



# REGULATORY COMPLIANCE AND BLOCKCHAIN IN MORTGAGES: LEVERAGING TRANSPARENCY AND EFFICIENCY FOR A SECURE FUTURE

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**Abstract:** The mortgage industry, a cornerstone of the global economy, grapples with intricate regulatory compliance challenges that demand innovative solutions. This research explores the transformative potential of blockchain technology in addressing regulatory compliance issues within the mortgage sector. The literature review delves into key regulatory requirements, historical challenges, and the foundational aspects of blockchain technology. The methodology involves a dual approach of reviewing existing blockchain implementations and analyzing current regulatory compliance measures. The paper examines blockchain's capacity to ensure transparent and auditable transactions, automate compliance processes through smart contracts, and mitigate risks associated with non-compliance. Successful case studies underscore the practical benefits of blockchain in achieving regulatory compliance objectives. The challenges and considerations are scrutinized, encompassing resistance from traditional systems, technological hurdles, and legal and ethical concerns. Despite these challenges, the research underscores the efficiency gains and risk mitigation benefits offered by blockchain, including streamlined processes, reduced administrative overhead, and enhanced data security. The future outlook anticipates potential developments in blockchain technology and the expected evolution of regulatory frameworks. The conclusion summarizes key findings, highlights implications for the mortgage industry, and offers recommendations for future research. The findings of this research emphasize the promising role of blockchain in reshaping regulatory compliance, paving the way for a more efficient, transparent, and secure mortgage ecosystem.

**IndexTerms:** Blockchain, Compliance, Mortgages, Privacy, Risk mitigation, Smart contracts

## I. INTRODUCTION

The mortgage industry plays a pivotal role in the global economy, serving as the backbone of real estate transactions. However, this critical sector is not without its challenges, particularly in navigating the intricate landscape of regulatory compliance. The mortgage industry operates under a myriad of regulations aimed at ensuring fair practices, consumer protection, and financial stability. These regulations, while essential for maintaining the integrity of the market, often pose significant challenges to industry participants, creating a need for innovative solutions to streamline compliance processes.

The regulatory framework governing mortgages is multifaceted, encompassing stringent requirements that demand meticulous documentation, secure data management, and adherence to specified timelines. As a consequence, industry stakeholders grapple with the complexities of compliance, encountering inefficiencies, delays, and heightened operational costs. The necessity for a transparent and accountable system that can revolutionize the traditional mortgage compliance landscape has never been more apparent.

### 1.1. Objectives

This research seeks to delve into the transformative potential of blockchain technology in alleviating the regulatory compliance burdens faced by the mortgage industry. Blockchain, a decentralized and distributed ledger technology, has demonstrated its prowess in enhancing transparency, security, and efficiency in various sectors. Understanding how blockchain can be tailored to meet the specific demands of the mortgage industry is crucial for envisioning a more streamlined and responsive compliance framework.

One of the key focuses of this research is to investigate how blockchain's inherent characteristics, such as transparent and auditable transactions, can serve as a catalyst for simplifying compliance processes. By immutably recording and timestamping every transaction, blockchain offers the promise of a tamper-resistant and verifiable record-keeping system. This has the potential to not only reduce the risk of legal issues but also foster a more trustworthy and accountable mortgage ecosystem.

In navigating these objectives, this research aims to contribute valuable insights into the intersection of blockchain technology and regulatory compliance within the mortgage industry, paving the way for a more efficient and secure future. Through a comprehensive exploration of these themes, we aspire to offer practical recommendations and considerations for industry stakeholders, policymakers, and researchers alike.

## II. LITERATURE REVIEW

The mortgage industry operates within a complex regulatory framework designed to ensure fair lending practices, protect consumers, and maintain financial stability. Key regulatory requirements encompass a spectrum of aspects, including but not limited to, stringent documentation standards, loan underwriting criteria, and adherence to specific disclosure timelines. Regulatory bodies such as the Consumer Financial Protection Bureau (CFPB) in the United States and their counterparts worldwide play a pivotal role in setting and enforcing these standards. Understanding the intricacies of these requirements is essential for comprehending the challenges that industry participants face in achieving and maintaining compliance. Few notable requirements as outlined by the U.S. Congress in the United States include:

### *Credit Reporting and Scoring*

Lenders are required to consider an applicant's credit history and credit score when evaluating mortgage applications. The Fair Credit Reporting Act (FCRA)<sup>1</sup> and related regulations set guidelines for how credit information should be collected, reported, and used in the lending process.

### *Anti-Discrimination Laws*

The Equal Credit Opportunity Act (ECOA)<sup>2</sup> prohibits discrimination in any aspect of a credit transaction, including mortgage lending, on the basis of race, color, religion, national origin, sex, marital status, age, or receipt of income from public assistance programs.

### *Escrow Account Management*

Regulations such as the Real Estate Settlement Procedures Act (RESPA)<sup>3</sup> govern the use of escrow accounts for mortgage payments. Lenders are required to accurately manage and account for funds in escrow, covering property taxes, insurance, and other related expenses.

### *Loan Servicing Standards*

The Dodd-Frank Wall Street Reform and Consumer Protection Act<sup>4</sup> established servicing standards to ensure fair and transparent practices in mortgage loan servicing. This includes provisions related to loan modification, foreclosure processes, and communication with borrowers.

### *Truth in Savings Act (TISA)*

While more directly related to deposit accounts, TISA<sup>5</sup> requires clear and accurate disclosure of the terms and conditions of deposit accounts, which can indirectly impact the mortgage application process, especially when combined financial products are involved.

### *Fair Housing Act*

Beyond ECOA, the Fair Housing Act<sup>6</sup> prohibits discrimination in housing-related transactions, including mortgage lending, based on race, color, national origin, religion, sex, familial status, or disability.

These requirements collectively contribute to the comprehensive regulatory framework that governs mortgage lending in the United States, ensuring fair and transparent practices while protecting the rights of consumers.

Historically, the mortgage industry has grappled with various challenges in meeting regulatory compliance. These challenges range from the interpretation and implementation of evolving regulations to the dynamic nature of financial markets. The historical landscape is marked by instances of non-compliance, leading to legal ramifications, financial instability, and a loss of trust among stakeholders. By examining past challenges, this literature review aims to provide context for the necessity of innovative solutions that can enhance compliance processes and mitigate historical issues.

### *Interpretation and Implementation*

Historically, the mortgage industry has faced difficulties in accurately interpreting and effectively implementing evolving regulatory requirements. The dynamic nature of these regulations often led to challenges in understanding and keeping pace with changes.

<sup>1</sup> U.S. Congress. (1970). [Fair Credit Reporting Act, 15 U.S.C. § 1681 et seq.](#)

<sup>2</sup> U.S. Congress. (1974). [Equal Credit Opportunity Act, 15 U.S.C. § 1691 et seq.](#)

<sup>3</sup> U.S. Congress. (1974). [Real Estate Settlement Procedures Act, 12 U.S.C. § 2601 et seq.](#)

<sup>4</sup> U.S. Congress. (2010). [Dodd-Frank Wall Street Reform and Consumer Protection Act, Pub. L. No. 111-203.](#)

<sup>5</sup> U.S. Congress. (1991). [Truth in Savings Act, 12 U.S.C. § 4301 et seq.](#)

<sup>6</sup> U.S. Congress. (1968). [Fair Housing Act, 42 U.S.C. § 3601 et seq.](#)

*Financial Market Dynamics*

The mortgage industry is highly influenced by the dynamic nature of financial markets. Fluctuations in interest rates, economic conditions, and housing market trends have posed challenges for lenders in aligning their practices with regulatory requirements.

*Instances of Non-Compliance*

Historical records reveal instances of non-compliance with regulatory standards in the mortgage industry. These instances ranged from unintentional errors to deliberate violations, resulting in legal consequences and financial penalties for industry participants.

*Legal Ramifications*

Non-compliance with regulatory requirements has historically resulted in legal ramifications for mortgage entities. Legal actions, including fines and sanctions, were imposed as a consequence of failure to adhere to established compliance standards.

*Financial Instability*

Regulatory challenges in the mortgage industry have, at times, contributed to financial instability. Economic downturns and crises have exposed vulnerabilities in compliance frameworks, leading to increased risks for lenders and financial institutions.

*Loss of Trust*

Historical non-compliance and financial instability have eroded trust among stakeholders, including borrowers, investors, and regulatory bodies. A loss of trust can have long-lasting implications, affecting the industry's reputation and hindering collaboration.

**2.1. Blockchain Technology**

Blockchain technology, originally conceived as the underlying framework for cryptocurrencies, is a decentralized and distributed ledger system. At its core, it comprises a chain of blocks, each containing a record of transactions, secured through cryptographic principles. The decentralized nature of blockchain ensures that no single entity has control over the entire network, fostering transparency and security. As depicted in **Figure 1** blockchain's fundamental structure consists of these interconnected blocks, forming an immutable chain.

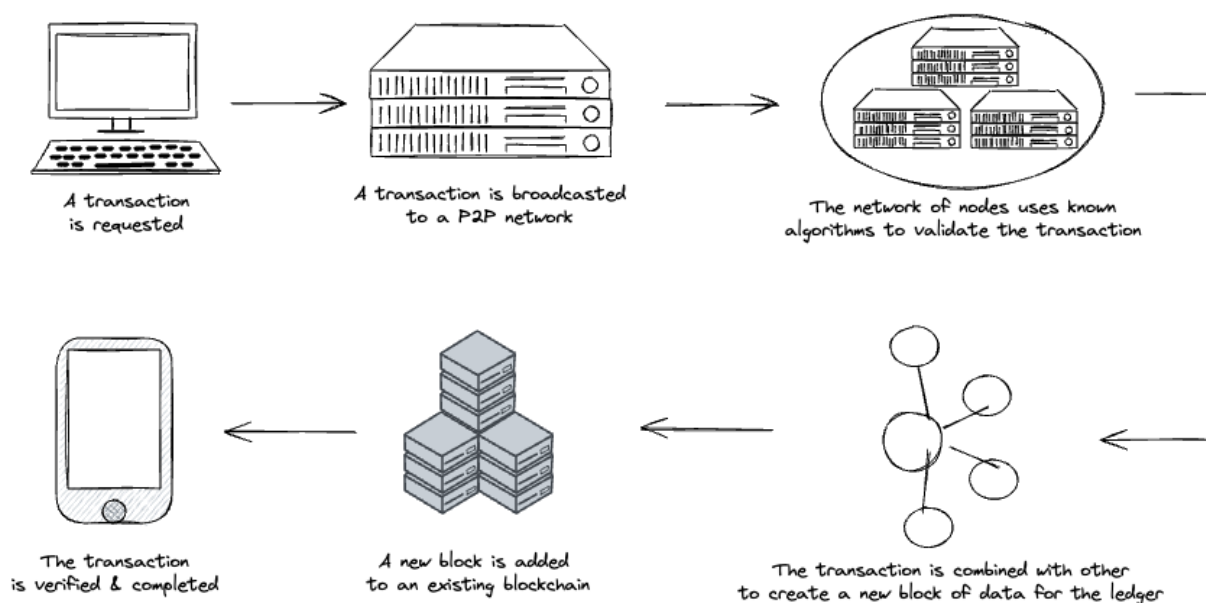


Figure 1: How Blockchain Technology Works.

Blockchain has witnessed successful implementations in various facets of the financial services sector. From enhancing cross-border payments to facilitating transparent supply chain finance, blockchain has demonstrated its capacity to revolutionize traditional processes. Examining these prior applications provides insights into the adaptability and efficacy of blockchain technology in addressing complex financial workflows. This knowledge is crucial for evaluating the feasibility of leveraging blockchain to tackle regulatory compliance challenges within the mortgage industry.

Blockchain's potential to streamline regulatory compliance in the mortgage industry lies in its ability to offer transparent, secure, and verifiable record-keeping. The immutability of blockchain records, coupled with the use of smart contracts, has the potential to automate compliance processes, reduce errors, and enhance overall efficiency. By exploring the theoretical and practical aspects of blockchain's potential in regulatory compliance, this literature review aims to lay the groundwork for understanding how this technology can be harnessed to address challenges within the mortgage sector.

### III. METHODOLOGY

The first phase of our methodology involves an extensive review of existing blockchain implementations within the mortgage industry. This review encompasses case studies, pilot programs, and ongoing initiatives where blockchain technology has been applied to address regulatory compliance challenges. By examining real-world applications, we aim to identify successful models, challenges faced during implementation, and the overall impact of blockchain on improving compliance processes.

Simultaneously, we conduct a thorough analysis of current regulatory compliance measures in the mortgage industry. This involves a comprehensive review of relevant regulatory frameworks, guidelines, and compliance procedures enforced by regulatory bodies. By understanding the specific requirements and pain points within the existing compliance landscape, we can effectively assess the suitability of blockchain solutions to address these challenges.

Building upon the insights gained from the analysis of regulatory compliance measures, we systematically identify common compliance issues faced by stakeholders in the mortgage industry. This involves categorizing challenges related to documentation, transparency, data security, and adherence to regulatory timelines. The identification of these common issues serves as a foundation for evaluating the potential of blockchain technology to address specific pain points.

In this phase, we assess various blockchain solutions proposed or implemented in the mortgage industry context. This evaluation includes an examination of the technological features, scalability, security protocols, and overall effectiveness of these blockchain solutions in enhancing regulatory compliance. By critically analyzing existing blockchain applications, we aim to provide insights into the strengths and limitations of different approaches, guiding the development of recommendations for future implementations.

Through this dual-pronged approach of reviewing existing blockchain implementations and analyzing regulatory compliance measures, our methodology aims to offer a comprehensive understanding of the current state of affairs in the mortgage industry. The data collected and analyzed will form the basis for drawing correlations between blockchain technology and regulatory compliance, ultimately contributing valuable insights to the broader discourse on the intersection of these two domains.

### IV. BLOCKCHAIN TECHNOLOGY AND REGULATORY COMPLIANCE

Blockchain technology introduces transparency to the mortgage industry through its decentralized and distributed ledger architecture. Each transaction is recorded in a block that is linked to the previous one, forming an immutable chain. This transparency is achieved through consensus mechanisms, ensuring that all participants in the network have access to the same set of records. Any alterations to the data require majority validation, reducing the risk of fraudulent activities. This section explores the fundamental features of blockchain that contribute to transparency within mortgage transactions and the broader implications for regulatory compliance.

#### 4.1. Auditing Capabilities of Blockchain

The auditable nature of blockchain transactions provides a robust foundation for compliance auditing. Every transaction, once recorded on the blockchain, becomes a permanent and timestamped entry. This characteristic ensures a comprehensive and unalterable audit trail, simplifying the process of regulatory audits. The cryptographic nature of the blockchain also enhances the security of these records, making them resistant to tampering. This section delves into how the auditability of blockchain transactions can streamline regulatory compliance processes and reduce the risk of legal issues.

#### 4.2. Smart Contracts

Smart contracts, self-executing contracts with coded terms directly written into lines of code, hold immense potential for automating compliance processes in the mortgage industry. These contracts can be programmed to enforce specific regulatory requirements automatically. For instance, smart contracts can validate documentation, verify borrower eligibility, and execute transactions only when predefined conditions are met. As depicted in **Figure 2**, the diagram illustrates how smart contracts operate within a blockchain network, automating processes and ensuring compliance.

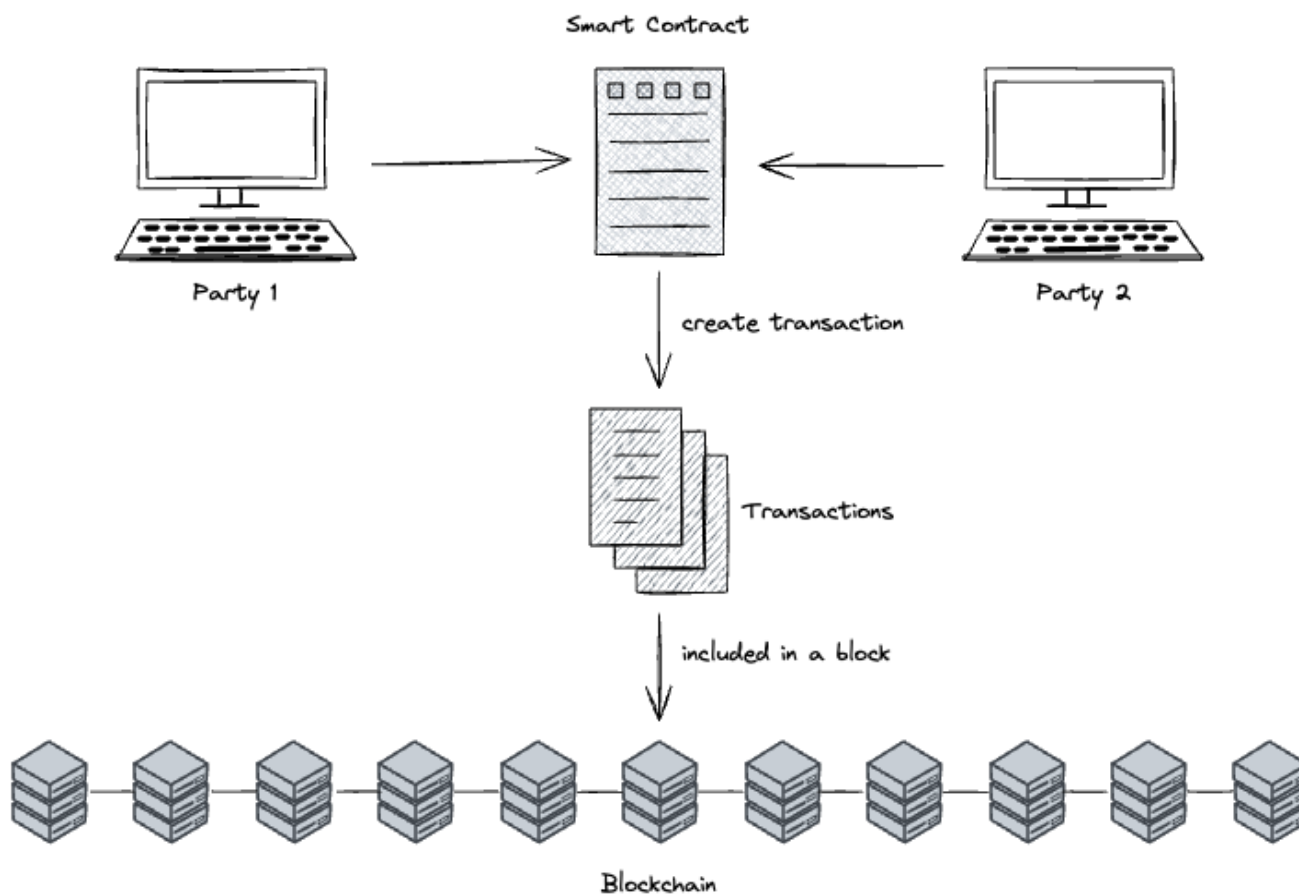


Figure 2: Blockchain based smart contract.

Smart contracts contribute to regulatory compliance by embedding specific regulatory standards directly into the code. This reduces ambiguity, ensures standardized processes, and mitigates the risk of non-compliance. As regulatory requirements evolve, smart contracts can be updated accordingly, providing a dynamic and adaptive compliance framework. By exploring the role of smart contracts in maintaining adherence to regulatory standards, this section aims to demonstrate how blockchain technology can not only enhance transparency but also proactively enforce compliance within the mortgage industry.

In synthesizing the transparency, auditability, and automation aspects of blockchain technology, this section seeks to provide a comprehensive understanding of how blockchain can reshape regulatory compliance in the mortgage industry. By examining the specific contributions of transparent and auditable transactions, as well as the transformative potential of smart contracts, we aim to illustrate the broader implications for creating a more efficient, secure, and compliant mortgage ecosystem.

## V. CASE STUDIES

This section presents an overview of three notable case studies that highlight successful implementations of blockchain technology in the mortgage industry. These case studies offer insights into diverse applications of blockchain, covering regulatory reporting, mortgage origination, and customer service enhancement. The selected studies aim to provide a comprehensive perspective on the practical application of blockchain within the mortgage sector.

### 5.1. Gozman (2020): Blockchain for Regulatory Reporting in the U.K.

Gozman's case study focuses on the development of a blockchain system for regulatory reporting of mortgages in the U.K.

#### *Key Findings*

The study underscores the benefits of blockchain in enhancing transparency and efficiency in regulatory reporting. It also addresses the challenges associated with implementation, shedding light on the practical considerations of adopting blockchain for regulatory compliance in the mortgage industry.

#### *Implications*

The case study implies that blockchain has the potential to streamline regulatory reporting processes, providing a secure and transparent platform for compliance-related data.

### 5.2. Ali (2019): Blockchain Model for Mortgage Origination

Ali's case study proposes a model for applying blockchain in the mortgage origination process, emphasizing the importance of considering people, process, and technology.

#### *Key Findings*

The study highlights the need for a holistic approach to blockchain implementation, emphasizing not only technological aspects but also the human and procedural elements in the mortgage origination process.

### *Implications*

The case study implies that successful integration of blockchain in mortgage origination requires a comprehensive understanding of the interconnected factors, showcasing the potential for a more efficient and streamlined mortgage application process.

### **5.3. Schepman (2020): Blockchain-Based Mortgage Assistant Platform**

Schepman's case study suggests a blockchain-based mortgage assistant platform to address customer dissatisfaction and process bottlenecks.

### *Key Findings*

The study explores the potential of blockchain in enhancing customer experience and resolving operational challenges in the mortgage industry.

### *Implications*

The case study implies that blockchain can play a pivotal role in improving customer satisfaction and operational efficiency in the mortgage sector, offering a glimpse into the broader applications of blockchain beyond regulatory compliance.

This comprehensive overview of case studies demonstrates the multifaceted applications of blockchain in the mortgage industry, showcasing its potential to address regulatory compliance challenges while also enhancing operational processes and customer satisfaction.

### **5.4. Positive Outcomes in Terms of Compliance**

Each case study will be scrutinized for its impact on regulatory compliance within the mortgage industry. The section will detail how the implemented blockchain solutions contributed to addressing compliance challenges identified in the literature review. Positive outcomes may include improved transparency, streamlined documentation processes, reduced instances of non-compliance, and enhanced data security. By examining the tangible benefits derived from these case studies, this section aims to provide empirical evidence of the efficacy of blockchain technology in achieving regulatory compliance objectives.

The exploration of successful case studies serves not only to highlight the potential of blockchain in mortgages but also to offer valuable insights and lessons learned. By examining real-world applications, this section contributes practical examples that can inform industry stakeholders, policymakers, and researchers about the benefits and challenges associated with implementing blockchain solutions to enhance regulatory compliance in the mortgage sector.

## **VI. CHALLENGES AND CONSIDERATIONS**

The adoption of blockchain technology in the mortgage industry faces resistance from traditional systems deeply ingrained in the sector. Legacy processes, established norms, and a conservative approach to change pose significant challenges. This section examines the resistance encountered from established financial institutions, mortgage service providers, and other stakeholders. Understanding these resistance factors is crucial for devising strategies to overcome inertia and foster a more widespread adoption of blockchain solutions for regulatory compliance.

The integration of blockchain technology in the mortgage industry is accompanied by technological and implementation challenges. Scalability concerns, interoperability issues, and the need for industry-wide standards may impede the seamless adoption of blockchain. This section delves into the technical intricacies of implementing blockchain solutions, exploring the hurdles faced during the transition from traditional systems to distributed ledger technologies. Identifying and addressing these challenges is vital for ensuring a successful and sustainable integration of blockchain into the mortgage regulatory compliance landscape.

The decentralized and transparent nature of blockchain, while offering enhanced security, raises privacy concerns. This section investigates the implications of blockchain on data privacy within the mortgage industry. The use of distributed ledgers may expose sensitive information to a wider audience, potentially conflicting with data protection regulations. Addressing these privacy concerns and ensuring compliance with privacy laws is essential for gaining regulatory approval and fostering trust among industry participants.

The legal validity of records stored on a blockchain poses another critical consideration. Traditional legal frameworks may not have caught up with the intricacies of blockchain technology. This section explores the challenges associated with ensuring the legal acceptance of blockchain records in courts and regulatory proceedings. It addresses issues related to the admissibility, enforceability, and recognition of blockchain-based transactions, contracts, and records within the existing legal landscape.

By examining the adoption challenges and legal considerations associated with implementing blockchain technology in the mortgage industry, this section aims to provide a comprehensive understanding of the obstacles that must be navigated. Acknowledging these challenges and considering the legal and ethical implications is essential for formulating strategies that promote the responsible and effective use of blockchain in regulatory compliance within the mortgage sector.

## VII. BENEFITS OF BLOCKCHAIN IN REGULATORY COMPLIANCE

Blockchain technology introduces efficiencies by streamlining complex processes within regulatory compliance in the mortgage industry. The decentralized and automated nature of blockchain transactions minimizes the need for intermediaries, reducing the time required for document verification, data reconciliation, and approval processes. As depicted in **Figure 3**, the diagram illustrates the various benefits of blockchain technology, including efficiency, transparency, security, network distribution, traceability, reduced cost, availability, automation, decentralization, and tokenization.

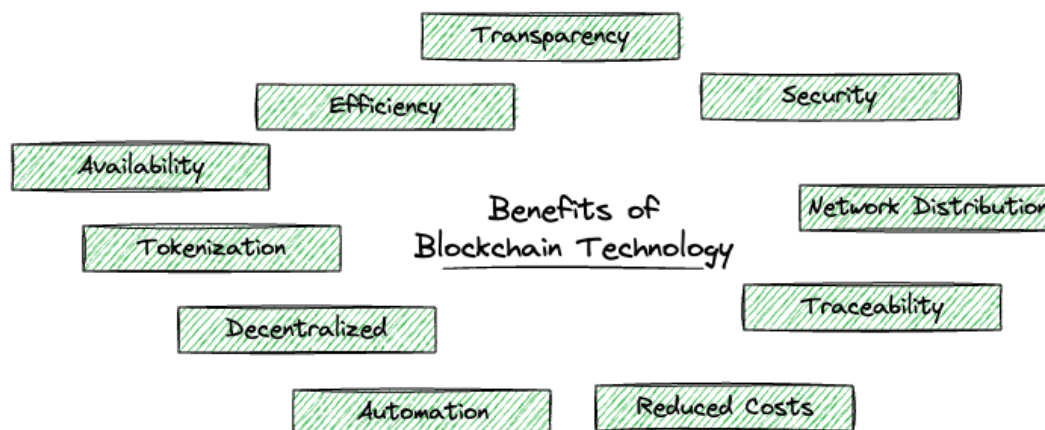


Figure 3: Benefits of Blockchain Technology

Traditional compliance processes often involve substantial administrative overhead due to manual record-keeping, verification, and auditing. Blockchain technology automates many of these tasks through smart contracts, reducing the need for manual intervention. The automation of routine compliance activities can lead to significant cost savings by minimizing the reliance on labor-intensive processes. The reduction in administrative overhead not only improves efficiency but also contributes to the overall economic viability of compliance procedures in the mortgage industry.

### 7.1. Risk Mitigation

Blockchain's transparent and auditable nature serves as a powerful tool for minimizing the risk of non-compliance in the mortgage industry. Smart contracts, programmed to execute specific compliance requirements, reduce the likelihood of errors and deviations from regulatory standards. This section delves into how the implementation of blockchain technology can act as a preventive measure, ensuring that transactions and processes adhere to regulatory guidelines, thus minimizing the risk of non-compliance and associated legal consequences.

Blockchain's cryptographic principles and decentralized structure provide a robust foundation for enhancing data security in regulatory compliance. This section explores how blockchain protects sensitive information by ensuring that data is stored across multiple nodes, reducing the vulnerability to hacking or unauthorized access. The immutability of records further safeguards against tampering, enhancing the overall integrity and security of compliance-related data in the mortgage industry.

In summarizing the benefits of blockchain in regulatory compliance, this section illustrates how the technology can deliver operational efficiencies, cost savings, and improved risk management in the mortgage sector. By leveraging the advantages of blockchain, stakeholders in the industry can create a more resilient and secure compliance ecosystem that aligns with the dynamic regulatory landscape.

## VIII. FUTURE OUTLOOK

The future of blockchain technology holds promise for continuous innovation and refinement. This section explores potential developments and advancements that could further enhance the application of blockchain in regulatory compliance within the mortgage industry. Areas of interest include improvements in scalability, the integration of advanced cryptography, and the evolution of consensus mechanisms. Additionally, the exploration of emerging technologies that may complement or enhance blockchain, such as quantum-resistant cryptography, will be considered. By anticipating and understanding these potential developments, stakeholders can better prepare for the evolving landscape of blockchain technology.

As blockchain technology becomes more integrated into the mortgage industry, regulatory frameworks are likely to evolve to address the unique challenges and opportunities presented. This section examines the anticipated changes in regulatory frameworks governing the mortgage sector, including the adaptation of existing regulations and the development of new guidelines specifically tailored to blockchain-based transactions. The collaboration between industry stakeholders, regulatory bodies, and policymakers will be crucial in shaping a regulatory environment that fosters innovation while ensuring consumer protection and financial stability. Understanding the expected evolution of regulatory frameworks is essential for stakeholders to proactively navigate compliance requirements and contribute to the responsible growth of blockchain technology in the mortgage industry.

In projecting the future outlook, this section aims to provide insights into the dynamic interplay between technological advancements and regulatory developments. By staying abreast of potential innovations in blockchain technology and anticipating shifts in regulatory frameworks, industry participants can position themselves to leverage emerging opportunities and effectively navigate the evolving landscape of regulatory compliance in the mortgage sector.

## IX. CONCLUSION

In summary, this research has delved into the intersection of blockchain technology and regulatory compliance within the mortgage industry. Through an exploration of key themes, including transparent and auditable transactions, smart contracts, successful case studies, challenges, benefits, and the future outlook, several findings have emerged. The transparent and auditable nature of blockchain transactions, coupled with the automation capabilities of smart contracts, presents a transformative potential for streamlining regulatory compliance processes in the mortgage sector.

The implications of integrating blockchain technology into the mortgage industry for regulatory compliance are profound. The benefits, such as increased efficiency, reduced administrative overhead, and enhanced risk mitigation, suggest a path toward a more resilient and secure compliance ecosystem. However, challenges related to adoption, technological complexities, and legal considerations need to be carefully addressed. The successful case studies highlighted demonstrate that the potential benefits are tangible and achievable.

While this research has provided valuable insights, the dynamic nature of technology and regulations necessitates ongoing exploration. Future research endeavors should consider in-depth analyses of specific blockchain implementations in different mortgage markets, the long-term impacts on compliance efficiency, and the evolution of regulatory frameworks. Additionally, investigating the scalability of blockchain solutions and addressing legal and ethical concerns surrounding privacy will be crucial for the sustainable integration of blockchain into the mortgage regulatory landscape.

In conclusion, the findings of this research underscore the transformative potential of blockchain technology in reshaping regulatory compliance within the mortgage industry. As the industry grapples with the need for greater efficiency, transparency, and security, blockchain emerges as a promising tool that, when strategically implemented, can contribute to a more robust and resilient regulatory compliance framework. The journey toward full-scale adoption requires collaboration among industry stakeholders, policymakers, and technology innovators to navigate challenges, capitalize on benefits, and usher in a new era of compliance excellence in the mortgage sector.

## REFERENCES

- [1] Gozman, Daniel, Jonathan Liebenau, and Tomaso Aste. "A case study of using blockchain technology in regulatory technology." *MIS Quarterly Executive* 19, no. 1 (2020): 19-37. [[CrossRef](#)][[Google Scholar](#)]
- [2] Ali, Azad I., and David T. Smith. "Blockchain and mortgage lending process: A study of people, process, and technology involved." *Online Journal of Applied Knowledge Management (OJAKM)* 7, no. 1 (2019): 53-66. [[CrossRef](#)][[Google Scholar](#)]
- [3] Schepman, Steve. "A Review of Use Cases for Blockchain in the Mortgage and Real Estate Industries." (2021). [[CrossRef](#)][[Google Scholar](#)]
- [4] Henriquez, Ricardo, Netanel Bittan, and Kanat Tulbassiyev. "Blockchain and business model innovation: Designing a P2P mortgage lending system." Netanel and Tulbassiyev, Kanat, *Blockchain and Business Model Innovation: Designing a P2P Mortgage Lending System* (April 14, 2019) (2019). [[CrossRef](#)][[Google Scholar](#)]
- [5] Nakamoto, Satoshi. "Bitcoin: A peer-to-peer electronic cash system." *Decentralized business review* (2008). [[Google Scholar](#)][[Publisher Link](#)]
- [6] Mougayar, William. *The business blockchain: promise, practice, and application of the next Internet technology*. John Wiley & Sons, 2016. [[Google Scholar](#)][[Publisher Link](#)]
- [7] Consumer Financial Protection Bureau (CFPB). (2022). "Mortgage Rules Under the Real Estate Settlement Procedures Act (Regulation X) and the Truth in Lending Act (Regulation Z)." [Online]. Available: <https://www.consumerfinance.gov/rules-policy/regulations/1024/>
- [8] U.S. Government Accountability Office (GAO). (2014). "Mortgage Reforms: Actions Needed to Help Assess Effects of New Regulations." [Report GAO-14-572]. [Online]. Available: <https://www.gao.gov/assets/gao-15-185.pdf>
- [9] Bianco, Katalina M. *The subprime lending crisis: Causes and effects of the mortgage meltdown*. New York: CCH, Wolters Kluwer Law & Business, 2008. [[Google Scholar](#)][[Publisher Link](#)]
- [10] Narayanan, Arvind, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. *Bitcoin and cryptocurrency technologies: a comprehensive introduction*. Princeton University Press, 2016. [[Google Scholar](#)][[Publisher Link](#)]
- [11] Merton, Robert C., and Zvi Bodie. "On the management of financial guarantees." *Financial Management* (1992): 87-109. [[CrossRef](#)][[Google Scholar](#)][[Publisher Link](#)]
- [12] Comert, Oguz. "Blockchain Revolution: How the Technology behind Bitcoin and Other Cryptocurrencies Is Changing the World." (2020): 272. [[Google Scholar](#)][[Publisher Link](#)]