ISSN: 2658-8455
Volume 6, Issue 8 (2025), pp. 590-600.

Revisiting Asset-Backed Securitization in the Digital Era: The Role of Blockchain and Tokenization

Revisiter la titrisation adossée à des actifs (ABS) à l'ère numérique : Le rôle de la blockchain et de la tokenisation

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Disclosure Statement :	Authors are not aware of any findings that might be perceived as affecting the objectivity of this study and they are responsible for any plagiarism in this paper.
Conflict of Interest :	The authors report no conflicts of interest.
Cite this article :	BAROUDI, M., & BENNIS, L. (2025). Revisiting Asset-Backed Securitization in the Digital Era: The Role of Blockchain and Tokenization. *International Journal of Accounting, Finance, Auditing, Management and Economics*, *6*(8), 590–600.
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Received: 24/05/2025 *Accepted: 17/08/2025*

International Journal of Accounting, Finance, Auditing, Management and Economics - IJAFAME
ISSN: 2658-8455
Volume 6, Issue 08 (2025)

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Abstract

Amid the ongoing digital transformation, blockchain technology has emerged as a key innovation in the financial sector. One of its most promising applications is asset tokenization, which enables the digital representation and fractional ownership of financial assets.

This study explores how the blockchain and asset tokenization can enhance the Asset-Backed Securitization process. In our research, we conduct a comprehensive literature review and present a case study highlighting the adoption of blockchain technology in financial institutions for securitization purposes. Based on these insights, we propose an ABS to incorporate blockchain and tokenization into the securitization process by increasing transparency, operational efficiency, and acceptability for investors.

Our findings show that this technological approach can significantly enhance the performance of ABS by reducing operational risks, improving data integrity, and promotes boarder investor participation through fractionalization. It contributes to a more resilient and inclusive financial system.

Keywords: Blockchain, tokenization, securitization.
JEL Classification: G10, O16, O31
Paper type: Theoretical Research

ISSN: 2658-8455
Volume 6, Issue 8 (2025), pp. 590-600.

Introduction

Blockchain, described as a decentralized and distributed digital ledger, stands out for the potential of how transactions are validated, by lowering costs, reducing counterparty risks, and minimizing errors. This technique has the ability to provide real-time transparency and asset tracking, which allows, investors to better assess risk independently of credit rating agencies.
Moreover, smarts contracts can automate and secure complex processes in securitization, like managing pooling, and servicing agreements, suggesting that blockchain could significantly impact the securitization operation.
In the 21st century, technology has moved rapidly. This development of digital platforms and the use of internet has significantly change the daily life. Since Bitcoin's launch in 2008, blockchain technology has attracted growing interest across different sectors for its versatile applications.
Originally introduced, by its creator, known as Satoshi Nakamoto; blockchain works as a peer-to-peer distributed ledger using technologies, such as P2P networks, consensus mechanisms, and cryptography. It was initially developed to facilitate digital transactions, and since then, blockchain technology has shown promise in various fields, including supply chain management, stock trading, and health care.
The benefits of blockchain are numerous; we cite transparency among them, anonymity, decentralization, trutlessness, autonomy, and resistance to tampering, these elements enhance security and integrity in many applications, by eliminating the need for intermediaries. As a result, blockchain technology can optimize business processes and reduce operational costs.
As noted by Zhang (2020) highlights that while blockchain technology offers many advantages, including efficient and secure operations, its application in commercial banking is still in the early stages. In the financial sector, blockchain holds promise for improving the efficiency and security of asset-backed securities, addressing issues such as information asymmetry and liquidity challenges.
Buterin (2014), a digital token represents an asset that exists outside the blockchain. In line with Hileman and Rauchs (2017), tokens backed by underlying infrastructure assets are managed and executed via smart contracts.
According to Xiaowan (2017), asset securitization has now become a key third alternative for raising capital. Its efficiency in delivering substantial funding makes it particularly appealing to small and medium sized enterprises.
In this study, we have adopted an interpretivist paradigm to explore the perceptions of blockchain by the components in the securitization mechanism. This paper investigates how the integration of blockchain and tokenization can enhance the securitization process by addressing key issues such as transparency, cost efficiency, and data security. The objective is to answer the following research question: "How can the integration of blockchain through tokenization improve the securitization process?"
In order to avoid the risks associated with this process. This methodological choice underlines the importance of grasping the underlying issues, which will enable us to improve the securitization process and reduce the associated risks. By integrating blockchain, we aim to offer an innovative solution that enhances the reliability and efficiency of financial transactions in the securitization process.
This work offers the following contributions, which can be outlined as follows:
Originally recognized for its innovative features, blockchain technology was initially used for the transaction of Bitcoin. Following Bitcoin's emergence, blockchain technology increasingly permeated financial markets. As its potential became increasingly evident, numerous financial institutions began to explore its application in financial operations. To reduce costs and enhance operational efficiency, these institutions started adopting blockchain technology in various

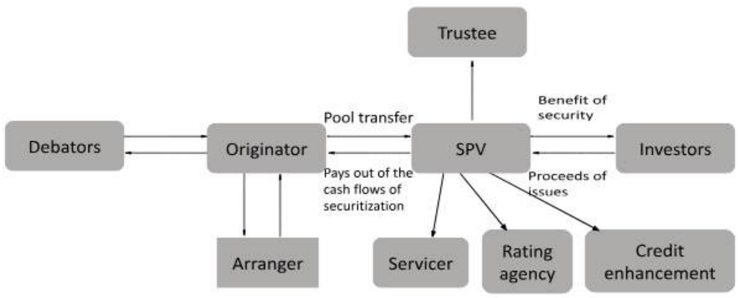
areas, including financial transactions, cross-border payments, and Asset-Backed Securitization. This evolution reflects the growing recognition of blockchain's transformative potential in the financial sector.
At the beginning, blockchain technology was widely utilized in financial markets. It offers significant benefits in information transactions, such as decentralization, transparency, autonomy, and anonymity. Despite being built on advanced mechanisms such as asymmetric cryptography, distributed consensus, and smart contracts, its integration into the securitization process remains at an early stage.
As stated by W. Sun (2022), blockchain technology is becoming nowadays a preferred solution for asset securitization, due to decentralization, smart contracts and tamper-proof.
Kumar (2024) indicated that this technology could simplify processes, reduce costs, speed up transactions, increase and enhance security.

1- Harnessing Blockchain Technology in Asset-Backed Securitization

1-1 – Conceptual framework of securitization

Asset securitization is a financial process, which pools the financial assets (loans, mortgages …) into special purpose vehicles (SPV), with the aim of issuing securities like Mortgage-Backed Securities and Asset-Backed Securities. This process creates securities backed by the cash flows from these assets.
Asset securitization involves pooling financial assets like loans and mortgages into Special Purpose Vehicles, which issue securities such as Mortgage-Backed Securities and Asset-Backed Securities. These securities are backed by the cash flows from these original assets, improving liquidity, and freeing up capital.
Traditional securitization is associated with several significant limitations. One of the most critical issues is the lack of transparency surrounding the underlying assets, making it difficult for investors to understand what they are actually investing in. In addition, the complex legal structures governing asset ownership often lead to challenges in asset recovery, particularly in cases of default. Another major drawback is the high cost structure, including management and agency fees, which can rival or exceed those of more traditional investment vehicles such as mutual funds. Furthermore, the frequent use of leverage, often without clear disclosure, adds another layer of risk for investors. These factors combine to create an environment where average investors struggle to accurately assess and understand the risks, reducing accessibility and increasing systemic vulnerability, as was notably revealed during the 2008 financial crisis.

Figure 1: Securitization process



Source: Adapted by the authors

1-2- Blockchain structure and tokenisation

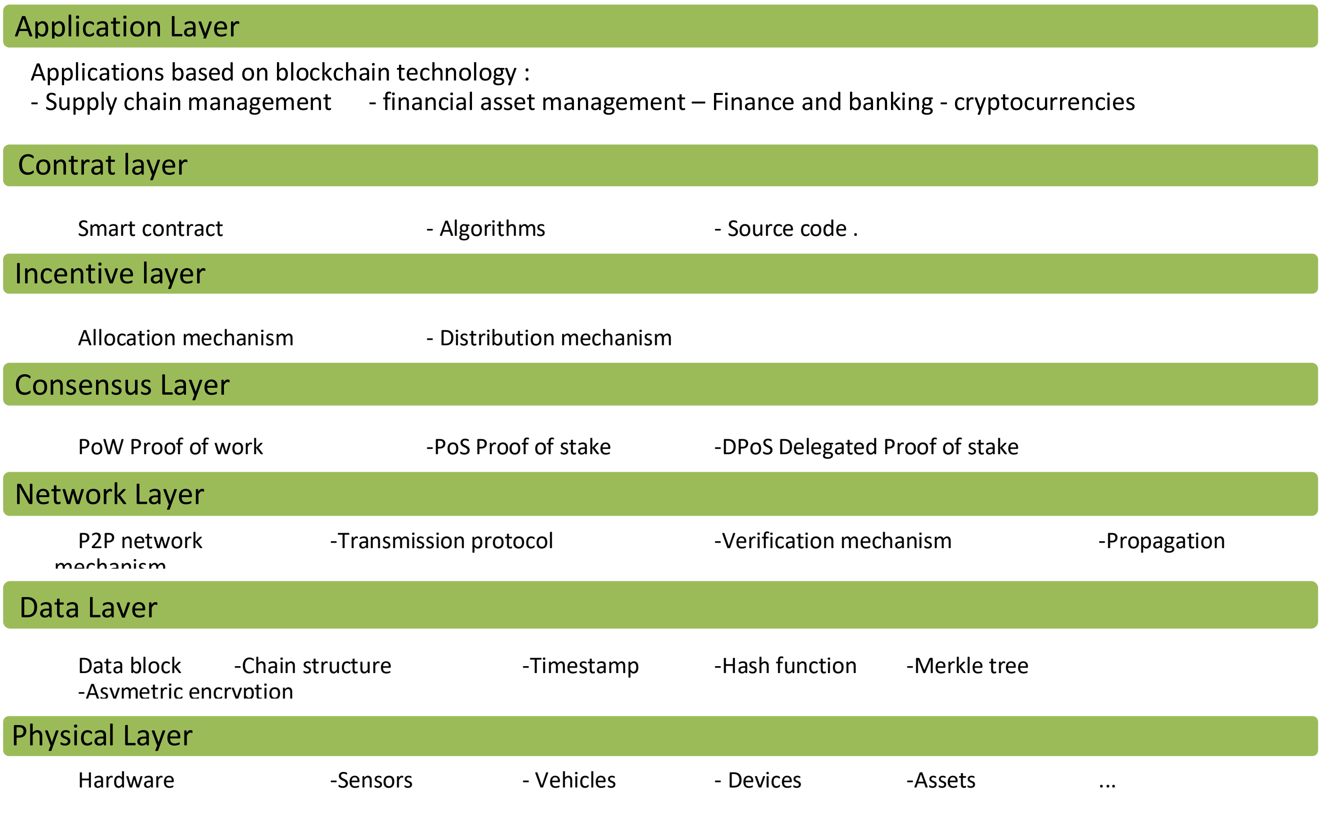
Blockchain technology significantly enhances this process by automating interest rate alignment and purchase amounts, streamlining contract formation, and ensuring compliance

ISSN: 2658-8455
Volume 6, Issue 8 (2025), pp. 590-600.

through encryption. It reduces costs, improves transparency, and enables real-time reporting. Blockchain also eliminates intermediaries with smart contracts, speeds up transactions, and facilitates asset tokenization for faster, cheaper trading. Additionally, blockchain provides secure, immutable records, efficient asset management, and more accurate credit ratings.

In the context of securitization, tokenization allows the fractional representation of asset-backed securities, increasing liquidity and access. Blockchain technology securely transfers securities assets within a peer-to-peer network, recording the entire transaction process on the blockchain. This reduces risks and prevents tampering. A proposed blockchain-based storage system, designed with Java technology, uses blockchain principles to ensure data integrity by recording and transferring securities transactions into a secure database.

Figure 2: Framework of blockchain structure



Source: Adapted by the authors

To better understand and use blockchain technology, it's helpful to grasp the different layers of the blockchain structure, and its roles and risks.

1. **Application layer: At the top level, application layer includes various decentralized applications (dApps) such as programmable finance. But they also come with risks, such as faces threats from centralized exchanges or dealing vulnerabilities in smart contracts.**
1. **Application Layer**: At the top, this layer includes various decentralized applications (dApps) such as programmable finance and society. While it enables diverse use cases, it also faces threats from centralized exchanges and potential vulnerabilities in smart contracts.
2. **Smart Contract Layer**: This layer encompasses smart contracts and algorithms that automate and enforce blockchain services. Risks here include vulnerabilities from poorly designed smart contracts and the centralization of control if developers or malicious actors exploit contract ownership.

3. **Incentive Layer**: To maintain network security and decentralization, nodes are incentivized through mechanisms that reward those who adhere to network rules. However, centralization can occur if mining pools control a disproportionate amount of hashing power, leading to skewed reward distribution and reduced network security.
4. **Consensus Layer**: This layer employs algorithms to achieve agreement among nodes on the validity of new blocks. Traditional Proof of Work (PoW) requires significant computational power and can lead to centralization if a few miners control a large share of the network's hash rate. Ethereum's transition to Proof of Stake (PoS) aims to address these issues by relying on validators instead of miners, promising greater energy efficiency and reduced centralization risks.
5. **Network Layer**: This layer involves transmission protocols and mechanisms for data propagation and verification across a Peer-to-Peer (P2P) network. Nodes communicate directly and synchronize data, but vulnerabilities exist, such as the weak security of DNS protocols used for node discovery.
6. **Data Layer**: This foundational layer handles the encapsulation of data within blocks, including the block header and body, which contains transaction details. Security concerns in this layer involve potential issues like modified transaction signatures or hash collisions.
7. **Physical Layer**: This layer consists of IoT devices that act as nodes and connect to the blockchain network. Integration challenges and security concerns arise if IoT devices lack proper authentication and interaction with blockchain systems.

Each layer plays a crucial function in the overall blockchain framework, contributing to its decentralization while also presenting specific risks that need to be managed.
Tokenization is the process of transforming assets or data into a digital unit known as a token. This token functions as a digital representation of an asset—physical or virtual—facilitating both the efficient management and the protection of sensitive information. Technically, tokens are generated through algorithms encoded within smart contracts, which are self-executing programs deployed on a blockchain. These smart contracts autonomously enforce the terms of agreements by executing predefined actions in a transparent and irreversible manner, without the need for third-party intervention. The computational output of a smart contract constitutes the token itself.

2- An outline of blockchain technology and tokenization application

- ***Block Data structure***

Figure 3: Block Data structure

Source: Adapted by the authors

For the Data management and security, data layer of the blockchain is fundamental. It includes:
Data blocks: Each block has a header that includes (version, previous block hash, Merkel root hash, timestamp, nonce, and bits). The block body contains the transactions, with a size limit of 1 MB.
Chain Structure: Blockchain, as its name suggests, is built like a chain of blocks, connected to the next using cryptographic hashes. This structure guarantees the integrity and immutability of the blockchain.

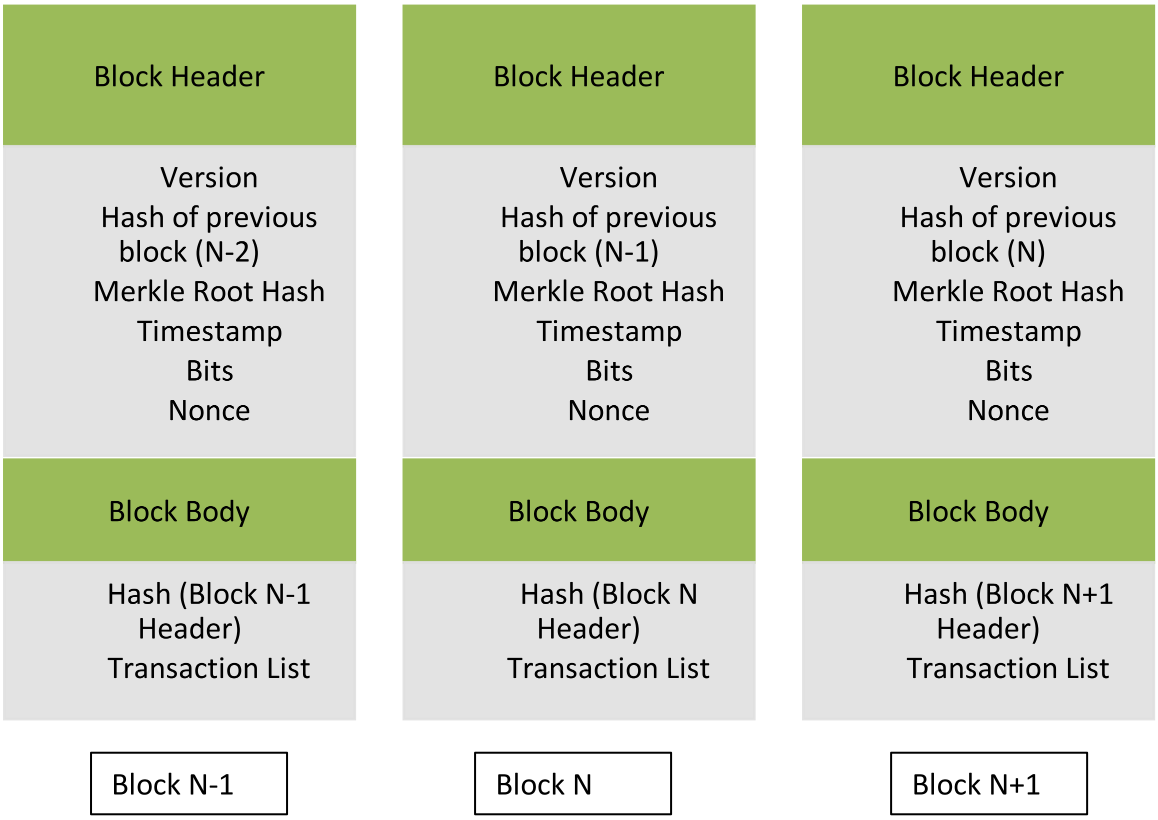
ISSN: 2658-8455
Volume 6, Issue 8 (2025), pp. 590-600.

IJAFAME
International Journal of Accounting, Finance, Auditing, Management & Economics

Timestamp: This feature records the time when the block was created, which allows to verify the authenticity of transactions.
Hash: This function is important for keeping the blockchain secure, its role is to protects data and detecting any changes.
Merkel Tree: Is a binary tree, that organize and hash transaction data in order to create a Merkel root, included in the block header, ensuring data integrity and authenticity.

- ***Encryptions structure***

Figure 4: Chain structure



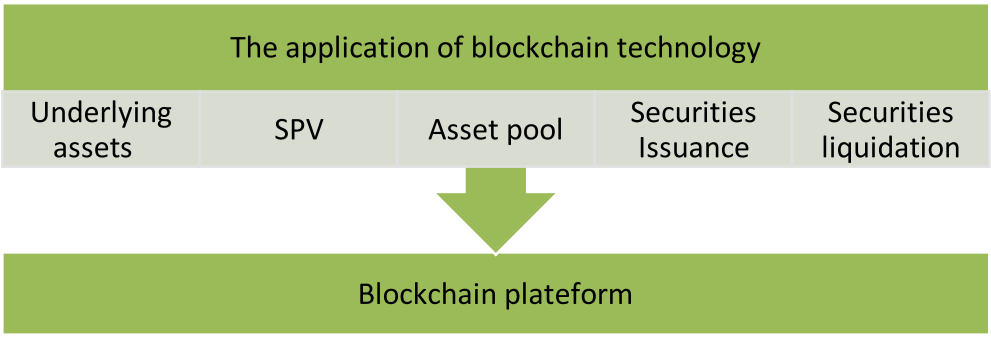
Source: Adapted by the authors

3- The application of blockchain technology in the securitization process

3-1 Applying blockchain technology to securitization: The role of tokenization

Integrating blockchain into the ABS sector addresses issues like too many participants and inefficient data flow. A consortium blockchain enables all parties to act as nodes with set permissions, enhancing security and cutting costs.
Blockchain technology offers an effective solution to many of these challenges. Owing to the transparent, immutable, and decentralized nature of distributed ledgers, information is fully shared and accessible to all stakeholders.
Assets registered on a blockchain benefit from clearly established ownership rights, and any leverage applied to these assets is entirely transparent.
Blockchain-generated tokens act as natural investment units for on-chain assets and provide global investors with low-cost access.
This mechanism, known as tokenization, aggregates and fractionalizes the cash flows derived from on-chain assets, with each token representing a proportionate ownership share.

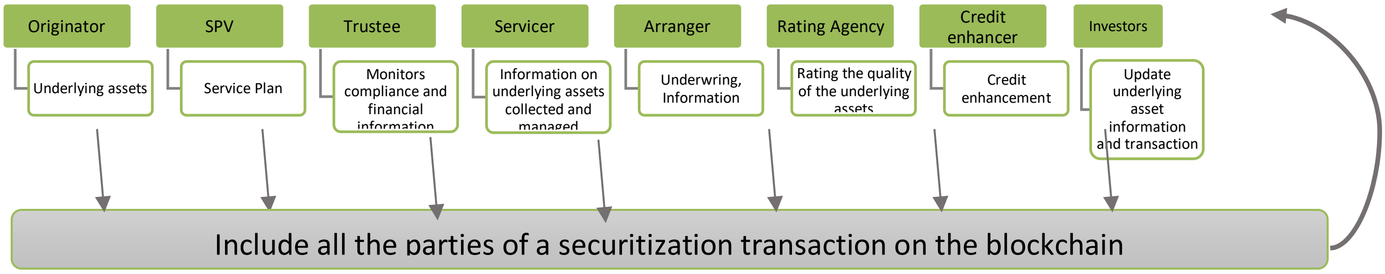
Figure 5: The application of blockchain technology



Source: Adapted by the authors

3-2- ABS Blockchain integration

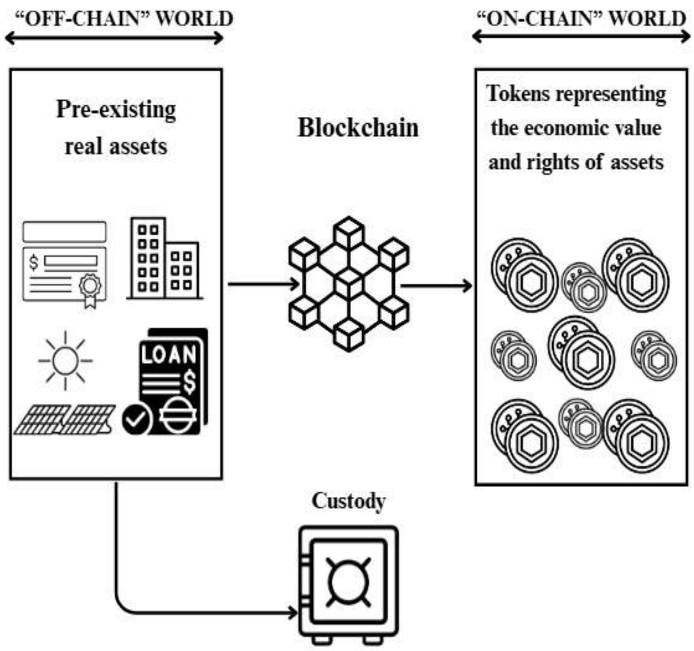
Figure 6: ABS Blockchain mechanism



Source: Adapted by the authors

The process involves creating a blockchain to share asset information, with financial institutions adding legal, regulatory, and evaluation data to ensure transparency and efficiency. Investors access real-time updates, resolving issues of opaque and slow data processing.
Users receive public and private keys to encrypt and sign information, ensuring secure and verified data on the blockchain.

Figure 7: Tokenization of physical assets off-chain



Source: (OECD 2020)

As stated by (OECD 2020) Asset tokenisation refers to the process of representing pre-existing real-world assets on a blockchain ledger by linking or embedding by convention the economic value and rights derived from these assets into digital tokens created on the blockchain.
A token acts merely as a reference to the underlying asset and does not inherently possess direct economic value; its monetary value is generally determined by market dynamics. Once issued and validated through a smart contract, tokens can be utilized in various applications or traded within the marketplace. In theory, any asset can be tokenized, with its ownership rights accurately represented on a distributed ledger.
Tokens created through asset tokenization are recorded on the blockchain, where they embody the rights associated with the underlying assets and serve as a store of value. However, the actual assets themselves remain off-chain. In the case of physical assets, secure custody is generally required to ensure that the tokens are consistently backed by the corresponding assets. This underscores the growing importance of custodial services in tokenization processes.
For an efficient asset management that exist outside the blockchain environment, the integration between blockchain-based (on-chain) systems, and traditional (off-chain) infrastructures is important.

4- Conclusion

Integrating blockchain technology into Asset-Backed Securities represents advancement with profound implications for the financial industry. This study has shown that blockchain effectively resolves several fundamental challenges in traditional ABS systems.
(Schmitz & Leoni, 2019)
(Schmitz & Leoni, 2019) By providing a decentralized, immutable ledger, blockchain enhances the security and integrity of transactions, ensuring that asset-related data remains accurate and transparent. This is particularly important in the ABS market, where reliable data and transparency are crucial for maintaining investor trust.
Blockchain also improves operational efficiency by automating and standardizing processes through smart contracts. These contracts streamline the execution of pooling and servicing agreements, manage cash flows more effectively, and provide a clear, tamper-proof audit trail. This not only reduces the likelihood of errors but also accelerates transaction processing and lowers associated costs.
Furthermore, blockchain’s ability to bolster data security helps alleviate some of the regulatory burdens that have historically slowed down the ABS process. By reducing the need for excessive regulatory scrutiny, blockchain facilitates a more agile and cost-efficient securitization process.
The potential benefits of blockchain extend beyond addressing existing challenges. The technology opens new opportunities for the securitization of unconventional assets, such as emerging revenue streams or innovative financial products, broadening the scope and flexibility of ABS.
In conclusion, while there are challenges to the implementation of blockchain, its advantages are substantial. Blockchain technology has the potential to transform asset-backed securities by enhancing their efficiency, transparency, and security. As such, it stands as a pivotal innovation poised to shape the future of financial services and asset securitization.

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