

Financial Mathematics and Fintech

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# Applications of Block Chain technology and Artificial Intelligence

Lead-ins in Banking, Finance, and  
Capital Market



Springer

# **Financial Mathematics and Fintech**

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Mohammad Irfan • Khan Muhammad  
Nader Naifar • Muhammad Attique Khan  
Editors

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# Chapter 1

## The Impact of Artificial Intelligence on the Future of Computing: A Comparative Study



Tarun Kumar Vashishth, Bhupendra Kumar, Md Shabbir Alam,  
Vikas Sharma, and Sachin Chaudhary

### 1.1 Introduction

One sector that stands to undergo significant transformation is the traditional banking system. As the backbone of global financial transactions, traditional banking systems have long played a central role in facilitating economic activities. However, they are not without their limitations, including inefficiencies, high costs, security vulnerabilities, and complex intermediation processes. Blockchain technology offers a decentralized and transparent approach to recording and verifying transactions, utilizing a distributed ledger that is shared among participants in a network. By leveraging cryptography and consensus mechanisms, blockchain introduces trust and transparency into financial interactions, reducing the reliance on intermediaries and potentially streamlining processes.

By examining various dimensions, including trust and transparency, security, cost efficiency, decentralization, and the emergence of cryptocurrencies, this study aims to shed light on the potential benefits and challenges associated with integrating blockchain into traditional banking systems.

One significant aspect to explore is the potential improvement in trust and transparency brought about by blockchain technology. The inherent immutability of blockchain records and Real-time transaction monitoring has the potential to improve the overall integrity of financial transactions, reducing fraud and enhancing customer confidence. Security is another critical consideration. Traditional banking systems face cybersecurity threats, and the storage of sensitive customer data poses

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risks. Blockchain technology's decentralized nature and cryptographic algorithms offer robust security measures that could potentially mitigate these vulnerabilities.

Cost efficiency is an important factor that can influence the adoption of blockchain by traditional banks. Blockchain technology can eliminate middlemen and streamline the process through smart contracts, thereby reducing transaction costs, increasing efficiency, and increasing profitability. Interest in the emergence of digital currencies such as Bitcoin and Ethereum has also increased in recent years. This digital asset is based on blockchain technology and has the potential to disrupt traditional banking by enabling peer-to-peer transactions and bypassing middlemen. Understanding the impact of cryptocurrencies on traditional banking is key to assessing the full impact of blockchain technology.

However, the integration of blockchain into traditional banking systems is not without challenges. Regulatory frameworks, scalability, interoperability, and data privacy are critical areas that need to be addressed. Blockchain technology's decentralized nature challenges existing regulatory structures, requiring policymakers to adapt and establish frameworks that try to balance customer protection and innovation. Additionally, scalability & interoperability concerns need to be resolved to accommodate the vast volume of transactions processed by traditional banking systems.

### ***1.1.1 Banking System***

The banking system is a fundamental component of the global financial infrastructure, serving as the backbone of economic activities and financial transactions. It encompasses a network of financial institutions, including banks, credit unions, and other entities, that offers a variety of financial assistance for people, companies, and governments. Accepting consumer deposits is one of the banking system's main duties. Individuals and businesses deposit their money into bank accounts, which are then used by banks to extend loans and provide credit to borrowers. This deposit-taking function helps individuals and businesses to safeguard their funds and earn interest on their savings, while simultaneously enabling banks to channel these deposits into productive economic activities.

Moreover, the banking system acts as a financial intermediary, connecting savers and borrowers. Banks play a vital role in evaluating the creditworthiness of borrowers, managing risks, and facilitating the flow of funds between surplus and deficit units in the economy. By providing financial intermediation services, banks facilitate lending and borrowing activities, enabling individuals and businesses to invest, expand, and finance various projects.

In addition to deposit-taking and lending, the banking system offers a wide range of financial services. These services include payment processing, such as facilitating electronic funds transfers, issuing checks, and providing debit and credit cards. Banks also offer services such as foreign exchange, trade finance, wealth

management, investment banking, and insurance, catering to the diverse financial needs of their customers.

Furthermore, the banking system serves as a custodian of financial information. Banks collect and store vast amounts of customer data, including personal information, transaction histories, and credit profiles. This information is crucial for banks to assess creditworthiness, manage risks, and provide tailored financial solutions. One of the most important duties of the banking system is to guarantee the confidentiality and safety of consumer data. The banking system is highly regulated to maintain financial stability, protect consumers, and prevent money laundering and fraudulent activities. Banks are required to comply with capital adequacy requirements, maintain liquidity buffers, and adhere to anti-money laundering and consumer protection regulations.

### 1.1.1.1 Traditional Banking System

In businesses to carry out everyday transactions, making commerce more convenient and efficient. Traditional banks provide investment banking, wealth management, foreign exchange, financial services, and other services in addition to these fundamental business operations. These services cater to the diverse needs of individuals, corporations, and institutional clients, offering specialized financial expertise and solutions.

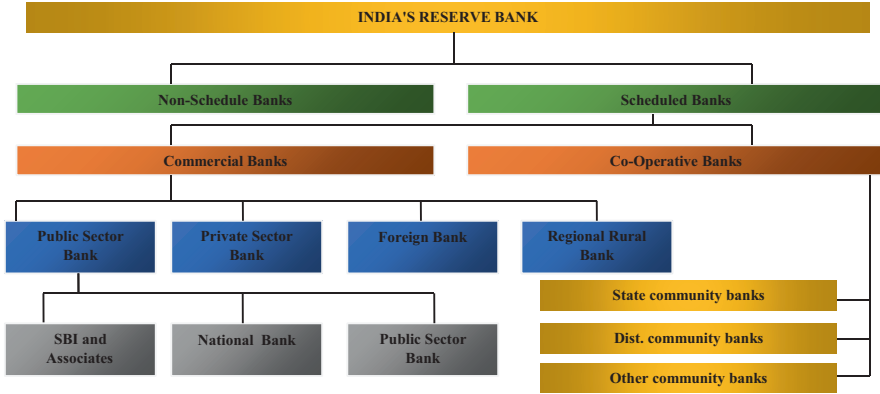
Furthermore, traditional banks serve as custodians of financial information, collecting and maintaining vast amounts of customer data. This information includes personal details, transaction histories, and credit profiles. Banks are responsible for safeguarding this sensitive data and ensuring the privacy and security of their customers.

However, traditional banking systems are not without their challenges. They often face issues related to inefficiency, high operational costs, complex regulatory frameworks, and limited accessibility. The reliance on intermediaries, manual processes, and legacy systems can result in delays, errors, and higher transaction costs (Fig. 1.1).

Moreover, traditional banking systems are susceptible to fraud and security breaches. Cyber attacks, identity theft, and unauthorized access to customer accounts pose significant risks. Maintaining robust security measures and protecting customer data are paramount for traditional banks.

In recent years, the rise of digital technologies and the advent of blockchain technology have presented both possibilities and difficulties for conventional banking systems. The adoption of digital banking solutions has allowed banks to enhance customer experiences, streamline processes, and offer innovative services. Mobile banking applications, online platforms, and digital wallets have transformed the way customers interact with their banks and carry out transactions.

Furthermore, blockchain technology, with its decentralized and transparent nature, can transform current banking practices. Distributed ledger for recording and verifying transactions, blockchain technology can enhance trust, transparency,



**Fig. 1.1** System of banking in India structure

and security. It has the potential to streamline processes, reduce costs, and mitigate fraud risks.

However, integrating blockchain into traditional banking systems also raises regulatory and implementation challenges. Legal structures must change to account for the special features of blockchain technology, such as decentralized governance and cross-border transactions. Additionally, scalability, interoperability, and data privacy issues need to be addressed to ensure seamless integration with existing banking infrastructure.

In conclusion, the traditional banking system plays a crucial role in facilitating economic activities and providing essential financial services. Despite its strengths, it faces challenges related to efficiency, security, and accessibility. The emergence of digital technologies and blockchain technology offers both opportunities and challenges for traditional banks. Embracing digital innovations and leveraging blockchains transformative potential can help traditional banks stay competitive, enhance customer experiences, and adapt to the evolving financial landscape.

### Drawback of Traditional Banking

While traditional banking has been a longstanding and reliable system for financial transactions and services, it does come with several drawbacks. Some of the drawbacks of traditional banking include:

- (i) **Limited Access:** Traditional banking requires physical presence at a bank branch during specific operating hours. This can be inconvenient for individuals who have busy schedules or live in remote areas with limited access to bank branches.
- (ii) **Time-consuming Processes:** Many traditional banking processes involve extensive paperwork, long waiting times, and multiple visits to the bank.

Transactions such as opening an account, applying for loans, or conducting certain financial operations can be time-consuming and cumbersome.

- (iii) **Geographical Constraints:** Traditional banks typically have a limited number of branches, which means that individuals living in rural or underserved areas may face difficulties accessing banking services. This can lead to financial exclusion and hinder economic development in those regions.
- (iv) **Higher Fees:** Traditional banks often charge various fees for their services, including maintenance fees, ATM withdrawal fees, overdraft fees, and transaction fees. These costs can add up and affect customers, particularly those with lower incomes or who frequently require banking services.
- (v) **Limited Innovation:** Traditional banks can be slow to adopt new technologies and innovations compared to fintech companies and online banking platforms. This can result in a lack of convenient digital services and limit access to the latest financial tools and solutions.
- (vi) **Strict Eligibility Criteria:** Traditional banks typically have strict eligibility criteria for loans and credit, making it difficult for individuals with limited credit history or lower incomes to access financial products. This can create barriers to obtaining necessary funds for personal or business needs.
- (vii) **Lack of Personalization:** Traditional banking often lacks a personalized approach to customer service. Customers may not receive tailored recommendations or personalized financial advice, leading to a less satisfying banking experience.
- (viii) **Security Concerns:** While traditional banks have implemented security measures to protect customer accounts, instances of fraud and identity theft still occur. Traditional banking methods such as checks and physical documents can be vulnerable to theft or forgery.

It is important to note that with the rise of technology and digital advancements, many traditional banks are working to address these drawbacks by offering online and mobile banking services, adopting innovative technologies, and improving customer experience.

### 1.1.1.2 Digital Banking System

The digital banking system represents a transformative shift in the way banking services are delivered and experienced by customers. It leverages technology and digital channels to offer a wide range of financial services through online platforms, mobile applications, and other digital channels. This evolution in banking has revolutionized the industry, providing customers with convenience, accessibility, and personalized experiences.

Online banking is a crucial component of the digital banking system. Through secure websites or mobile apps, customers may access their accounts, examine balances, and carry out various transactions. Customers no longer need to travel to

actual bank locations in order to conveniently manage their funds because of online banking.

Mobile banking applications are a significant component of the digital banking system. With smartphones becoming ubiquitous, customers can access their bank accounts, make payments, transfer funds, and perform other financial activities directly from their mobile devices. Mobile banking apps often offer additional features like biometric authentication, budgeting tools, and personalized financial insights.

The digital banking system also includes electronic payment services that simplify and expedite transactions. Customers can make online purchases, pay bills, and transfer funds electronically, reducing the reliance on cash and checks. Peer-to-peer transfers, contactless payments, and mobile wallets are examples of digital payment mechanisms, offer convenience and speed, enhancing the overall customer experience.

Furthermore, digital banking has facilitated the emergence of innovative financial products and services. Fintech companies, in collaboration with traditional banks, are introducing novel solutions to meet evolving customer needs. These include robo-advisory services, automated investment platforms, crowdfunding, and peer-to-peer lending. Open banking, which enables users to securely share their financial data with authorized third-party providers to receive customized financial goods and services, has also been made possible by digital banking.

The digital banking system has empowered customers by providing self-service options and personalized experiences. Customers can customize their banking preferences, set alerts and notifications, and access a wealth of financial information and educational resources. This self-service approach enhances financial literacy and empowers individuals to make informed decisions about their finances.

Moreover, the digital banking system has the potential to promote financial inclusion. It allows individuals who were previously underserved by traditional banking to access basic financial services. Digital banking reduces barriers to entry, such as physical distance and documentation requirements, making banking services more accessible to marginalized populations.

However, the digital banking system also presents challenges and considerations. Cybersecurity and data privacy are critical concerns, as the reliance on digital channels increases the vulnerability to cyber threats and data breaches. Banks must invest in robust security measures, encryption technologies, and fraud detection systems to safeguard customer information and transactions.

The digital banking system requires ongoing investment in technology infrastructure and digital literacy initiatives to ensure broad adoption and usability. Banks need to address digital divides, provide support for older or less tech-savvy customers, and ensure accessibility for individuals with disabilities.

## Benefits of Digital Banking

Online banking, usually referred to as digital banking, or electronic banking, has many benefits over conventional banking practices. The following are some benefits of digital banking:

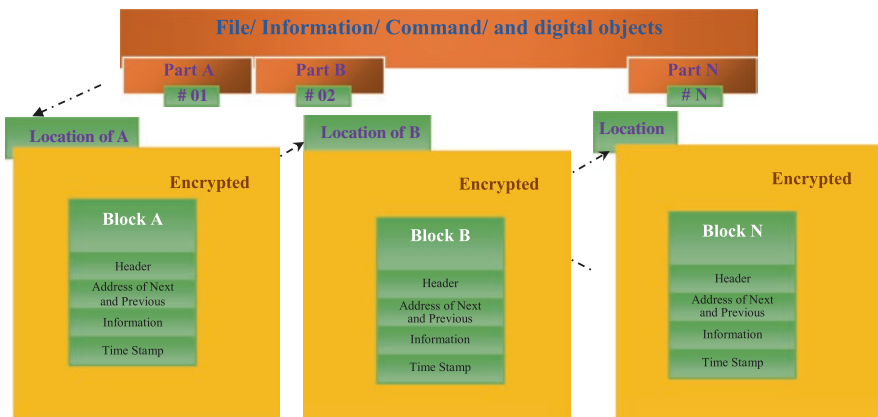
- (i) **Facilitation:** If a customer has access to digital banking, it saves time and effort by eliminating the need to go to a physical bank branch.
- (ii) **Availability round-the-clock:** Unlike traditional banking, digital banking services are accessible every day of the week, 24 h a day. Customers can check their account balances at any time, even on weekends and holidays, make transfers, pay bills and complete other operations.
- (iii) **Cost Savings:** Comparing digital banking to traditional banking, costs are frequently lower or nonexistent. Many online banks offer fee-free accounts, reduced transaction fees, and no or minimal account maintenance fees. This can result in significant cost savings for customers.
- (iv) **Enhanced Account Management:** Digital banking provides users with real-time access to their account information. Customers can monitor their transactions, track expenses, view statements, and analyze their financial activity using intuitive interfaces and tools. This enables better financial management and budgeting.
- (v) **Quick and Efficient Transactions:** Digital banking allows for fast and seamless transactions. Funds can be transferred between accounts instantly, and bill payments can be made with a few clicks. This eliminates the need for writing and mailing checks or visiting physical branches to conduct transactions.
- (vi) **Mobile Banking:** Many digital banking platforms offer dedicated mobile apps that provide even greater convenience. Customers can use their smartphones or tablets to instantly access their accounts, complete transactions, and manage their finances. Mobile banking also often supports additional features like mobile check deposit and biometric authentication for added security.
- (vii) **Enhanced Security Measures:** Digital banking platforms employ advanced security measures to protect customer information and transactions. These may include multi-factor authentication, encryption, fraud monitoring, and secure data transmission protocols. In some cases, digital banking can be considered more secure than traditional banking methods, such as paper checks or physical documents.
- (viii) **Access to Financial Tools and Services:** Digital banking often integrates with other financial tools and services. Customers can easily apply for loans, credit cards, or investment accounts online, and accesses a wider range of financial products and services. Additionally, digital banking platforms may offer financial planning tools, budgeting apps, and personalized recommendations to help customers manage their finances effectively.

Digital banking has transformed the way individuals and businesses interact with their finances, providing greater accessibility, convenience, and flexibility. However, it is crucial for users to remain vigilant and follow recommended security practices to protect their personal and financial information.

### 1.1.2 Blockchain Technology

A decentralized and distributed ledger system known as blockchain technology keeps track of and verifies transactions across numerous computers, or nodes. It uses cryptographic algorithms to ensure security and immutability of data. Some key points are following for block-chaining (Fig. 1.2).

- (i) **Decentralization:** Unlike traditional centralized systems, blockchain operates in a decentralized manner, where no single entity has full control. Transactions are validated and recorded by multiple participants in the network, creating a transparent and tamper-resistant system.
- (ii) **Transparency and Immutability:** Blockchain provides transparency as every transaction is recorded on a public ledger, visible to all participants. Once recorded, transactions are nearly impossible to alter, providing a high level of data integrity.
- (iii) **Security:** Blockchain protects data using advanced encryption techniques to prevent unauthorized access and manipulation. A proof-of-work or proof-of-stake consensus protocol ensures the authenticity of transactions and maintains the integrity of the blockchain.



**Fig. 1.2** Show how a Digital object is stored at various places, with encrypted blocks of chain, no single point know where the whole object is stored. All sections take part to accomplish a single operation, smoothly and securely. It is a link list that is controlled by numbers of computers/nodes, encrypted links, and encrypted operation for store digital objects over the distributed network

- (iv) **Effective Agreements:** When specific criteria are met, effective agreements—which are self-executing contracts written in code—automatically take effect. Peer-to-peer transactions are made possible by these contracts, which do away with the need for middlemen.
- (v) **Use Cases:** Blockchain technology has applications beyond cryptocurrencies. It can be used for decentralized finance (DeFi), and more. Blockchain’s ability to provide transparency, security, and trust has opened up numerous possibilities across various industries.
- (vi) **Challenges:** Blockchain technology faces challenges compatibility, energy use, and legal frameworks, and privacy concerns. Scaling blockchain networks to handle large transaction volumes while maintaining efficiency remains a significant challenge.
- (vii) **Public vs. Private Blockchains:** Open to all users and supported by a distributed infrastructure of nodes, public blockchains like Bitcoin and Ethereum are available to all users. Blockchains that are private or permissioned limit access to authorized users and are frequently utilized within organizations in particular purposes.
- (viii) **Blockchain compatibility:** It refers is the capacity of several blockchains to interact and communicate with one another. Standards and protocols are being developed to facilitate seamless integration between various blockchain platforms.

### *1.1.3 Digital Currency*

One of the most well-known and widely adopted digital currencies is Bitcoin, which was introduced in 2009. Bitcoin’s creation marked the beginning of a new era in financial transactions, offering a decentralized and secure alternative to traditional monetary systems. Since then, numerous other digital currencies have emerged, each with its unique features and use cases.

Digital currencies provide several key advantages over traditional currencies. First and foremost, they offer increased security using cryptography. Transactions conducted using digital currencies are encrypted and verified through complex mathematical algorithms, ensuring the integrity of the transaction data and protecting against fraud and counterfeiting.

The potential for greater financial transaction efficiency is a key benefit of digital currency. Due to intermediaries and complicated settlement procedures, cross-border transactions in traditional banking systems can be time-consuming and expensive. Peer-to-peer transactions using digital currencies are nearly instantaneous, requiring no middlemen and lowering transaction costs.

Additionally, digital currencies provide for increased financial inclusion, especially in places with limited access to traditional banking services. With access to the internet and a digital wallet, individuals can participate in the global economy, conduct transactions, and store value without the need for a traditional bank account.



Moreover, digital currencies provide transparency and traceability in transactions. Blockchain technology, which underlies many digital currencies, creates a distributed ledger where transaction records are immutably stored. This transparency can help combat illicit activities, as transactions can be easily audited and traced back to their source.

Despite the numerous benefits, digital currencies face challenges and considerations. One notable challenge is regulatory oversight. Governments and regulatory bodies are still grappling with how to effectively regulate digital currencies, as they can pose risks related to money laundering, tax evasion, and consumer protection. Striking a balance between innovation and regulation remains a key focus for policymakers.

Additionally, the volatility of digital currencies is another consideration. The value of digital currencies can experience significant fluctuations, making them subject to speculation and potential financial risks. This volatility can be attributed to factors such as market demand, regulatory changes, and technological developments.

Looking to the future, digital currencies hold the potential to reshape the financial landscape further. Central banks are exploring the concept of Central Bank Digital Currencies (CBDCs), which would be digital representations of fiat currencies issued and regulated by central banks. CBDCs aim to combine the benefits of digital currencies, such as efficiency and traceability, with the stability and credibility of traditional fiat currencies (Fig. 1.3).

In conclusion, digital currencies have emerged as a transformative force in the financial world. With their potential for enhanced security, efficiency, financial inclusion, and transparency, digital currencies offer new possibilities for individuals

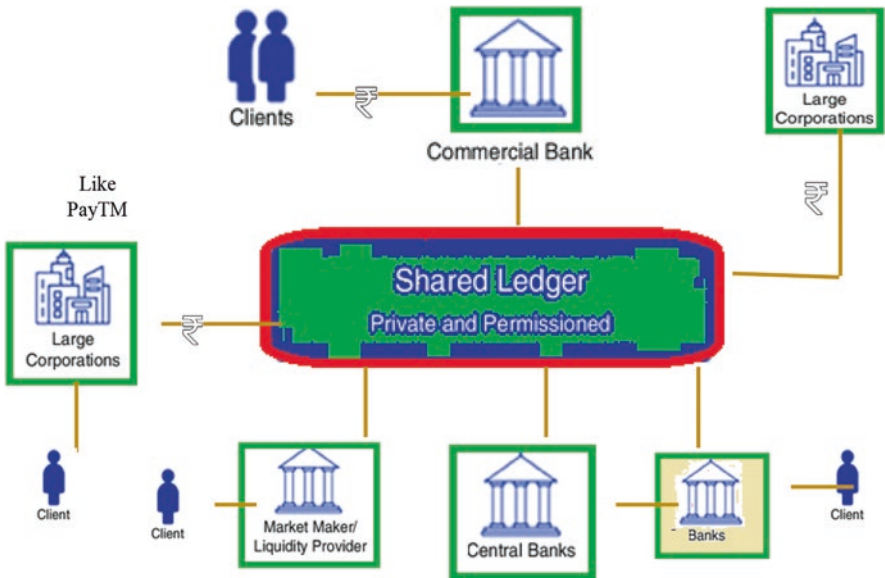


Fig. 1.3 Digital banking system

and businesses worldwide. However, navigating the regulatory landscape and addressing volatility remain important considerations as the future of digital currencies continues to unfold.

## 1.2 Literature Review

The impact of blockchain technology on traditional banking systems is a topic that has received significant attention in recent years. A number of scholars have conducted research and have provided a comparative analysis of blockchain-based banking systems and traditional banking systems. Some studies are-

Nakamoto (2008) Bitcoin whitepaper provides a detailed technical description of the Bitcoin protocol and outlines the benefits of a decentralized, peer-to-peer payment system. Since its publication, the Bitcoin network has grown significantly and has spawned an entire ecosystem of cryptocurrencies and blockchain-based applications.

Yermack (2017) provides a thoughtful analysis of blockchain technology's possible effects on corporate governance. The author suggests that while there are challenges to the adoption of blockchain technology in this area, the potential benefits are significant and should not be ignored.

Al-Turjman and Almsafir (2019) provides a comprehensive review of the potential use of blockchain technology for improving the security and privacy of IoT systems. The authors suggest that while there are challenges to the adoption of blockchain technology in this area, the potential benefits are significant and should be explored further.

Chiu and Koepl (2017) provides a comprehensive examination of the economic aspects of cryptocurrencies, shedding light on their potential benefits, challenges, and implications for the broader economy.

Iansiti and Lakhani (2017) It makes the case that blockchain technology has the power to transform numerous industries by offering a safe and open platform for transacting, and it incites businesses and decision-makers to look into its possible uses. Overall, "The Truth about Blockchain" is a highly informative and accessible overview of blockchain technology, highlighting its fundamental features, advantages, and challenges. The article provides a useful starting point for anyone interested in understanding the potential applications of blockchain technology.

Mazières and Kohli (2018) provides a comprehensive overview of the SCP, highlighting its unique design features and potential applications. The article offers valuable insights into the challenges and opportunities associated with achieving consensus in decentralized networks, and it provides a useful starting point for further research in this area.

Raskin (2017) concludes by emphasizing the transformative potential of blockchain technology in banking and finance, while acknowledging the need for further research, experimentation, and collaboration to overcome the challenges and fully realize its benefits. Overall, "The Application of Blockchain Technology in Banking

and Finance” provides an overview of the potential impact of blockchain technology on the banking and finance industry. It highlights the benefits, challenges, and real-world use cases, contributing to the broader understanding of how blockchain can revolutionize financial services.

Swan (2015) concludes by summarizing the key takeaways and demonstrating how blockchain technology has the potential to change the world’s economy. Overall, “Blockchain: Blueprint for a New Economy” is a valuable resource for anyone seeking to understand the principles, applications, and implications of blockchain technology. The book provides a comprehensive overview of the technology and its potential, making it an essential read for entrepreneurs, investors, developers, and policymakers alike.

Zheng et al. (2018) concludes with a summary of the key takeaways and a discussion of the future of blockchain technology. The authors emphasize the need for continued research and development to address the challenges associated with blockchain and to fully realize its potential as a transformative technology. Overall, “Blockchain Challenges and Opportunities: A Survey” provides a comprehensive overview of the state of blockchain technology, highlighting both the challenges and opportunities that the technology presents. The article is a valuable resource for anyone seeking to understand the potential impact of blockchain on various industries and domains.

Catalini and Gans (2019) explores the potential challenges and limitations of blockchain, including issues related to scalability, interoperability, and governance. The authors highlight the need for further research and development to address these challenges and fully realize the potential of blockchain. Overall, “Some Simple Economics of Blockchain” provides a valuable contribution to the growing body of research on the economics of blockchain technology. The paper highlights the potential economic implications of blockchain and identifies key areas for future research and development.

Overall, the literature suggests that blockchain technology has the potential to disrupt traditional banking systems and improve the efficiency and security of banking services.

## 1.3 Discussion (Fig. 1.4)

### 1.3.1 *Advantage of Blockchain in Banking*

The impact of blockchain technology on traditional banking systems has already begun to reshape the financial landscape, and its future scope is vast and promising. Here is a comparative analysis of the potential future impacts of blockchain technology on traditional banking systems:

- (i) **Enhanced Security and Trust:** Blockchain’s decentralized and immutable nature ensures enhanced security and trust in financial transactions. In the



Fig. 1.4 Impact of digitization on banking system

future, traditional banks can leverage blockchain to strengthen their security measures, reducing the risk of fraud, data breaches, and cyberattacks. This technology can enable secure and transparent verification of transactions, identities, and ownership, fostering a higher level of trust between banks and their customers.

- (ii) **Streamlined Invoices:** Traditional banking systems often involve multiple intermediaries, resulting in lengthy and expensive processes. With blockchain, financial institutions can leverage smart contracts and distributed ledger technology to streamline cross-border payments, making them faster, more efficient, and cost-effective.
- (iii) **Financial Inclusion and Accessibility:** One of the significant benefits of blockchain technology is its potential to provide financial services to the unbanked and underbanked populations. By utilizing blockchain-based solutions, traditional banks can extend their services to individuals and businesses in remote areas or countries with limited access to banking infrastructure. This can lead to greater financial inclusion and economic empowerment worldwide.
- (iv) **Improved Compliance and Regulatory Processes:** Blockchain’s ability to provide a transparent and immutable record of transactions can simplify compliance and regulatory processes for banks. In the future, blockchain-based solutions can automate regulatory reporting, ensuring accuracy, consistency, and real-time monitoring of transactions. Additionally, smart contracts can be programmed to enforce regulatory compliance automatically, reducing the need for manual intervention.
- (v) **Efficient Identity Management:** Blockchain-based identity management systems have the potential to revolutionize customer onboarding and KYC (Know Your Customer) processes. Traditional banks can utilize blockchain to create a secure and decentralized identity verification system. This would allow customers to maintain control over their personal data while granting banks access to necessary information, simplifying the onboarding process and reducing the risk of identity theft.
- (vi) **Tokenization of Assets:** In the future, traditional banks can leverage blockchain to create digital tokens representing these assets. This would facilitate fractional ownership, enhance liquidity, and enable efficient transfer and trad-

ing of assets. It could also open up new investment opportunities for individuals and institutions.

- (vii) **Collaboration with Fintech Startups:** Banks can partner with blockchain companies to develop and implement new financial products and services, such as decentralized lending platforms, smart contract-based insurance or peer-to-peer payment systems. Such collaborations can drive innovation, enhance customer experience, and create new revenue streams.

### *1.3.2 Disadvantage of Blockchain in Banking*

While blockchain technology offers numerous advantages for the banking industry, it is essential to consider the potential disadvantages and challenges it may present. Here are some disadvantages of blockchain in banking:

- (i) **The adaptability Issues:** Due to its distributed nature, blockchain technology has difficulties with scaling. The blockchain network may become slower and less effective as more transactions are made. This poses a challenge for banking systems that handle a large volume of transactions daily. Resolving scalability issues while maintaining the security and decentralization of the blockchain remains a significant hurdle.
- (ii) **Regulatory Uncertainty:** The regulatory landscape surrounding blockchain technology is still evolving. Banks need to comply with various regulations and standards to ensure customer protection, prevent money laundering, and adhere to know-your-customer (KYC) requirements. However, blockchain's decentralized and pseudonymous nature can create challenges in meeting these regulatory obligations, especially in terms of identity verification and transaction monitoring.
- (iii) **Energy Consumption:** Blockchain networks demand a lot of processing power and energy, especially those that use proof-of-work (PoW) consensus methods like Bitcoin. Concerns concerning blockchain mining's environmental impact have been highlighted because to its energy-intensive nature. When adopting blockchain technology, banks must take sustainability into account and figure out how to reduce the carbon footprint of maintaining blockchain networks.
- (iv) **Governance and Legal Issues:** Blockchain networks typically operate in a decentralized manner without a central authority controlling the system. This lack of centralized governance can pose challenges when it comes to resolving disputes, enforcing legal contracts, and managing the overall system. In the banking sector, where legal frameworks and contractual obligations are crucial, adapting blockchain technology to align with existing legal and governance structures can be complex.
- (v) **Integration with Legacy Systems:** Many traditional banks have complex legacy systems and infrastructure that are not easily compatible with block-

chain technology. Integrating blockchain into existing banking systems may require significant time, effort, and cost. Banks need to carefully plan the integration process to ensure smooth transitions, minimize disruptions, and maintain the security and integrity of customer data.

- (vi) **User Adoption and Education:** Encouraging user adoption and educating customers about the benefits and proper usage of blockchain-based services can be a challenge. Banks need to invest in customer education initiatives to ensure a seamless transition to blockchain-based banking solutions and address any concerns or misconceptions.
- (vii) **Potential for Smart Contract Vulnerabilities:** While smart contracts offer automation and efficiency, they are not immune to vulnerabilities or bugs. Inadequate coding, programming errors, or malicious attacks can exploit smart contracts, leading to financial losses or legal disputes. Banks must carefully audit and test smart contracts to ensure their reliability, security, and compliance with regulatory requirements.

It's important to note that many of these challenges are being actively addressed and mitigated as the technology matures. Blockchain is an evolving field, and ongoing research, development, and industry collaboration are essential to overcome these disadvantages and unlock the full potential of blockchain in the banking sector.

## 1.4 Conclusion

In conclusion, the impact of blockchain technology on traditional banking systems has been substantial and continues to evolve. Through a comparative analysis, it becomes evident that blockchain technology brings several benefits and challenges to the traditional banking landscape.

Blockchain technology offers increased transparency, security, and efficiency in financial transactions. The distributed ledger system eliminates the need for intermediaries, streamlines processes, and reduces costs. Smart contracts enable automated and secure execution of agreements, reducing the potential for errors and disputes. Moreover, the immutability of blockchain records enhances the security and auditability of transactions.

However, the integration of blockchain technology into traditional banking systems is not without its challenges. Regulatory frameworks and compliance requirements need to be addressed to ensure a smooth transition. Scalability issues must be overcome to handle large-scale transaction volumes effectively. Interoperability between different blockchain platforms and legacy systems is another important aspect that needs to be considered.

Despite these challenges, forward-thinking banks have started exploring and implementing blockchain technology to enhance their services. Collaboration with partnerships between traditional banks and fintech companies have emerged as a strategy to harness the potential of blockchain technology effectively. As the

technology matures and regulatory frameworks adapt, we can anticipate further integration and innovative use cases in the banking sector.

It is important for traditional banks to actively monitor and understand the evolving landscape of blockchain technology. By embracing the opportunities it presents and addressing the associated challenges, banks can position themselves at the forefront of digital transformation, delivering enhanced financial services and meeting the evolving needs of customers in the digital age.

## 1.5 Future Scope

The future scope of blockchain technology in traditional banking systems is incredibly vast and holds immense potential for transforming the financial landscape. As blockchain continues to mature, several exciting opportunities lie ahead. One prominent area of exploration is enhanced interoperability between different blockchain networks and traditional banking systems. Developing standardized protocols and frameworks that enable seamless communication and data exchange will facilitate the integration of blockchain into existing banking infrastructure.

Central Bank Digital Currencies (CBDCs) represent another exciting avenue for future development. Central banks worldwide are exploring the idea of issuing digital currencies using blockchain technology. Implementing CBDCs would revolutionize the monetary system, enabling faster and more efficient transactions while maintaining regulatory oversight. Extensive research and development efforts will be dedicated to designing secure and scalable CBDC platforms that seamlessly integrate with traditional banking systems.

Decentralized Finance (DeFi) is another area that holds tremendous potential. DeFi platforms built on blockchain enable individuals to engage in financial activities, such as lending, borrowing, and trading, without intermediaries. The future scope involves exploring the integration of DeFi applications into traditional banking systems, creating hybrid models that combine the advantages of decentralized finance with the stability and regulatory compliance of traditional banks. Future research will focus on addressing scalability challenges and developing interoperable blockchain networks that enable seamless transactions between different banking systems. Identity verification is another critical aspect where blockchain can make a significant impact. Blockchain-based identity solutions have the potential to simplify and secure Know Your Customer (KYC) processes used by banks. Future developments will focus on building robust, privacy-preserving identity solutions that put individuals in control of their personal data while ensuring compliance with regulatory requirements.

To support the widespread adoption of blockchain technology in traditional banking systems, clear and adaptable regulatory frameworks are necessary. Collaborative partnerships between regulators, banks, and blockchain technology providers will be vital in establishing comprehensive regulatory frameworks that foster innovation while ensuring financial stability and consumer protection.

Addressing scalability and energy efficiency challenges is also crucial for the future of blockchain in banking. Research will focus on developing innovative solutions such as layer-two scaling techniques, sharing, and improved consensus mechanisms to enhance the scalability and energy efficiency of blockchain networks, making them suitable for large-scale banking operations.

In conclusion, the future scope of blockchain technology in traditional banking systems is promising and diverse. Further exploration and development in areas such as interoperability, CBDCs, DeFi integration, cross-border payments, identity solutions, regulatory frameworks, scalability, and energy efficiency will shape the transformation of traditional banking systems, enabling a more efficient, secure, and inclusive financial ecosystem.

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# Chapter 2

## Apparent Advantages and Negative Facet of Block Chain in Banking Sector: An Innovative Theoretical Perspective



Diksha Verma, Pooja Kansra, and Shad Ahmad Khan

### 2.1 Introduction

Banking companies have shifted themselves from traditional mode to digitization mode using different models like mobile banking, omnichannel banking etc. Not only banking sector but other industries also are shifting themselves towards digitization mode. As per latest survey, it has been found that technology is going to grow to \$ 67.4 billion in 2026 from \$ 4.9 billion in 2021. In spite of numerous challenges, Banks have initiated use of Blockchain technology in a whole hearted manner (Chirag 2023). Blockchain has the capability of transforming the financial market in to a digitized hub by creating a transparent and public ledger for recording the transactions (Gupta 2021). According to the latest scenario, Economies are witnessing a pioneering gesture related to industrial technologies which is popularly known as “Industry 4.0”. Earlier the concept of Industry 4.0 was acknowledged with manufacturing sector but nowadays along with the mechanized sector, many service industries lining from telecom to banking are expectant of the remuneration in the same field. This digitalization has resulted in invention of new business models. Service sector nowadays is contributing a majority of share in GDP of the developed and developing economies. The industries related to service sector are either trying or in line of trying digitalization as a new practice of doing business. Various

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options such as cloud computing, internet of things, artificial intelligence, 3D Printing and block chain are the new normal of doing business and fall under the span of industry 4.0 revolutions (Garg et al. 2019).

Block chain is one such element in industrial revolution that has expected considerable concentration in financial field of technology (FinTech) (Guo and Liang 2016). It is basically a data base that stores the transaction record digitally, connected mutually in a single list named as chain. Block chain is a system that abridges the likelihood of occurrence of hacking, cheating etc. of stored information (Ravi 2021). Currently, International bodies such as IMF and UN and also various developed countries like the United States, the United Kingdom and Japan, have started focusing on growth and enlargement of block chains in various areas. Likewise, India, Russia, China and South Africa have boosted the effort of research on block chain technology (Guo and Liang 2016).

Banking industry is nowadays shifting towards modern banking from traditional business. This area has also put forward their shoes in to the block chain side. Banks majorly replicate transactions of their current assets on the block chain resulting in efficacy for their solutions in relation to block chain. A kind of software developed for holding the transactions related to transfer of digital assets to the customers digitally is typically called block chain in banking (Ravi 2021). Block chain has the prospective to diminish and vanish the existing middle men and also civilizing recording of transactions by implementing transparency and traceability of transactions digitally which ultimately impact advancement of traditional way of banking to modern banking. Globally \$ 20 billion amount could be saved before year 2022, if block chain is implemented in banking, according to a statement by Accenture (Garg et al. 2019).

Different uses of Blockchain technology associated with banking sector are discussed below. These uses ultimately are making banking industry decentralized. Transfer of payment from one point to the destination is made easy and less costly with the help of Bitcoin, Ether etc. These are the developed open blockchains which can be used by bank customers to send or receive money without any additional charges. Secondly, it takes around 3–4 days to clear or settle one problematic transaction because of various channels involved in settling the transaction. But blockchain performs as a decentralized ledger that keeps record of transaction in transparent and open manner making it accessible for all. Therefore blockchain has another advantage of settling and clearing the problematic transaction in few seconds of time. If a customer is involved in buying or selling of securities through banking institutions as intermediaries, banks also have to maintain the record of debts, stocks, brokers, exchanges in order to execute the actual transaction. Blockchain has another advantage of creating a decentralized database that keeps the record of digital securities and making the transaction easy for customers. Banks in order to provide loans to their customers has to go through multiple rounds of checking credit score, income of the consumers, possession standing, debts payoff ratio etc. Blockchain has a transparent investment friendly system through which personal loans can be given to the bank customers making it convenient for clients to apply for loan (Gupta 2021; Chirag 2023).

Numerous challenges and difficulties are associated with the invention of a new technology whether in any field. Although the vocation related to block chain is in progress and efforts are being done to present a simplistic image of organization's issues yet more is required. Frequently it is quoted that dependence on middlemen diminishes with the use of block chain technology in various sectors and the trust is build by the block chain on its own still there is a high need for supremacy to formulate and implement such a scenario in which block chain can operate with the organizations (Janssen et al. 2020).

Description of block chain's scientific position has been discussed and explored theoretically from different perspectives still any endeavor is being made in previous review related to positive or negative role of implementation of block chain in banking industry where other variables in banking are also being associated time to time such as omni channels, bancassurance etc. (Garg et al. 2019). Despite the fact that block chain technology has just started to become known nowadays, still there is a need for extensive overview of the concept for practical espousal in the banking industry (Janssen et al. 2020). The current study is an attempt to add to this conversation by providing a conceptual model on block chain with special relevance to banking sector. Firstly discussion of theoretical background of Block chain in relation to the banking sector will be initiated depending on the previous literature and after that a effort will be made to identify the apparent advantages of implementing block chain technology in banking industry giving boost to industry revolution 4.0 (Garg et al. 2019).

Study has been tailored into five unrelated sections. Section I defines the basic information about the notion and conception of block chain technology and its effect general effect on banking sector followed by section II which discusses about the available literature on the same concept. Section III is detailed narration about the apparent advantages of implementing block chain technology in banking industry and Section IV includes conversation about the disadvantages and negative aspect of implementing technology of block chain in the field of Banking (Oberoi and Kansra 2019).

## 2.2 Review of Literature

### 2.2.1 *Block Chain Technology*

According to Hackett (2016), corroboration of various records and data available in digital mode can be consummate by examining the similar set of connections since they are allied to internet connectivity and all peer structure has comprehensive way in to all digitally available records. Therefore, block chain is exclusively a series of blocks linked collectively with the application of computational algorithms (Woodside et al. 2017).

According to Yoo (2017), a scattered practice of preparing ledgers in which all the participants simultaneously share records of transactions among them is typically called Block chain. A data base that is basically dispersed and keeps records of incessantly developing list of data which is difficult to tamper and adjustment is Block chain. The collection of various transactions is often known as Blocks and concept wise the same is called block chain under which various blocks are symmetrically assembled one after another.

According to Cocco et al. (2017), Block chain technology has the power of advancing the whole environment related to financial systems and also improvising the efficacy of present financial structure. Block chain technology helps in controlling wastage of conservative energy and might set at the place of consumptive systems of energy that basically hold up the fiat currency. Because all the records available digitally are assembled cryptographically under a particular heading along with the address of those coupled with the transaction, the chain is concurrently modernized at every single nodule. Hence, it is grueling for hackers to fetch the data available online or records out of any nodule or adapted system (Golosova and Romanovs 2018).

### ***2.2.2 Block Chain Technology in Banking***

Guo and Liang (2016) discussed about numerous challenges witnessed by traditional banking sectors. Commercial banks are more required to bank upon the latest technologies introduced nowadays in order to be victorious and conquer the aggressive market. Block chain is one of such technologies that could be worn to meet the present challenges of emerging innovative techniques of serving customers. Block chain ultimately aids in dropping the cost for banks by providing more efficient services. Block chain in collaboration with the banking sector has enhanced the operating system of banks in a different manner. Block chain helped in reducing the need for intermediaries for transactions related to banks and other financial institutions (Cocco et al. 2017).

According to Garg et al. (2019), currently merchant financing, loyalty and trust programs for bank customers and syndicated loans are certain tools under block chain technology being tested by Indian Banking Sector on regular basis. Various banks such as Axis Bank, SBI, Yes Bank and Reserve Bank of India are actually testing block chain technology in practical scenario.

Hence this paper is trying to centre upon the apparent advantages of implementing Block chain technology in banking sector and also the drawbacks and limitations of using bock chain technology in the same field. Despite the fact that, prospect are astonishing, appliance of block chain is yet at embryonic stage and have not been fully employed (Olaf et al. 2017).

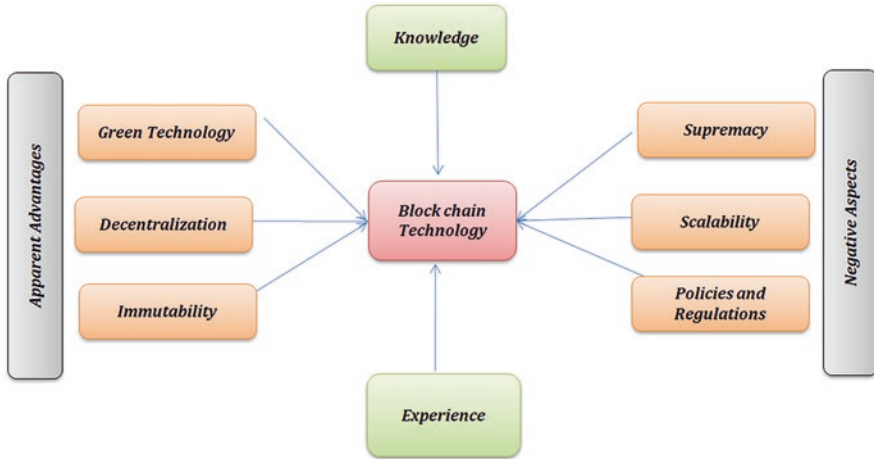
### 2.3 Apparent Advantages of Implementing Block Chain Technology in Banking

Currently the key compassion of every association is to make initiatives for saving environment. Every organization endeavours to develop ecological presentation by launching numerous programs so that surroundings could be protected. For the purpose of achieving same many institutions are conducting experiments and implementing block chain technology so that intention can be achieved. Block chain technology has the capability to associate green technologies with its services which lead to development of economy in a better way. Block chain technology is intended to provide peer to peer arrangement and do not depend on a solitary middle power. Banks related transactions are processed with the aid of transmit system. It transmits the communications with the help of nodes. Every node has imitation of the block chain which is basically connected with other nodes. Every node is secure as its existence is unknown to the other ultimately securing the block chain from exterior assaults. Various crypto currency networks depend on defined algorithms, consent mechanism like PoW, Bitcoin network etc. Block chain technology has prompt a lot curiosity something like its prospect succession and the significant advantages that it might get in the framework of the reassign of material goods and belongings contained by industrial system. Though, present be numerous apprehension about the block chain technology, like its probable and potential capability to accomplish the dispensation velocity desirable for an mechanized defrayal domicile, to lesser overheads in contrast to established compensation structure, and to include the enhance the shattered removal possessions when superior deal capacity are concerned (Cocco et al. 2017).

It could be seen that vicinity where block chain which is more vigorously practical in the fiscal zone is enhancing for defrayal, transfer of funds, contracts related to securities etc. According to the literature it has been observed that in various countries also validation process for holding assets are normally used with the intention of keeping block chain in dominating part. The initiative to commence a clogged or confidential disseminated ledger that does not depart in the course of the central bank is pacing in costs amid banks. Domestic fiscal establishment too require mutual stroke by fiscal association throughout a block chain conglomerate to relate block chain technology with financial segment. End user's desires and industrial expansion are varying. Equivalently, when the prospect to contravene the information detained by folks has stretched, the necessity for block chain technology is sturdily budding for the reason that the efforts of the association could be protected (Yoo 2017).

Block chain technology is one such kind of technology that basically unites with multiplicity of circumstances. It majorly target on fiscal and monetary transactions leading to accomplishment of asset digitization. This stridently augments the procedure effectiveness of the clearance and defrayal of economic possessions subsequent to dealings, at the same time as reducing overheads. Block chain technology ultimately solve numerous of problems related to banking sector in various ways.

Obviously, block chain has come up with an only back up plan for all the banking related issues. Many banking industries have started using block chain technology as their core operation. Banking sector is utilizing its resources on conducting research activities related to block chain technology. This will facilitate them to turn into the lead the way of industrial appliance that can escort and contribute in the creation of novel industry background, therefore, endlessly humanizing the aptitude and content of high-value pecuniary services and nurturing innovative impetus for development in the sector (Guo and Liang 2016).



Source: Model based on Review of literature

## 2.4 Negative Aspect of Implementing Block Chain Technology in Banking Industry

Decentralized composition of Block chain provides unattired defies for financial and regulatory associations and bodies looking forward adopting technology as its controller. Presently there are three main block chain restrictions such as shortage of supremacy, lack of scalability and risks associated with dictatorial fulfillment.

### 2.4.1 Shortage of Supremacy

However the decentralized character of block chain technology is somewhat its advantageous feature still it poses various restrictions for the financial segment. In the absence of central decision maker, a severe hurdle is members who participate in block chain powered transactions may have uneven objectives. Block chain is