributes the following:

1. Identify Open Challenges that affect the operations of the Zambian Financial Sector
2. Highlight opportunities that blockchain provides to address the identified open challenges
3. Identify benefits that blockchain can provide if adopted

V. METHODOLOGY

A. Search Inclusion criteria

English scientific, empirical and non-empirical, peer-reviewed articles and conference papers were included in the literature search. The papers were available in IEEE, Elsevier, Springer, MDPI and other databases and were published between 2010 and 2022 inclusive. The search criteria included papers with research scope of blockchain technology and the application of blockchain technology for the domain related to the financial services sector. The search terms included" Blockchain AND Financial Sector"," Blockchain AND Banking", " Blockchain AND Mortgages", "Blockchain AND Fintech", "Blockchain AND Accounting", "Blockchain AND Insurance" Furthermore, papers studying the open challenges of key sectors in the Zambian financial industry were also included.

B. Papers Used Selection Protocol

The protocol used to arrive at the papers used in this study involved papers that highlighted open challenges in the Zambian financial sector, papers that specifically addressed the open challenges, papers that specifically conducted similar research and papers that gave relevant background to blockchain technologies. Table II summarises the number of articles reviewed and the number of articles used.

TABLE II: Summary of Literature Search

Data Source	**No. of Articles Reviewed**	**Used**
IEEE	45	11
Elsevier	10	5
Springer	41	3
MDPI	21	8
Others	70	45
Total	**187**	**72**

C. Exclusion criteria

Papers without full-text availability and papers that were not written in the English language were not included in the search scope. Furthermore, studies such as editorials, summaries of keynotes, workshops, tutorials and book chapters were not included in the literature search.

D. Limitations

The systematic literature review was only done on peer-reviewed journals that were published in English and found in the databases searched. Furthermore, book chapters and articles that were not published in peer-reviewed journals were not reviewed. This exclusion limited the search scope.

VI. BACKGROUND TO BLOCKCHAIN TECHNOLOGIES

A. Distributed Ledger Technology

Distributed Ledger Technology (DLT) is a term that describes a computer system that has a distributed ledger that provides high levels of resilience, trust, security, and service availability in addition to distributed storage, computation and control [21]. Even though the terms DLT and Blockchain are used interchangeably in the literature, a difference exists. A blockchain can be regarded as a type of ledger that stores data in a specific format. When the blockchain is distributed across a network, it is called a Distributed ledger [22].

Data in a DLT is moved across the network and is added to the ledger as transactions in a chronologically ordered sequence. A transaction has metadata that constitutes a timestamp, digital asset or program code. Digital signatures using public keys are used to validate proof of ownership of digital assets [23][24]. Key characteristics of DLTs include the absence of central control and the security and accuracy of data being managed cryptographically in conformance with the agreed network rules [25].

B. Smart Contracts

Smart contracts are software-based transaction protocols, implemented on top of blockchains, that execute contractual terms of an agreement between parties [26]. Nick Szabo a computer scientist and legal scholar first proposed the concept in 1990[27].

Contractual terms are automatically enforced when conditions are fulfilled by parties involved in the contract [26]. Smart contracts have a unique address on the blockchain and they are activated by addressing a transaction to them. The execution occurs automatically and independently on every node on the network as prescribed by the data included in the triggering transaction [28].

Despite being around since the early 1990s, smart contracts did not thrive because authorised trusted third parties were still required to monitor the execution of encoded contractual terms. However, the advent of blockchain technology made it possible to replace third-party monitors with distributed participating network nodes [29].

Smart contracts have advantages over traditional contracts in that they reduce transaction risks, reduce service costs and generally improve process efficiency in businesses because they run on a secure blockchain [27]. They also help in reducing incidences of contract breaches, delays in finalising contracts and contractual disputes that lead to litigation [30]. Fig 1 depicts the life cycle of a smart contract.

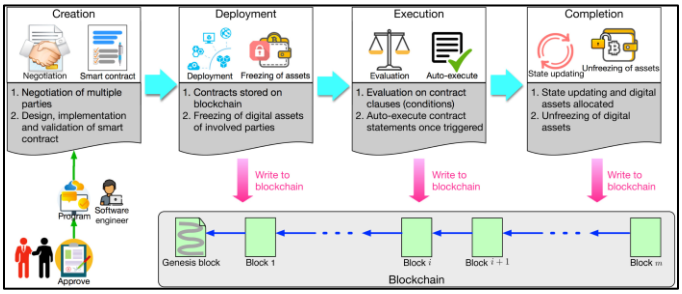

Fig. 1. A life cycle of a smart contract consists of four major phases: Creation, Deployment, Execution and Completion. Source [26].

C. Oracles

In Greek mythology oracles are entities that can communicate directly with God and foresee the future. In a blockchain, oracles are systems that transfer information from the real world for example weather information, stock prices or political events [31].

The motivation behind oracles is that blockchains by nature are not able to transfer data from the real world to themselves directly. Oracles are controlled by a sole authority that can either be a web API or an IoT sensor that is managed by a company or provider. The main objective of an oracle is to prove that the collected data has not been tampered with before gathering. They interact with smart contracts on the blockchain for purposes of data processing [32][33].

D. Permissioned Blockchains

In Permissioned blockchains, only a limited number of participants are authorised to transact on the blockchain. A central authority is responsible for granting read or write rights to participants. Examples of implementations include Hyperledger Fabric and Corda [34]. The identity of the participant is managed by a central identity provider who maintains and controls network access of participants in validation processes. The blockchain is less prone to cheating because the participant's identity is known by the central identity server [35].

Permissioned blockchains are private blockchains that can be public to view but are not public to use. In other words, it does not permit open participation in transaction submission and validation without granted central authority [36].

E. Permissionless Blockchains

Permissionless blockchains maintain a state and allow the modification of the state by users on a peer-to-peer network(P2P). Changes to the state are done as transactions by users and are made available on the network. Transactions are

cryptographically signed to make sure that only authorized users change the state [37].

They can be implemented as Public Permissionless Blockchains where transactions are transparent and participants are either anonymous or pseudo-anonymous. A good example is their application in cryptocurrencies [38].

Participants can join the P2P network by using their devices for example computers or mobile devices. Everyone can participate in the P2P network without establishing trust beforehand as crypto mechanisms are used to establish trust [39]. Participating members are algorithmically governed based on the P2P agreed principles, interests and motives without any direct authority [40].

The major drawback of permissionless blockchains is the slow processing speed when dealing with large volumes of transactions [41].

F. Non Fungible Tokens

The term Fungible means that parties in a transaction can swap a token without any gain or loss in value. Non Fungibility means that a token can not be divided or merged. Non Fungible Tokens (NFTs) were created to represent ownership of digital or physical assets [42]. They cannot be exchanged or traded for another because each one is unique. They are characterised by their traceability, atomicity, verifiability and tamper resistance [43]. NTFS have seen an explosive application in the Fintech industry since 2020 in areas such as collectables, artwork, gaming and other markets. Scholars have predicted that they will be an innovative technology that will have a disruptive impact in the field of technology. Creators of music, artwork and images will enter markets that had previously high entry barriers [44].

VII. BLOCKCHAIN APPLICATION IN THE FINANCIAL SERVICES SECTOR

A. Accounting and Finance Sector

In the field of Accounting and Finance, Blockchain as a service has been used to implement distributed book keeping. Users in different geographical locations carry out trade in assets and incur reduced transaction fees. This results in an open and transparent enterprise financial system that guarantees the openness of corporate financial information for regulators. This makes the public audit of accounting information easy. In addition, it guarantees the security of financial information because of the immutability characteristic of the block. The resulting benefit has been the reduction of financial risks [45].

Cost is the value that is forgone to achieve a specific purpose. Anti-money laundering, anti-terrorism financing and anti-proliferation financing are very important responsibilities for financial institutions because they invest huge amounts of money to tightly secure their financial systems. Blockchain technology can reduce security and transaction costs drastically [46].

In Supply chain finance, suppliers and financial institutions can instantly access reliable information using a blockchain supply chain. This is because the technology efficiently solves the trust problem of the traditional supply chain by facilitating the cooperation and financing of beneficiary SMEs. In the long term, the development of the real economy is promoted. Furthermore, transaction costs are drastically reduced [47].

In the traditional internal audit process, most transactions have to be scrutinized and authorized before they occur as a control measure. Blockchain can support the work of an auditor by reducing checks, controls and reconciliation controls [48].

Accounting work involves Financial and management accounting. The former uses accounting standards to accurately measure business transactions while the latter uses the former as a basis for preparing internal reports for management action. Distributed bookkeeping helps enhance efficiency and accuracy in financial accounting by resolving the shortcomings of the double entry system. Furthermore, blockchain addresses the challenges of theft and tampering during transfer of information in addition to preserving the integrity of data. Furthermore, timeliness and neutrality of accounting information are guaranteed as information is recorded and authenticated in the shortest period of time [49].

B. Banking Sector

Banks spend a lot of time checking for data duplication by using manual means when dealing with financing food suppliers. Document processing can be reduced by blockchain through matching timestamp data to avoid data duplication and manual checking [50].

According to Buitenhek [51], industry-wide payments and settlement infrastructure based on trust, cryptography and transparency have attracted a lot of attention from the banking industry. The advantages that this will bring include reduced transaction and operational costs, more transparency, traceability, reduced risks and fast processing speeds. This will be possible because blockchain will facilitate payments and settlements without the need for a central clearing party.

Central Bank Digital Currencies (CBDCs) models are being seriously considered by many central banks and the research community as a replacement for fiat money in the context of being the next milestone in the evolution of money. Blockchain is being considered to power the operation of the CBDC infrastructure because it can greatly improve the audit and regulatory functions of central banks through monitoring and auditing of transactions in real-time. The audit logs provided by the Distributed Ledger Technology will guarantee the integrity of the records [52].

Supervisory and regulatory authorities are focusing their blockchain research on the potential benefits, risks and implications the adoption will have on the financial system. Proponents of the technology contend that it will streamline very complicated financial processes and it will change the roles that financial intermediaries play in trade. A consortium of 80 of the world's biggest financial institutions was formed and created an open-source distributed ledger platform called

Codra to record financial events and execute smart contracts [53].

C. Insurance Sector

Insurance companies have to contend with fraud because human beings sometimes engage in fraud to make easy quick money. Blockchain could be the answer to mitigate the ever-prevalent problem of fraud. For example, double dipping fraud could be avoided by submitting the contract to the blockchain so that other companies could verify that a motor vehicle already has an active insurance policy with another company. Only when the terms in the smart contract policy are fulfilled can a client acquire a new insurance policy with another company [54].

Smart contracts can drastically reduce the creation of claims and processing times. In addition, immutable and auditable statements can be transparent to all participants during the various stages in the insurance claim processing [55].

Business rules can be encoded using Smart contracts, particularly insurance processes, where for instance clients that express interest in acquiring insurance products can be registered on the blockchain distributed ledger. Claims and refunds can be handled automatically by smart contracts and fraudulent transactions can be avoided if they do not conform to the rules of the smart contracts [56].

In the traditional insurance business process, processing claims is time-consuming and costly. For example, blockchain and smart contracts can be exploited by triggering the transfer of funds if a customer making a claim repairs the motor vehicle at a certified mechanic, where a mechanic sends a transaction to the smart contract to prove their identity. Oracles can also be employed to transfer information from the real world to the blockchain. For example, the weather could be checked at intervals periodically and the data obtained can be fed to a crop insurance smart contract on the blockchain to trigger a payment in the event of persistent bad weather [57].

High demand for health insurance and massive volumes of health data requests have resulted in an increase in counterfeit fraud that is perpetrated by stakeholders or users. Governments as a result of fraud have invested large sums of money and time to eliminate this fraud problem. Blockchain happens to be the natural choice as the technology that can prevent counterfeiting in the health insurance sector. Data will be stored in a distributed manner securely by taking advantage of the immutability property. In addition, it will improve trust problems, privacy and long time-consuming procedures [58].

Motor vehicle insurance is a mandatory regulatory requirement for the motor vehicle owner in many countries. Drivers need to have valid motor vehicle insurance for them to drive and are obligated to provide proof of insurance when requested by the police, when buying or leasing a vehicle, registering a vehicle and when renewing motor vehicle road licenses. Blockchain can be used as a reliable tool for sharing and verifying insurance records by stakeholders. The sharing and verification can also be a record of the blockchain for audit purposes [59].

D. Tax Sector

Due to its transparency, blockchain technology will lead to the transformation of the way global tax systems operate. Transactions of a company can be revealed to the entire public such that every transaction that generates a profit or a loss will be easily accessed by tax revenue authorities. VATCoins that are only valid for VAT tax payments will also be possible to implement on the blockchain. Every enterprise using VAT coins will be able to access VATCoins transaction records [60].

Tax enforcement by governments will be very easy to do because of the level of security that the blockchain is going to facilitate. The Chinese government plans to introduce an electronic tax invoice system that will use blockchain technology to issue electronic invoices where the system will be a just-in-time application [61].

Distributing data on nodes is regarded as safe on a blockchain. A Tax serial number that is stored on the blockchain will be quicker to process and the blockchain-based system will be more efficient to operate. In addition, the system will enhance trust between taxpayers and tax authorities because it will guarantee data openness [62].

Businesses take issue with disclosing commercially sensitive information because it can affect their competitive advantage. The disclosure of this sensitive information can occur because of the transparent characteristics of blockchain. However, using zero-knowledge-proof on the blockchain can resolve the issue of transparency and confidentiality. This is achieved by balancing the benefits of transparency against losses that arise because of confidentiality breaches [63].

Technological changes in tax administration can directly improve the ability of governments to collect taxes. Blockchain can assist governments in curbing the use of fake taxpayer-identification numbers by the use of secure unique tax identities for every taxpayer. This allows an individual taxpayer to submit tax claims and refunds in a secure fraud-proof manner [64].

E. Mortgages Sector

Permissioned Distributed Ledgers can be used to link lawyers, notaries and other gatekeepers for the verification of mortgage transactions. The mortgage data can be brought into the blockchain by oracles that can verify real-world events such as buyer terms and previous charges on the property. Official digital IDs can be linked to the blockchain to allow only authorised access to the transactions. For instance, underage persons can not apply for a mortgage or sell a house without legal backing [65].

Digitising mortgages and using smart contracts in the mortgage process can help financial institutions to save money. This will be achieved because efficiency will be introduced in the mortgage execution process by sharing title deeds and land registry records on the blockchain. The money saved can be passed on to the consumer by offering lower interest rates [66].

In crowd-lent mortgages, loans are syndicated among many lenders and the problem of whether to assign the mortgage to a group or individuals arises. Smart contracts provide a natural solution to this problem by pre-coding the collateral assignment rights. Each individual in the group will be issued a security share for each funded loan [67].

Mortgage applications involve multiple parties in different organisations where each party plays a role before the transaction is completed. While transactions are done by these parties, security and trust become a very critical concern and blockchain technology becomes a natural technology in the mortgage process. Compatibility issues are resolved by the blockchain because all parties involved record data on it. Every transaction is secured with digital signatures that require consensus before a transaction is recorded [68].

F. Fintech Sector

Financial Technology uses computer software and other technologies to facilitate operations in the financial industry. More and more Fintech firms are adopting blockchain technology to run their systems, with smart contracts being the key applied technology [69]. Blockchain has emerged as technology that offers many capabilities and features to the rapidly emerging financial services, where customers can send and receive money quickly and securely at very low transaction costs without the need for a third party [70].

Integrated technology results in the improvement of financial system efficiency and this forms the basis of Fintech. Blockchain can provide the fintech industry with innovative ways that can potentially benefit society. One benefit is that it can substitute trusted third parties or intermediaries in the verification of transactions thereby directly reducing operational costs. This is achieved by substituting trusted third parties with smart contracts [71].

The due diligence process for customers has been simplified by blockchain technology because all the customer data can be recorded at once in a distributed ledger resulting in the fintech having a real-time and complete view of the data such as transaction history and outstanding details [72].

VIII. OPPORTUNITIES FOR THE ZAMBIAN FINANCIAL SECTOR

For the Auditor general's office, problems can be addressed by mandating all government and quasi-government institutions to record all the accounting transactions on a Permissioned Blockchain that implements smart contracts derived from the budgeting process.

The benefits will be reducing the public financial risk of misappropriation and misapplication of funds. In addition, the timeliness and neutrality of public accounting information will be guaranteed in addition to improving the efficiency, accuracy and security of accounting work.

Blockchain offers an opportunity for commercial banks to bypass third parties by incorporating the technology into their operations. The technology can drastically reduce transaction fees and this can in turn help reduce the number of the unbanked population.

As reserve banks are positioning themselves in introducing CBDCs using blockchain [52], the Bank of Zambia should also start work in the background. One of the ways it can facilitate this background work is to support research in blockchain in institutions of higher learning in Zambia. CBDCs will have huge benefits for Central Banks when they become operational because of the improvements they will bring in the auditing of financial institutions, their regulation and the curbing of money laundering activities. This will be facilitated by the transparent and secure characteristics of blockchain technology.

Smart contracts and oracles riding on the blockchain can help eliminate the problem of prolonged processing times and fraud. Smart contracts and oracles can automate the entire claim workflow in near real-time for weather related insurance and other types of insurance. Fraud, especially counterfeit fraud can be eliminated by the identity tamper proof characteristic of blockchain. Other benefits will include the reliable sharing and verification of insurance data by all authorised stakeholders.

Blockchain can offer an invoice tamper-proof solution to ZRA that will be transparent and secure, thereby ensuring that all eligible taxpayers comply with the requirements. It will be possible to see every transaction that will result in a profit or a loss for corporate tax purposes.

Other benefits will include the resolution of the problem of tax transparency and confidentiality through the application of Zero-knowledge proofs. In addition, it will be possible to create VATCoins that can be used for the sole purpose of redeeming VAT payments to curb tax fraud.

Smart Contracts can help Mortgage Houses by reducing or eliminating processing fees resulting from the involvement of third parties. This can subsequently result in mortgage houses offering affordable mortgage loans for all. In addition, the blockchain will address the problem of security and trust when it comes to verifying and validating land records especially customary tenured land, personal IDs and applicant eligibility.

Crowd-funded mortgages will also become commonplace because blockchain will solve the problem of syndicating mortgages to either a group or an individual.

Blockchain offers an opportunity to reduce transaction fees by eliminating third parties. In addition, the security, verification and validation of Personal IDs resolve the problem of KYC (Know Your Customer) due diligence and subsequently eliminate fraud. Lastly, It offers Fintechs a massive opportunity to create innovative products that can achieve high universal affordability for all.

TABLE III: Summary: Issues and Solutions

Sector	Authors	Challenges	Solutions
Accounting and Finance	Songyue [45] Feng-Zhou [46] Yu [47] Avaneesh [48] Mingjing [49]	- Misappropriation of Funds -Misapplication of Funds	-Permissioned Blockchain
Banking	Arief [50] Mark [51]	- High transaction fees	-Eliminate third parties

	Natalia [52] Alexandros [53]	- High Operational costs	
Insurance	Rui [54] Anokye [55] Mayank [56] Valentina [57] Baker [58] Mehmet [59]	- Long claims process -Compensating losses due to climate change	-Smart contracts - Oracles
Tax	Derya [60] David [61] Milla [62] Filip [63] James [64]	- Tax compliance - Complex filling procedures - Tax fraud	-Tamper-proof invoicing - VATCoins
Mortgages	Rosa [65] Akram [66] Ricardo [67] Azad [68]	- Complex procedures involving third parties - High Loan access costs - Poor record maintenance	-Smart Contracts -Eliminate third parties. - Permissioned/Permissionless Blockchain
Fintech	Simon [69] Anitha [70] Shifa [71] Vivek [72]	- Hight transaction fees -High number of phishing frauds	-Eliminate third parties -Tamper-proof identity

IX. CONCLUSION

This study has presented a systematic literature review of blockchain technologies and their application in the financial sector with the view of identifying opportunities and open challenges that it can address in the Zambian Financial Sector Context. The study has shown that innovative opportunities for blockchain application exist in the key financial sectors that were studied. If adopted, blockchain will provide benefits among them tamper-proof customer identity validation, guaranteed security and trust, reduction of operational costs, elimination of third parties in transaction processes, reduced financial risks and reliable sharing and verification of data.

Further research is recommended in other sectors and disciplines in Zambia so that a framework for legislation and implementation can be formulated to derive the maximum benefits from the technology.

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