FinChain: Adaptation of Blockchain Technology in Finance and Business - An Ethical Analysis of Applications, Challenges, Issues and Solutions

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Abstract
Blockchain Technology is a distributed database technology that has emerged as a ground-breaking technology with several possible solutions to critical applications, say from supply chain management, agribusiness, marketing to healthcare industry including internet of medical things. Although it started as a digital coin (popularly known as bitcoin), it is slowly influencing business, marketing policy and society. We have presented an in-depth study and ethical analysis of how blockchain is applied over the economic and financial sector including banks, credit unions and other retail giants. During our research, we have also investigated how blockchain technology can affect financial institutions around the world and businesses including large and small businesses. Our contributions included the following: (i) classifying blockchain models and architecture for finance and business markets (ii) analyzing recent and relevant works for finance applications and business solutions using blockchain (iii) discussing the advantages of using blockchain technology in financial institutions like banks, government firms. education sectors (iv) pointing out challenges and issues of blockchain technology for finance and business organizations (v) summarizing future research on integration and adaptation of blockchain technology along with C2C, B2C, and B2B with finance and recommendations for improvement.

Keywords *- Applications, Blockchain Technology, Ethical Analysis, Finance*

1. Introduction
The technology after the world's most common cryptocurrency i.e., Bitcoin is the blockchain technology. Emerged as a ground-breaking technology for all corporations, governments, and agencies, there is no disbelieve that blockchain technology has influenced business and society in the previous years. An initial system to involve blockchain data storeroom structure now has numerous applications from business to building trust among citizens. In blockchain, the data structure is distributed and replicated throughout members in a network where each block carries a set of transactions including a hash to the previous block. Cryptocurrencies trust on three technology elements: blockchain, crypto wallets, and exchange platforms. Cryptocurrencies and digital financial services both rely on a host of underlying technologies to secure transactions, except cryptocurrency lacks central authority backing (Marella et al., 2020). Blockchain technology has no doubt that it forms the backbone of cryptocurrency.

Information transparency plays a vivacious role in adding the citizens' trust like in the case of finance and business. In dissimilarity to client-server architecture (a network that possesses a single point of failure), blockchain technology is constructed on P2P architecture where the power doesn't rest on a sole computer. P2P network is generated by the mutual connection among all joining computing devices. The communication of data occurs without going through the main server. Blockchain comprises blocks of data (transactions) which are arranged in linear sequence

and accomplishment of blockchain technology on rare public services like online voting, land reform management, supply chain management, health care systems, cyber defense and countermeasures etc. has verified an existence of boundless potential for public service delivery (Kshretri, 2021).. An efficient and effective communal administration is an essential pioneer for socio-economic development. Inefficiency of civic service is contributed by drought of transparency, trust, and accountability.

Business and finance involves several different actors from companies, retailers, wholesalers, distributors to banks, business firms, insurance companies, and several government agencies. Increase in online fraud, corruption, finance losses, money laundering, barriers on intra-country trade including several hidden costs is the primary concern of any business today. Blockchain technology grants us to track the changes or apprises from the commencement of the network. Immutability and verifiability increases the trust among every participant of the network. Based on cryptography, blockchain is a distributed database that maintains a persistently expanding list of data entries that are proved by every network node (Kshretri et al., 2022). Privacy is one of the core on-demand features needed for business sectors and it is the core property of blockchain technology. For any financial institution to operate and succeed, transaction identity must be shielded by cryptographic function to ensure anonymization of the involving business parties, to gain an extreme degree of privacy beside with trust and transparency.

As applied successfully in the financial sector, especially in banking, blockchain technology has verified a perfect solution in areas where trust is needed. Blockchain architecture of business process management systems to apply blockchain-based process monitoring to guarantee for it to be applicable helps the technology to be adopted (Meroni et al., 2022). The focus is on blockchain-oriented process design, or execution able to endorse processes via smart contracts. Distributed Ledger Technology (DLT) along with blockchain technologies are ideal settings for inter-organizational business processes. Organization involves various kinds of transactions and processes and often do not trust each other, which can be fulfilled by “immutability” and “distributed database” properties of blockchain technology. Blockchain technology is an assuring aid as the status of the running process or transaction can be distributed and trusted among the parties.

In this article, the objective of our study is to conduct the ethical analysis of blockchain technology adaptation in finance and business including its challenges and solutions. The central concepts are at the core of blockchain technology and its flexibility features concerning the business and financial institutions, the paper provides the following five key contributions: (i) classifying blockchain models and architecture for finance and business markets (including online transactions). (ii) analyzing recent and relevant works for finance applications and business solutions using blockchain technology. (iii) discussing the advantages of using blockchain technology in financial institutions like banks, companies, and government firms. (iv) pointing out challenges and issues of blockchain technology for finance, banking institutions, and business organizations. (v) summarizing future research on integration and adaptation of blockchain technology along with C2C, B2C, and B2B with finance and recommendations for improvement in light of assessment.

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The rest of our paper is structured as Section “Section 2. Related Work”, that bestows a brief overview and background study, past works, in connection to usage and need of blockchain technology in the finance and business sector. We then presented Section 3. BCT adaptation of blockchain technology in areas of finance and business. To understand how blockchain solutions aids finance and business, we presented the blockchain solutions over the next two sections as Section 4. and Section 5. Our next section is Section 6. BCT Challenges and Issues that try to address the ongoing challenges and issues of blockchain adoption. The disruption of BCT w.r.t. Education is presented and analyzed in Section 7. with some major use cases in education. Section 8. “Ethical analysis of BCT adaptation” presented an in-depth analysis of blockchain usage with its ethical consideration. We then presented the upcoming scope of our paper in Section 9. “Future Scope & Conclusion”, that also concludes the article.

Table 1. Blockchain technology features and property for business process monitoring and finance-based applications

S. N.	Blockchain Description for features and property for finance and business	BCT features	Ref.
1.	Platform in use concludes which nodes can approach the distributed ledger: private BCs are restricted	Accessibility	[4]
2.	Help users to reestablish their personal anonymity, addresses are identifiable with public keys, accessible via private keys	Anonymity	[6]
3.	The consensus mechanism reign how participants agree on a sole common fact when storing and verifying blocks	Consensus Mechanism	[3]
4.	Technology based on cryptography that preserves a constantly expanding data list entries verified by each network node	Cryptography	[3]
5.	Records are saved in a decentralized fashion, reduces the data risks of centralized storage	Decentralization	[5]
6.	Blockchain solves and avoids the double-spending problem, prevents buyer from using same coin with two different sellers	Double-spending Problem Prevention	[9]
7.	Blockchain permits trust of information by using Distributed Ledger Technology (open ledger)	Distributed Ledger	[8]
8.	Easier handover of academic records, learning data traceability, and information security for learners via BC in education	Efficiency	[9]
9.	Enables dynamic binding of companions and empowers companions the control of sub-process to promote flexibility	Flexibility	[8]
10	Once data noted in blockchain customer information stays ever &	Immutability	[5]

.	cannot be changed		
11.	Refers to participants who can elect on next transactions: if right granted, permissioned; otherwise permissionless	Mining Strategy	[4]
12.	Use of blockchain to issue and validate academic certificates without middleman as use case of blockchain in education	Non-Intermediaries	[9]
13.	Private blockchain enables corporate collaboration without disclosing information to general public, specification via smart contracts	Privacy	[12]
14.	Executable code expressing how trade is to be conducted among parties, offer programming ability	Programmability	[4]
15.	To make sustainable deployment & maintenance profitable, platforms include a remuneration plot, require fee	Remuneration	[4]
16.	Blockchain provides a trusted room among partners for recording, retrieving information	Shared Storage	[8]
17.	Prices and payment options including enrolment are all possible since BC ameliorates traceability and openness, record of transactions saved by all members	Traceability	[10]
18.	Blockchain can be viewed and written by anyone, hence it provides maximum transparency, and minimum level of confidence among participants	Transparency	[12]
19.	Information of customer is no longer controlled by a single trusted third party	Trust	[5]
20.	BC applications in finance use permissioned blockchain, participants identity is typically verifiable, quite straightforward to implement consensus mechanism	Verifiability	[7]

2. Literature Review

Blockchain has use cases in the regions of investment banking and securities, which are previously served very well by the Corda/R3 platform (Polyviou et al., 2019). Blockchain use cases offer fertile grounds for pioneers in the financial sector, including FinTech and InsurTech ventures. One most prominent problem associated with bank credit is drought of information on credit scoring, causing persons and SMEs to have troubles in obtaining loans. The five blockchain technology use cases in the financial zone are i. Know your customer and know your business, ii. Credit risk scoring for SMEs, iii. Customer profile management and product personalization, iv. Insurance claims management, and v. Collaborative security in the financial services chain.

Disagreement over acquiring space value in metaverse but many (McDonald, Wendy, Nike) businesses have jumped in first. This study proposes a novel framing issue and stares at intersections where finance, technology like blockchain, and law are converging to stop another Dot-com bubble in virtual transactions of real estate (Hutson et al., 2023). The case with the emergence of online commerce reveals that courts will look to conventional and established legal principles when addressing issues until the portrayal of regulations. The elongated term legal and regulatory considerations of investment capitalizing, as well as the manner in which Blockchain Technology can safe users' data and digital assets has to be scrutinized.

An attractive way to organize modern finance is provided by the decentralized repeated ledger technology (blockchain technology) that underlies Bitcoin and other cryptocurrencies (Varma, 2019). Decentralized systems like the blockchain that shrink the need for trust become eye-catching when trust in the vital hubs of finance is being increasingly interrogated. Central counterparties (CCP) guarantees trades in exchanges, central securities depositories (CSD) for securities resolution, the Society for Worldwide Interbank Financial Telecommunication (SWIFT) for worldwide transfer of money are a number of centralized trusted intercessors on which the current financial system depends. Another factor that has destroyed trust is the repeated instances of hacking of computers of huge financial institutions beyond The Global Financial Crisis (2007-08), and The Eurozone Crisis (2010-12).

Blockchain enables trust of information by consuming Distributed Ledger Technology (DLT) and blockchain enforces counterparties obligations in a business process by programming contracts as trades with the power of smart contracts (Viriyasitavat et al., 2022). Adopting blockchain in business process management has attracted a great attention and over the Internet of things (IoT) have been moved from centralized to decentralized, persistent to transient, and from static to dynamic enabling technologies to fulfill functional requirements. As an emerging technology, blockchain applications are at their initial stages, to meet technical challenges future research efforts are needed. Business Process Management (BPM) is being revolutionized in numerous ways; main adoption is to aid as a trusted infrastructure to promise trust of collaboration among multiple allies in virtual trustless environments.

Many erstwhile works in the field of blockchain technology after the invention of cryptocurrency, with applications related to agricultural business, as combination of peer-to-peer network and communication security as cryptography (Chapple & Seidl, 2021; Kshretri et al., 2021). The traceability of food is of serious concern due to extensive use of pesticides and fertilizers in agriculture that are unsafe. Without having to rely on state and governance bureaucracy, blockchain governance is coined that provides a distributed diffusion of authority. Agricultural supply chain involves several actions - farming, distribution, processing, and product advertising as part of agribusiness. Existing agricultural supply chains lack food traceability because of middlemen corruption, no or less transparency as goods transit, and lack of accountability between stakeholders. Blockchain have powerful business features that can fulfill the prerequisite of an efficient traceability system for information source, processing, retailing, and product destination.

2.1 BCT Adaptation in Finance and Business

The cryptography concept is the foundation of blockchain technology apart from achieving the solution to the double-spending problem. Development of blockchain technology in today's cyber

world is aided by cryptography progress that relates with several BCT features such as transparency, trust, privacy, and verifiability. Many corporations including brick and mortar stores started to acknowledge Bitcoin as payment since 2008 including well known merchants like Subway, Expedia, Microsoft, and Newegg etc. Bitcoin and ultimately blockchain technology grasp the attention of financial organizations almost immediately after issue. Some of the major reasons of adaptation of blockchain technology in finance and business are pointed and discussed below:

I. Transaction transparency and business process monitoring (Kshretri, 2021; Meroni et al., 2022): Transparency of information and practices plays a vital role for adding citizens' trust. Blockchain technology has the capability to authorize transparency and build citizen's trust in communal service delivery (especially in business and finance transactions) while maintaining a sufficient level of privacy. Transparency and trust have close relation to fraud and citizen's satisfaction with communal services including business and finance. To generate trusted environments where contestants do not trust each other, blockchain and distributed ledger technologies are particularly appropriate.

II. To achieve security and trust in the cyber as well as cryptographic world (Kshretri et al., 2020; Misra et al., 2023): Started as a digital currency or cryptocurrency, bitcoin, there is no uncertainty that blockchain technology is influencing business and society. Blockchain is distributed database technology constructed on cryptography that maintains an endlessly expanding list of data entries that are certified by every network node. Blockchain underlying features of decentralization, consensus mechanism, immutability, traceability, and privacy provide a strong base for cyber defense and data security in finance and business transactions. Blockchain technology's development is both aided and hampered by the progress of cryptography technology.

III. Blockchain models for agriculture and food supply chain (Kshetri et al., 2023; Sugandh et al., 2022): Blockchain technology plays a serious role in the transformation of conventional means of storing, sorting, and exchanging agricultural data into a more truthful, immutable, transparent, and decentralized method of distributing data. The necessity to create smart peer-to-peer systems capable of validating, securing, monitoring, and analyzing agricultural data has impelled discussions regarding the development of blockchain-based Internet of Things (IoT) systems in smart farming. The use of blockchain technology can aid deprived farmers to automate the agribusiness process with extreme trust.

IV. Blockchain-based infrastructure financing system (Zhang et al., 2021): The main reward of the blockchain technology was the probability of permitting information swapping between the parties without physical occurrence. The consensus algorithm occupied by blockchain has proved the security, scalability, and confidentiality in finance via operating on 100% verification and 0% trust. Infrastructure financing is a severe problem that can have a foremost impact on the project in question but also on civilization as a whole. Blockchain technology, a decentralized ledger database for recording trades can modernize many aspects of the financial services zone and the broader economy by eliminating intercessors, automating transactions across organizations, and widening entree to finance.

V. Need of trust in finance and fast lane trade (D'Monte,2018; Varma, 2019): It is no luck that Bitcoin was launched soon after the catastrophe of Lehman that marked the peak of international

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financial crises. Currently, the financial system depends on the number of trusted mediators: central counter parties (CCP) guarantee trades in exchanges; central securities depositories (CSDs) provides securities settlement; the Society for Worldwide Interbank Financial Telecommunication (SWIFT) intermediates worldwide transfer of money; CLS Bank knobs the settlement of foreign exchange transactions. HSBC Holdings has accomplished a trade financial deal using blockchain for a trade by Reliance Industries Ltd to US-based Tricon Energy, making the opening ever overseas blockchain imbursement from India in November 2018.

VI. Authentication, decentralization in education and data security (Vangala et al., 2022; Viriyasitavat et al., 2022): To facilitate transactions amongst two parties that do not trust each other, the blockchain preserves a ledger that is available to both parties and the authenticity of the ledger is promised through a consensus mechanism. Blockchain conveys innovation to academic research, reputation, e-portfolio, and intellectual property, connecting lifelong learning and learning analytics stages. Today almost all the utilities are enabled with internet connectivity. With the idea to control devices that are in domestic by the user who is outside the home might sound fancy, but comes with potential fears. Blockchain-based robust security schemes in an IoT-enabled environment by authentication and key establishment will make a user in a smart home safe and secure.

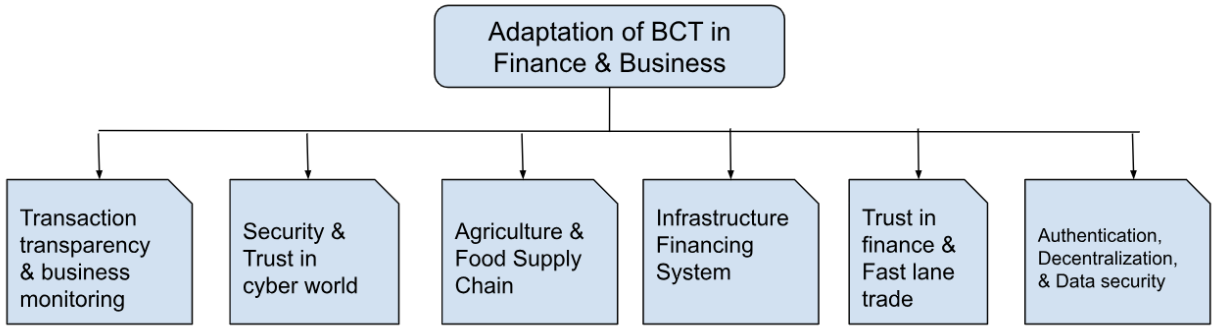

Figure 1. Reasons for Adoption of Blockchain Technology in Business and Finance

2.2 BCT Solutions W.R.T. Finance

The decentralized finance system underlying blockchain technology has some benefits over the current centralized system. In this section, we first highlight some of the plusses of using blockchain technology in financial institutions. Some recent applications of blockchain finance have been discussed along with some applications in finance that are in the proof-of-concept testing stages for possible future use. Also, some of the challenges and barriers that may impact blockchain technology uses in finance are discussed.

Blockchain technology can reduce the cost of trust in a number of financial issues ranging from cybersecurity to the excess amount that banks and other financial institutions could charge their customers. Post-trade processes at banks, brokerages, clearinghouses, etc. currently take up a lot of time and some of the processes may be repetitive and unnecessary leading to an increase in the cost of trust and subsequent inefficiency. Distributed Ledger Technology (DLT) is gaining importance in banks as well as in securities exchanges for secondary market transactions and

central clearing houses for derivatives securities. The implications of wider acceptance of DLT are reductions in transaction costs for financial institutions in terms of bypassing the need for layers of intermediaries that may be redundant. Based on a study, the use of blockchain technology at the top 10 banks could reduce infrastructure costs by almost 30% resulting in savings up to $12 billion (Casey, et. al. 2018). The longer time to settle trades through traditional clearinghouses due to risk of errors and delivery failures as the trades would pass through multiple intermediaries results in higher opportunity costs of securities trading. Such implicit costs could be avoided by applying the DLT in blockchain transactions.

The settlement and clearing time for trades related to stocks and bonds could be reduced significantly by using DLT. Although trading can be conducted in real time, the settlement and clearance takes more time currently due to duplicative record keeping, etc. Collateral management including margin calls, etc. and clearinghouse roles in reducing counterparty risks and transferring net payments among parties in derivatives transactions involving swaps and futures contracts could also be addressed more efficiently using smart contracts employing blockchain technology.

Cross border payments and remittances are currently costly, time consuming and may have embedded counterparty risk due to multiple layers of intermediaries. As a result, these are good candidates for application of blockchain technology. Ripple is one company that is currently using a blockchain based protocol to connect bank ledgers to assist in real time cross border outgoings and increase liquidity in foreign exchange transactions. SWIFT also recently conducted a proof of concept with interbank payments using DLT to reduce delays in cross border payments. Standard Chartered and Deloitte also conducted a proof of concept to record shipping documents in cross border export-import trade finance using blockchain based platforms that are aimed to increase confidence and trust for banks in issuing letters of credit in international trade finance operations.

Following the advent of cryptocurrencies including bitcoin and other “altcoins” blockchain based systems have given rise to alternative means of raising financing (in contrast to IPOs, initial public offers) for startups via the ICOs (initial coin offering, providing transferable, fungible tokens) that have been used in some crowdfunding initiatives. Digital Identity using DLT could help in assisting with KYC (know your customer) requirements so that one time submission of KYC could be used by different financial institutions instead of the current requirements of submitting the same KYC documents to multiple financial institutions. For example, one KYC submission for customers at one bank would satisfy the requirements at multiple financial institutions in which the customer may have accounts,

Blockchain based systems are being tested by some companies to issue corporate bonds and loans. Using DLT to issue loans or bonds provides a digital record and updates of the transaction history of all parties involved in real time (e.g., debt issues in excess of permissible amounts set by bond covenants could be viewed by creditors and thereby prevent issuers from increasing leverage and risk for the bondholders). Also, smart contracts initiated by DLT could make the bondholders less reliant on trustees and other intermediaries. Also, DLT could help in maintaining cybersecurity and consequently increase trust among customers resulting from digital identity validation of financial transactions through the sequential coding technology used in blockchains. Since the sequential coding technology provides a historical audit trail it may also be useful for regulatory authorities in tracking past transactions records.

Varma (2019) points out that networks could now be used to make very low value payments. Micropayments on a blockchain can be extended to applications in microfinancing loans, savings,

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etc. This could create a more inclusive financial environment by circumventing traditional intermediaries who may not be as willing to offer micro-lending facilities, etc. Blockchains using distributed ledger technology can provide transparency before and after the trade of securities to the parties involved in the transactions. Brokers and custodians could be replaced by the blockchain platform. Blockchain may also offer solutions and provide more security against data breaches and cyber-attacks at credit bureaus.

Katona (2021) reiterates that public permissionless blockchains allow more participants to join, providing a more inclusive environment, in contrast to the centralized financial system governed by central banks. Decentralized Finance (DeFi) also provides a more transparent data history that may be disclosed to all parties to a transaction in real time. Hutson et al. (2023) points out that the use of digital currencies could ensure a more independent process in terms of enabling easier entree to users without a traditional bank account, while preserving security in terms of digital identity authorized through the sequential coding technology in blockchain transactions. Varma (2019) recognizes some legal barriers and challenges for non-cryptocurrency applications of the blockchain (e.g., in real world assets such as dollars, real estate, securities, etc.) The legal framework for such non-cryptocurrency assets could be overly dependent on codes on the blockchain.

Harwick and Caton (2019) discuss some obstacles in the development of the crypto currency credit markets. In the traditional credit markets, there is a requirement of trust between borrowers and lenders that may be facilitated by collateral usage intermediation. This may be challenging in a blockchain environment where there may be pseudonymity and ease of exit. Blockchain Finance governance does not depend on the main bank for governance. As a result, Ozili (2019) points out that many central banks including those in Nigeria and Spain have prevented regulated banks from using blockchain or bitcoin transactions. In spite of the issues regarding regulation, etc. Blockchain technology in finance is gaining momentum for the near future. As noted in Hutson et. al. (2023), a basic necessity of a medium of exchange in a market transaction amongst two parties involves whether the medium is a good store of value and universally tolerable for the involved parties in the market. These two properties are currently absent in the cryptocurrency market due to the high volatility observed in the crypto market.

Central banks across the planet are cognizant of the popularity of the decentralized financial system among the forthcoming generations and are presently designing central bank digital currencies (CBDC) that may be structured to provide more stability to the system. Since the store of value is a basic property of a tolerable medium of exchange, we could anticipate the applications and acceptance of blockchain technology in finance in a more regulated arcade in the prospect.

2.3 BCT Solutions W.R.T. Business

Blockchain technology is mostly associated with Bitcoin and other cryptocurrencies designed as a public ledger for digital payment systems. Even though cryptocurrencies were designed to promote security, trust, and openness as an alternative to a centrally controlled payment system, it is the volatility and abnormal return from crypto trading that popularized the technology among other stakeholders. The past few years have witnessed increasing adoption of blockchain technology outside the public crypto currencies domain that was designed primarily for various payment solutions and trading purposes. While business organizations are at the forefront of innovative applications of technology, blockchain has found some interesting niche applications that go against the initial proposition of distributed, publicly available, secure, and transparent technology.

Blockchain applications have strong appeal in the application areas that are in need of balancing protecting personal information (information security), enhancing user trust through transparency and decentralized control, minimizing fraud with immutable records, and reducing transaction costs. According to their objectives, organizations are more than likely to prioritize one objective over others and deviate from the core philosophy of the technology. For instance, in 2017, the UN World Food Program (WFP) tested "Building Block", an Ethereum-based payment solution across the refugee camps in Jordan (Seibert, 2019). The payment system allowed refugees to purchase food from designated stores using the food vouchers associated with their accounts. A biometric scanner at the store complemented the payment system allowing the WFP to design a system that supported the efficient allocation of cash redemption for over 100 thousand Syrian refugees. As a result, WFP managed to reduce the transaction cost by eliminating 98% of banks' transaction fees (Tietoevry, 2020). However, blockchain enthusiasts were quick to point out whether one can consider such applications truly a blockchain or a mere database (Gerard, 2017). Unlike other blockchain applications, "Building Block" was implemented as a private blockchain running on four different nodes, inaccessible for other parties to join, drawing a comparison to the database system. While trust, transparency, and security are the essence of blockchain application, WFP's approach is just one example of how an appeal of innovative technologies like blockchain technology can lure organizations to digitalization with the promise of financial reward of reduced transactional cost. WFP is also a representative case, where a shiny innovative technology ushers the organization for digitalization -- after all, it attracts more eyeballs compared to boring existing legacy systems (Yang, 2022).

Like the UN WFP, The International Committee of the Red Cross (ICRC) also has a blockchain project aimed at easing the problem of hard cash across Kenya and Ethiopia (Piaggio, 2023; Pollock, 2019). This two-year project brought together Norwegian, Danish, and Kenyan Red Cross societies to develop a blockchain solution aimed at providing a smooth trade of goods, products, and labor by keeping track of the mobile-to-mobile payments using mobile phones instead of cash or vouchers. The system was designed to work with crypto-based payments and, unlike other blockchain systems, does not require association with the national currency for transactions (Dylan, 2019).

Blockchain has also been adopted by national-level social organizations to improve their services. In 2019, the Social Insurance Institution of Finland – Kela and TietoEVRY, developed a proof-of-concept for smart money to fully digitalize reimbursement solutions for rehabilitative psychotherapy (Tietoevry, 2020). The smart money-based payment system would allow Kela to track real-time information on therapy sessions, eliminate paper works and save 700 days of work each year. Kela planned to extend this solution to basic social assistance vouchers –for food, medication, eyeglasses, moving assistance and home insurance – with the potential benefit of guaranteeing the payment as well as reducing the risk of fraud and misuse of the payments. Again, the goal of the organization is to promote efficiency and transparency in the use of social funds.

Fundraising and donations are among the areas of applications that can benefit from adopting blockchain technology. Fundraising for election campaigns is not new in the USA and is common across other democracies. However, there is a demand for greater transparency on how the fund is raised and spent. Interestingly, former US president Donald Trump is facing charges of campaign

finance violation (Yang, 2022). Such a situation could have been averted with the use of Blockchain to maintain the record of election campaigns. A Blockchain-based record-keeping system can keep a trustworthy and tamper-proof record that public and legal authorities can rely on. Similarly, other donations and fundraising activities can also benefit from the use of blockchain technologies. However, such an application would require a necessary regulatory framework for handling sensitive public data. Such challenges could be even more severe for the international organization operating in multiple countries where the legal regularities vary from one country to another.

2.4 BCT Challenges and Issues

Several issues and challenges arise in the context of blockchain technology implementation and authorization. Danger of money laundering, tax evasion, and pony-trekking were some most ranked issues in case of finance and business adaptation. The framework for blockchain-based finance systems (say Hyperledger Fabric platform) are in primary stages and have several challenges ahead. There is a high financial pressure and insufficient investment funds in terms of government agencies in several blockchain based projects. We have summarized some key challenges and issues of blockchain technology with respect to finance and business.

I. Smart contracts, data monitoring, & interoperability challenges (Meroni et al., 2022): With a specific stress on business process monitoring, blockchain is a hopeful aid as the status of running processes can be distributed and trusted among the parties. Capabilities proposed by a blockchain are significant for business process monitoring because of several requirements on characteristics such as event support, pluggability of participants, differential access to information, access to contextual data, auditing-oriented data provisioning. Transparency proposed by the smart contracts deeply impacts on the platform, requires careful accomplishment of monitoring and trust in order to undercut the control that participants have on the data being provided. Smart contracts lack the capability of autonomously making calls or invocation external the blockchain.

II. Targets for cyber-attacks & lack of information on credit scoring (Kshretri et al., 2020; Polyviou et al., 2019): Beyond cryptocurrencies, blockchain technology has been deliberated for a plethora of other applications as it summarizes unique possessions including decentralization, security, transparency, and anti-tampering. It is also believed as the overhyped technology and of the fact that cryptocurrencies are up to date the only wide-ranging applications of blockchain. What will occur in the medium and long-term residues to be seen as several security applications are targeted by cyber-attacks every second. For the FinTech and InsurTech enterprises, lack of information, or use of fake information and data is very popular among the stakeholders.

III. Commercial users remain in legal and regulatory challenges (Hutson et al., 2023): As humans interrelate in virtual or augmented environments, the potential for legal glitches via relationships and legal expectations will rise that has not been measured until now. As virtual objects, such as Non-Fungible Tokens (NFTs), become nearer or combined with physical objects, the more legal expectations of possession will blur. While blockchain has the potential to undergird the metaverse and substitute existing payment retails, concepts such as proprietorship cannot be readily transposed from the traditional economy into the new simulated world. One should first study the costs and benefits of blockchain technology in this sector. Since the medium of interchange in this

virtual sector would encompass cryptocurrency, a brief review and probable challenges would be prudent.

IV. Regulatory compliance, commercial viability from incumbent players (Varma, 2019): Even a decade after the blastoff of Bitcoin, we have seen only a limited pilot applications of blockchain to other parts of finance. Blockchain applications in many domains are already technologically practical, and the challenges are mostly legal, regulatory, institutional, and commercial. Recurring instances of hacking of computers of large financial institutions is another factor that has devastated trust. It could take many durations to overcome these legal/commercial barriers, and mainstream financial intermediates could use this time window to reconstruct their vanished trust quickly enough to stave off the blockchain test. Instead of trusting on a central trusted body to maintain the trustworthy record, blockchain allows all attracted parties to maintain their individual copy of the ledger.

V. Primary application, technical interoperation, and trust challenges (Viriyasitavat et al., 2022): The study of adopting blockchain in business process management (BPM) has charmed a great deal of attention that has been demonstrated by a rapidly rising number of relevant articles. Blockchain has been intensively verified as a promising solution to assure the trustiness of both business processes and their executions in decentralized BPM. Most reported that the blockchain applications are at their initial stages, future research works are needed to meet the technical challenges complicated in interoperation, determination of trusted entities, confirmation of time-sensitive execution, and care of irreversibility. In public environments, sympathetic data flow across distributed stakeholders, and this raises the concern in assuring security and privacy.

VI. Regulatory issues in agriculture, farmers not advanced in tech (Kshretri et al., 2021): When utilizing the blockchain technology in favor of farmers, although it looks easy and ground-breaking, the efficiency and inventory automation process cannot be as good as expected because of several challenges. There are several complex regulatory issues for agribusiness and the food supply chain. The technology is not compatible with the education level of farmers and still very complex for farmers to understand and implement blockchain in their agriculture sector. Blockchain in the agribusiness and foodstuff sector has huge potential despite many barriers in its development. There is the need for future research on how clearly blockchain-based solutions can advantage agribusiness and farmers.

VII. Laws incompleteness, complex financing instruments (Zhang et al., 2021): Existing laws and regulations are deficient, and the rights and obligations of the regime and private investors are not visibly stipulated. Infrastructure projects, such as roads and high-speed railway, are usually capital intensive. Because many stakeholders are involved in infrastructure projects, their relationships are complicated. During the execution and operation of infrastructure projects by private entities, report opacity and frequent calamities have promoted distrust from the general civic. Due to the large number of projects in the asset group, the financing process is long-lasting, difficult, and little in transparency.

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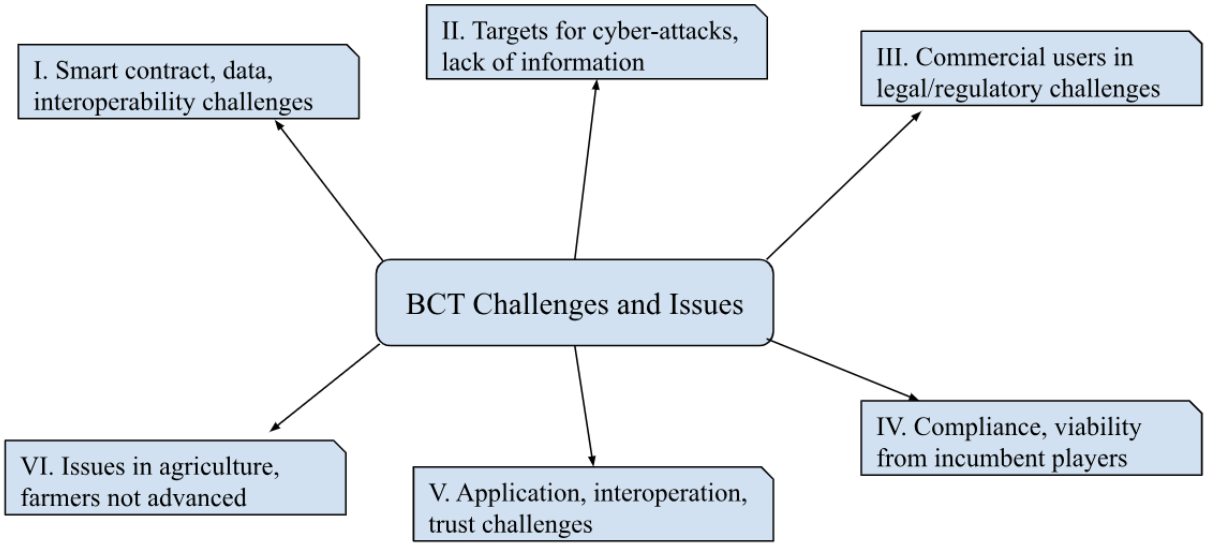

Figure 2. Blockchain Technology Challenges and Issues in Business and Finance

3. BCT DISRUPTION & EDUCATION

Blockchain technology has been disrupting business, finance, including government services, and the future of education too. Only been around for 14 years, blockchain technology in research and education has been actively used for the last five - six years. One strong consequence where blockchain mounts as a solution in education is technology setup while continuing trust and tamper-proof records management. Some of the major use cases of blockchain in education and research include:

I. Reporting, verifying academic transcripts and certificates with blockchain to improve educational outcomes (Ocheja et al., 2022): A distinctive bibliometric and quantitative analysis of blockchain in education with latest contributions on temporal development. As current education systems do not reflect interoperability at the blockchain level, advent of BCT over the last era has led to the development of multiple use-cases of decentralization in numerous fields including education. Distinctive institutes implement different technologies to issue credentials and manage academic records, blockchain brings modernization to include academic research, reputation, e-portfolio, connecting lifelong learning platforms, credentials, and certificates.

II. Solve cold-start problems and improve learning analytics via Blockchain of Learning Logs (BOLL) framework (Seibert, 2019): There is a key requirement of taking proof of preceding learning achievements or experiences, as learners transport from one learning environment to additional learning environment. From information on a learner's behavior to functioning in quizzes and assignments, data from a reference point for evaluating and refining engagement and performance towards awareness of learning goals. Different institutions having their learning data inaccessible from each other, it becomes more problematic to easily access a learner's learning memoire for all learning activities. A blockchain based approach for linking learning data across different learning systems, leveraging on unique properties of BCT, solutions to ensure learning data consistency, availability, privacy, immutability, and security.

III. Skill and credential management with pedagogical techniques, Smart Ecosystem for Learning, and Inclusion (SELI) platform (Harwick & Caton, 2022): The concern for quality educational services and activities is connected with the information and communication technologies. Novel opportunities are recognized with the latest information technology answers. A digital ecosystem architecture, called SELI, targets to provide a manageable learning environment and its contents, moreover proper authoring tools based on latest technology such as blockchain technology, microsites, and complete accessibility guidelines. Various initiatives have made accessible open educational resources, obtainable through educational platforms to achieve a larger spectators.

IV. Education records verification system for data interchange and information sharing, a novel blockchain-based technique on Ethereum Client (Gerard, 2017): The interchange and sharing of learning records among educational institutions for one scholar are very common academic affairs. Data is also used in academies for paying specific care to students' extra attention. A blockchain is an immutable, transparent, digitalized, decentralized, public record of all cryptographic data interchanges. With key characteristics of decentralized nature, dissimilar accounts preserved by university, department, college, government agencies, blockchain does not oblige an intermediary to ample education records or alter records. The blockchain framework could also deliver services and functions for the after-college education and several other future norms.

V. Work based on natural learners' need to compete as gamification, modern blockchain opportunities for education (Yang, 2022): Gamification provides the chance to awaken the ludic characteristics in the process of knowledge achievement. New information and communication technologies are lucratively used in both school and adult education. A model example of linking information technology and the natural human needs of competition in the learning process is gamification. Two solutions for supporting education in the modern world are - potential of modern blockchain and work based on natural learners as gamification. Transferring the mechanisms found in PC games into the learning-teaching process growths motivation to meet the desired intentions.

SN	BC use cases in education & research	BC type	BC Platform	BC feature	Ref
1.	Verify and report academic transcripts and certificates	Private	Smart Contract, Hyperledger	Transparency, Distributed	(Ocheja et al. 2022)
2.	Solve cold-start problem and improve learning analytics (BOLL framework)	Private	Ethereum, Smart Contract	Privacy, Distributed Ledger	(Seibert, 2019)
3.	Skill and credential management with pedagogical techniques	Private	Smart Contract, Digital Storytelling	Accessibility, Interoperability	(Tietoevry, 2020)

4.	Blockchain-based education record verification system via smart contract	Private, Hybrid	Ethereum, Smart Contract	Decentralization, Non-Intermediaries	(Gerard, 2017)
5.	ICT-mediated solutions supporting adult education, based on gamification via BC	Public, Private	Consortium BC, Distance Learning	Traceability, Immutability	(Yang, 2022)

Table 2. Summary of Blockchain Use Cases in Education and Research with Type of Blockchain Used

4. Ethical Analysis of BCT Adaptation

There is no doubt that the initiation of blockchain technology over the last decade has disrupted several key areas including finance and business (apart from non-banking institutions). Traceability is the aptitude to track a specific transaction indoors the blockchain network. Inspecting the block detailed information of each transaction will reveal useful truths for transaction tracking. Information on the blockchain cannot be modified without the consent of other participants, therefore building mutual trust, reliability, durability versus attacks. We have summarized the ethical analysis of the adaptation of blockchain technology along with related issues and recommendations in the table below.

Ref.	Ethical analysis of blockchain technology adaptation in finance and business	Related issues & challenges	Recommendations & future research
(Meroni et al., 2022; Piaggio, 2023)	Although business and finance are compatible with blockchain technology, the higher the amount of data, the more costly the transaction gets. Care should be taken in proposal of smart contracts to minimize the cost. Trust among business partners, stealing sales, business through revenue loss, product defamation impacts on the economic growth.	Smart contracts, Oracle, Data monitoring, Mitigation, Applicability & Interoperability challenges	Aim at extending techniques to BC, Expect new mitigation schemes that exploit advancements
(Polyviou et al., 2019; Pollock, 2019)	Permissioned blockchains such as R3/Corda and Hyperledger Fabric support hundreds of transactions per second (TPS) as a part of quicker transaction completion that is supported by orthodox public blockchains (Bitcoin and Ethereum) remains the same. Temporal constraints of business processes need	Financial organizations are principal targets for cyber-attacks. Financial institutions have a lack of evidence on credit scoring.	Use cases of BCT will become mainstream in financial sector in next era, Provide ground for pioneers in financial sector

	additional enquiry although BCT can be used to find treaty between untrusted collaborating parties.		
(Hutson et al., 2023; Dylan, 2019)	Using digital currency would be cautious since exchanges in the virtual sector involve cryptocurrency. Currently lacking in the crypto market, problems with bitcoin's custom due to its extremely high volatility in the market, thus increasing the financial risk. Focus on distributed applications such as business processes and distributed roadmaps, as blockchains provide an attractive decentralized solution for auditability.	Challenges for commercial users linger in legal and regulatory arenas, Case with emergence of online commerce, issues addressed by courts	Technology alone will not tile way for true ownership of digital assets, Research should include a reflection of BC impact
(Ocheja et al., 2022; Varma, 2019)	Despite being applied to most parts of finance, blockchain technology has to overwhelm some major legal barriers. In most applications, properties that exist in the real world have to be represented by BC entries, unlike cryptocurrencies that happen only on the blockchain. For all involved parties, integration of business processes across organizations is fruitful, despite lack of trust is often a roadblock.	In finance, most blockchain applications need to ensure regulatory compliance, Ensure commercial viability from incumbent players	Hard to forecast how successful it would be outside cryptocurrency domain; Underlying ideas are powerful and likely to be influential
(Martins et al., 2019; Viriyasitavat et al., 2022)	Blockchain-based systems are loomed as services that provide support to decentralized BPM. With the power of smart contracts, blockchain imposes obligations of counterparties that conduct in business processes by programming the contracts as transactions. Smart contracts deployed on the blockchain require both policies and attributes for their evaluation to manage auditability property from immutability & transparency.	Applications are at initial stages, research needed to encounter technical challenges in interoperation, trusted entities determination	Envisioned to gain trust in an untrusted environment, trust has been a long-standing hindrance for effective business collaboration
(Han et al., 2018;	Efficiency in SCM and the food-sector can be improved and transported real-	Regulatory issues of blockchain-based	Despite many obstacles in BCT

Kshetri et al., 2021)	time via blockchain technology to all members that can affect the inventory and product price. Customers and farmers are both benefited with extra care. To track activities, identify inefficiencies, and streamline the roadmap, business process management systems are often used via a trusted central system.	systems need to be investigated, since agriculturalists are not very advanced in technology	development, use of BC in business, agriculture has great potential for success
(Olelere et al., 2019; Zhang et al., 2021)	Internal strength, weaknesses along with external opportunities and threats discovered via fuzzy AHP-SWOT analysis in using blockchain-based finance systems on infrastructure projects. A conceptual framework authenticated through deployment on Hyperledger Fabric is excellent. Although emerging as an effective solution, the basic algorithms in business blockchain are not practicable for big scale IoT systems.	Incompleteness of laws, policies, as BCT is being developed vigorously, financing instruments are complex, insufficient transparency, lack of data	Tiny research on infrastructure stock and financing based on BC, traceable feature make financing visible

Table 3. Ethical Analysis of Blockchain Technology Adaptation in Finance and Businesses with Related Issues, Challenges, and Recommendations

5. Future Scope and Conclusion

While the research on blockchain technology and several cryptocurrencies is still ongoing, it is necessary to frame the exact foundation. We advocate that forthcoming work on blockchain in finance, business, and education should address several challenges and issues including interoperability via proper standardization. Blockchain has been intensively studied as an assuring solution to assure the trustiness of together business processes and their execution. Future systematic assessments can present how blockchain in finance is used to address ongoing financial crises and financial goals as the blockchain in finance is continuously evolving. In future works, we can build and analyze the finance, business model of blockchain considering the above ethical analysis of blockchain solutions. We have shown the ethical analysis and impact of blockchain technology in major areas of finance and business including education sectors. We have also discussed the solution of blockchain technology with respect to finance and business, and presented several reasons for the adoption of blockchain technology by financial firms around the earth. We also recommend that future effort on blockchain in finance and business should address the key issues such as the interoperability and smart contract programmability through proper standardization.

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