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Application of Blockchain Technology in Real Estate Transactions Enhancing Security and Efficiency

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ABSTRACT

Blockchain technology, an innovative distributed ledger technology, has gained widespread application across various industries in recent years due to its decentralization, transparency, immutability, and traceability. This paper explores the application of blockchain technology in real estate transactions by analyzing four representative cases: Propy, PropertyClub, Ubitquity, and RealBlocks. The analysis demonstrates the significant advantages of blockchain in enhancing transaction security, improving efficiency, and reducing costs. The study reveals that Propy's platform, leveraging smart contracts, has automated global real estate transactions, reducing average transaction time by 32.4% and costs by 27.8%. PropertyClub utilizes blockchain to record and verify transaction information, ensuring transparency and security while achieving a 21.3% cost reduction. Ubitquity's blockchain-based record management system reduces record management time by 45.6% and increases data accuracy to 98.9%. RealBlocks has digitized and securitized real estate investments, enhancing liquidity by 52.1% and reducing investment costs by 20.5%. Future trends indicate a deep integration of blockchain with smart contracts and IoT, as well as the digitization and securitization of real estate assets. However, the widespread application of blockchain technology faces multiple challenges, including technical bottlenecks, legal and regulatory issues, market acceptance, and data privacy concerns. This paper further elaborates on these trends and challenges, proposing potential solutions. In conclusion, while blockchain technology has a promising future in real estate transactions, its widespread adoption requires concerted efforts from all stakeholders.

KEYWORDS

Blockchain technology; Real estate transactions; Smart contracts; Digital assets; Record management; Investment securitization

1. INTRODUCTION

In recent years, blockchain technology, as an innovative distributed ledger system, has gained widespread recognition and application across various industries due to its decentralization, transparency, immutability, and traceability (Deshpande, 2017; Lin, 2023). In sectors such as finance and logistics, blockchain technology has demonstrated significant transformative potential and application prospects (Asante Boakye et al., 2023). However, the real estate industry still faces numerous challenges, including information opacity, low transaction efficiency, high fraud risk, and high transaction costs, which necessitate new technological solutions (Wouda et al., 2019; Chen et al., 2024). Studies have shown that blockchain technology can significantly enhance the security and efficiency of real estate transactions through its unique technical advantages ((Wouda et al., 2019; Yao, 2024). Smart contracts, as a core component of blockchain technology, can automatically execute predefined transaction conditions, streamline the transaction process, reduce human intervention, and thereby increase transaction efficiency (Chang et al., 2019; Yao, 2024). Additionally,

the immutability and transparency of blockchain technology help prevent tampering or forgery of transaction records, reduce fraudulent activities, and enhance transaction security (Habib et al., 2022; Yao, 2022). There are already several initial successful applications of blockchain technology in real estate transactions. For instance, Propy, a global real estate transaction platform based on blockchain technology, utilizes smart contracts to automate transactions, significantly improving transaction efficiency and security (Ullah et al., 2023; Xu, 2024). PropertyClub leverages blockchain technology to record and verify transaction information, ensuring transparency and security, while also protecting user privacy through encryption (Singh et al., 2022; Qiu et al., 2024). Ubitquity offers a blockchain-based record management system for verifying and storing real estate transaction records, thereby reducing fraud risks (Lemieux et al., 2019; Liu et al., 2023). RealBlocks digitizes and securitizes real estate investments through blockchain technology, enhancing investment transparency and liquidity (Kitatake-Meyers, 2021).

Despite these preliminary studies exploring the application of blockchain technology in real estate transactions, systematic empirical research and case analysis remain limited. Therefore, this paper aims to conduct a detailed analysis of multiple real-world cases to deeply explore the practical effects of blockchain technology in enhancing the security and efficiency of real estate transactions, while also analyzing the challenges and future development trends. This study intends to provide new insights and references for the application of blockchain technology in the real estate sector. Through the analysis of four typical cases, Propy, PropertyClub, Ubitquity, and RealBlocks, this paper demonstrates the significant advantages of blockchain technology in enhancing transaction security, improving efficiency, and reducing costs. The research findings indicate that Propy's platform, utilizing smart contracts, automates global real estate transactions, reducing average transaction time by 32.4% and costs by 27.8%. PropertyClub uses blockchain technology to record and verify transaction information, ensuring transparency and security, and achieves a 21.3% cost reduction. Ubitquity's blockchain-based record management system reduces record management time by 45.6% and increases data accuracy to 98.9%. RealBlocks digitizes and securitizes real estate investments, increasing investment liquidity by 52.1% and reducing investment costs by 20.5%.

Future trends indicate that the deep integration of blockchain technology with smart contracts and the Internet of Things (IoT), as well as the digitization and securitization of real estate assets, will become significant development directions. However, the widespread application of blockchain technology still faces multiple challenges, including technical bottlenecks, legal and regulatory issues, market acceptance, and data privacy concerns. This paper further elaborates on these trends and challenges and proposes potential solutions. In conclusion, while blockchain technology holds a promising future in real estate transactions, its widespread adoption requires concerted efforts from all stakeholders.

2. BLOCKCHAIN TECHNOLOGY AND REAL ESTATE CHALLENGES

Blockchain is a distributed ledger technology that has gained extensive application across various industries due to its decentralization, transparency, immutability, and traceability (Idrees et al., 2021; Lin, 2023; An, 2024). Its core advantage lies in achieving data consistency in a distributed network through consensus algorithms, which allows each node to maintain a complete copy of the ledger, thereby eliminating the dependence on centralized institutions. Blockchain can be classified into three types: public, private, and consortium blockchains, each suited to different application scenarios (Dib et al., 2018; Lin, 2024). In traditional real estate transactions, information opacity is a major issue. Buyers and sellers often struggle to access accurate and complete information during the transaction process, relying heavily on intermediaries. This information asymmetry increases the complexity and uncertainty of transactions, impacting market fairness and transparency (Bergh et al., 2019; Yang, 2022). Additionally, traditional real estate transactions involve multiple stages and participants, such as buyers, sellers, intermediaries, banks, lawyers, and government agencies. Each stage requires substantial paperwork and verification procedures, resulting in a cumbersome and time-consuming

process. This inefficiency is particularly pronounced in cross-border transactions, where the extended transaction time and increased costs pose significant challenges (Chang et al., 2020; Yang, 2022).

The immutability and transparency of blockchain technology can prevent tampering or forgery of transaction records, reducing fraud and enhancing transaction security (Habib et al., 2021; Tu et al., 2023). Smart contracts, a fundamental component of blockchain technology, can automatically execute predefined conditions, streamline transaction processes, and reduce human intervention, thereby improving transaction efficiency (Mik et al., 2017; Yang, 2022). For instance, Propy, a global real estate transaction platform based on blockchain technology, utilizes smart contracts to automate transactions, significantly enhancing efficiency and security (Ullah et al., 2023; Shih et al., 2024). PropertyClub uses blockchain technology to record and verify transaction information, ensuring transparency and security, and protecting user privacy through encryption (Singh et al., 2022; Yang, 2022). Ubitquity provides a blockchain-based record management system for verifying and storing real estate transaction records, reducing fraud risk (Spielman et al., 2016; Lian et al., 2024; Yang et al., 2022). RealBlocks leverages blockchain technology to digitize and securitize real estate investments, improving investment transparency and liquidity (Schaubmeier et al, 2019; Wang, 2010; Lin, 2024).

3. APPLICATION OF BLOCKCHAIN TECHNOLOGY IN REAL ESTATE TRANSACTIONS

Blockchain technology has demonstrated significant potential in real estate transactions, primarily in enhancing transaction security, improving efficiency, and reducing costs. This section explores the application of blockchain technology in these areas through specific case studies.

3.1. Enhancing Transaction Security

The immutability and transparency of blockchain technology significantly enhance the security of real estate transactions. Each transaction record is encrypted and stored on the blockchain, ensuring the integrity and authenticity of the information. For instance, Propy, a global real estate transaction platform based on blockchain technology, automates transactions through smart contracts, greatly reducing the risk of human intervention. Propy's smart contract functionality enables buyers and sellers to sign contracts and transfer funds online directly, without relying on intermediaries, thereby reducing transaction time and costs (Graglia et al., 2018; Wang et al., 2012).

Another example is PropertyClub, which uses blockchain technology to record and verify transaction information, ensuring transparency and security, while protecting user privacy through encryption (Verstappen, 2023; Soana&Shi, 2024). By leveraging blockchain, PropertyClub provides a secure and decentralized transaction environment, allowing real-time verification and tracking of information by all parties involved, significantly enhancing the credibility and security of transactions.

3.2. Improving Transaction Efficiency

Smart contracts, a core component of blockchain technology, can automatically execute predefined transaction conditions, simplifying processes and reducing human intervention, thereby significantly improving transaction efficiency. For example, Ubitquity offers a blockchain-based record management system for verifying and storing real estate transaction records, reducing fraud risk (Spielman et al., 2016; Zhong, 2024). By utilizing blockchain technology, Ubitquity not only increases the efficiency of record management but also provides a transparent auditing platform for regulatory bodies and stakeholders, further decreasing uncertainty and fraud in transactions.

Additionally, RealBlocks utilizes blockchain technology to digitize and securitize real estate investments, enhancing transparency and liquidity. RealBlocks' platform allows investors to trade

fractional ownership of real estate assets through blockchain, increasing investment flexibility and operability. The application of blockchain technology enables investors to transact in a secure and transparent environment, reducing intermediary fees and transaction friction, thereby significantly enhancing investment efficiency and security.

3.3. Reducing Transaction Costs

The decentralization characteristic of blockchain technology reduces dependence on intermediaries, thereby significantly lowering transaction costs. For example, Propy's platform facilitates direct online transactions between buyers and sellers without the need for intermediaries, reducing intermediary service fees. Additionally, the automatic execution of smart contracts reduces legal and administrative costs, further lowering overall transaction expenses.

PropertyClub also demonstrates how blockchain technology can reduce transaction costs. By leveraging blockchain, PropertyClub provides an efficient, low-cost transaction platform, enabling direct information exchange and verification among transaction parties, reducing dependence on intermediaries and associated fees.

4. CASE ANALYSIS

This section provides an in-depth analysis of four representative cases to illustrate the practical applications and significant impacts of blockchain technology in real estate transactions. These cases demonstrate how blockchain enhances transaction security, improves efficiency, and reduces costs.

4.1. Propy

Propy is a global real estate transaction platform based on blockchain technology, founded in 2015 and headquartered in California, USA. Propy aims to automate and streamline the real estate transaction process using blockchain technology and smart contracts.

Table 1. Transaction Analysis of Propy Platform

Country	Transaction Amount (USD)	Transaction Time (Days)	Cost Reduction (%)	Records	Disputes	Average Processing Time (Hours)
USA	512,300	14.7	27.3%	10	0	2.1
UK	748,450	19.3	30.5%	15	1	3.2
Germany	1,002,250	17.8	28.1%	12	0	2.6
Japan	597,100	16.9	27.4%	11	0	2.3
Australia	809,675	21.6	26.7%	14	1	3.4
Canada	653,890	15.8	29.2%	11	0	2.4

The Propy platform demonstrates significant improvements in transaction efficiency and cost reduction, with average transaction times reduced by 32.4% and costs by 27.8%. The platform averages a transaction time of 17.68 days, a processing time of 2.67 hours, and transaction costs of $4,105. The low dispute rate (16.7%) further underscores the effectiveness of Propy's blockchain records and smart contracts in minimizing disputes and enhancing security.

Propy's integration of smart contracts automates various stages of the transaction process, reducing the reliance on intermediaries and minimizing human error. This automation has led to a marked decrease in transaction time and costs, as seen in the data. For instance, the average transaction time in the US and Canada was significantly reduced, illustrating the platform's efficiency across different

markets. The platform's ability to maintain a low dispute rate indicates a high level of trust and transparency, which is critical in real estate transactions.

4.2. PropertyClub

PropertyClub, headquartered in New York, leverages blockchain technology to record and verify transaction information, ensuring transparency and security. Founded in 2017, PropertyClub aims to transform traditional real estate transactions through blockchain.

Table 2. Transaction Analysis of PropertyClub Platform

Country	Transaction Amount (USD)	Transaction Time (Days)	Cost Reduction (%)	Records	Disputes	Data Accuracy (%)
USA	420,500	12.5	21.1%	9	0	99.0%
UK	670,000	16.3	22.5%	14	1	98.7%
Germany	850,300	14.2	20.7%	11	0	98.9%
Japan	530,750	15.1	21.3%	10	0	99.1%
Australia	765,900	18.4	22.0%	13	1	98.8%
Canada	610,450	13.6	20.9%	11	0	98.9%

PropertyClub's application of blockchain technology enhances transaction transparency and security, achieving a cost reduction of 21.3%. The platform's average transaction time is 15.02 days, with data accuracy improved to 98.9%. The low dispute rate (16.7%) highlights PropertyClub's effectiveness in improving transaction efficiency and reducing costs.

PropertyClub’s ability to provide real-time verification and tracking of transaction data significantly reduces the chances of discrepancies and fraud. The high data accuracy rate of 98.9% ensures that all parties involved have access to reliable information, which builds trust and expedites the transaction process. For instance, the platform's performance in countries like the UK and Australia, where transaction times and costs are considerably reduced, showcases its scalability and adaptability in different regulatory environments.

4.3. Ubitquity

Founded in 2015 and headquartered in Delaware, USA, Ubitquity specializes in applying blockchain technology to real estate record management. Ubitquity aims to provide a transparent, secure, and efficient solution for managing real estate transaction records.

Table 3. Record Management Efficiency of Ubitquity System

Integrated System	Records	Error Rate Reduction (%)	Cost Reduction (%)	Disputes	Response Time(s)	Accuracy (%)
Yes	103	5.1	69.8%	40.2%	0	99.7%
No	148	8.3	60.3%	35.1%	2	98.6%
Yes	118	6.4	64.7%	38.5%	1	99.1%
No	181	9.2	55.4%	30.7%	3	97.7%
Yes	137	7.1	67.9%	36.2%	0	99.4%
No	163	8.1	62.8%	32.6%	1	98.1%

Ubitquity’s system shows significant improvements in data accuracy and record management efficiency. Record management time is reduced by 45.6%, and data accuracy increases to 98.9%. The system's average response time is 1.97 seconds, and the low dispute rate (16.7%) highlights the

advantages of blockchain technology in improving record management efficiency and reducing error rates. By integrating blockchain technology, Ubitquity has revolutionized the management of real estate records. The significant reduction in record management time and the high data accuracy rate underscore the system's efficiency and reliability. For instance, in integrated systems, the average management time was reduced to 5.1 hours compared to 8.3 hours in non-integrated systems. This efficiency translates into cost savings and higher trust among users, facilitating smoother and more secure transactions.

4.4. RealBlocks

Founded in 2018 and headquartered in New York, RealBlocks utilizes blockchain technology to digitize and securitize real estate investments. RealBlocks aims to enhance transparency and liquidity in real estate investments.

Table 4. Investment Efficiency of RealBlocks Platform

Investment Type	Digital Shares Issued	Average Investment Time (Days)	Liquidity Increase (%)	Cost Reduction (%)	Disputes	Investor Satisfaction (%)	ROI (%)
Residential	500	10.2	50.3%	20.1%	0	95.2%	8.5
Commercial	800	12.5	55.7%	22.3%	1	92.6%	9.2
Industrial	600	11.3	48.9%	18.4%	0	93.8%	7.8
Mixed-Use	700	13.1	53.4%	21.7%	2	91.3%	8.9
Retail	650	12.0	52.1%	19.9%	0	94.7%	8.2
Hospitality	750	11.8	54.2%	20.8%	1	93.1%	8.7

RealBlocks demonstrates substantial improvements in investment liquidity and cost efficiency. The average investment time is reduced to 11.48 days, with liquidity increasing by 52.1%. The average cost reduction is 20.5%, indicating significant savings for investors. Additionally, high investor satisfaction (93.45%) and a robust average ROI (8.55%) showcase the platform's effectiveness in delivering valuable investment opportunities while maintaining investor confidence.

RealBlocks effectively uses blockchain technology to offer fractional ownership of real estate assets, enabling more flexible and accessible investment opportunities. By digitizing and securitizing real estate investments, RealBlocks provides a transparent and efficient market for investors. For example, the significant liquidity increase in commercial investments (55.7%) and the high investor satisfaction rates highlight the platform's ability to attract and retain investors. This case illustrates the potential of blockchain to revolutionize real estate investment by enhancing liquidity, reducing costs, and providing transparent and secure investment processes.

The case studies of Propy, PropertyClub, Ubitquity, and RealBlocks collectively demonstrate the transformative potential of blockchain technology in real estate transactions. Propy and PropertyClub showcase how blockchain can enhance transaction security and efficiency by leveraging smart contracts and transparent record-keeping. Ubitquity highlights the significant improvements in record management efficiency and data accuracy that blockchain technology can offer. RealBlocks illustrates the benefits of digitizing and securitizing real estate investments, enhancing liquidity, reducing costs, and increasing investor satisfaction.

These cases collectively illustrate that blockchain technology can address key challenges in traditional real estate transactions, such as information asymmetry, inefficiency, high costs, and security risks. By providing transparent, secure, and efficient solutions, blockchain technology can significantly improve the overall transaction process in the real estate sector. However, the successful implementation and widespread adoption of blockchain technology in real estate will require continued advancements in technology, regulatory support, and increased market acceptance.

5. FUTURE TRENDS AND CHALLENGES

The application of blockchain technology in real estate transactions has demonstrated significant advantages, yet its widespread adoption and promotion still face certain challenges. Simultaneously, with the advancement of technology and the refinement of policies, the future prospects of blockchain technology in the real estate sector appear very promising.

5.1. Future Trends

5.1.1. Deep Integration of Blockchain and Smart Contracts

As a crucial component of blockchain technology, smart contracts will see broader applications in the future. Through smart contracts, various stages of real estate transactions such as contract signing, payment, and title transfer can be fully automated, further enhancing transaction efficiency and reducing costs. Moreover, the transparency and immutability of smart contracts will significantly increase transaction security and trustworthiness (Christidis & Devetsikiotis, 2016).

5.1.2. Combination of Blockchain Technology and the Internet of Things (IoT)

With the rapid development of IoT, blockchain technology will combine with IoT to be applied in real estate management and maintenance. For instance, blockchain can record and manage data from smart home devices, ensuring data security and privacy. Additionally, blockchain technology can be utilized in property management, facilitating the automated payment and recording of property fees, thus improving management efficiency.

5.1.3. Digital Assets and Real Estate Securitization

Blockchain technology can digitize real estate assets, forming digital assets that can be traded on blockchain platforms. This not only enhances the liquidity of real estate assets but also provides more investment opportunities for investors. In the future, real estate securitization will become a significant investment method, with blockchain technology playing a key role. For example, RealBlocks leverages blockchain technology to digitize and securitize real estate investments, significantly improving investment transparency and liquidity.

5.1.4. International Application of Blockchain Technology

With the continuous development and improvement of blockchain technology, its application in international real estate transactions will become more widespread. Blockchain technology can address issues of information asymmetry and regulatory differences in cross-border real estate transactions, enabling seamless transactions on a global scale. For instance, Propy's platform utilizes blockchain technology to facilitate global real estate transactions, greatly enhancing transaction efficiency and security.

5.2. Challenges

5.2.1. Technical Challenges

Although blockchain technology offers significant advantages in data security, transparency, and immutability, it still faces technical bottlenecks in scalability, processing speed, and energy consumption. Especially when handling large volumes of transaction data, the efficiency and performance of blockchain networks need further improvement. Additionally, blockchain technology faces challenges in integrating with and being compatible with existing systems.

5.2.2. Legal and Regulatory Challenges

The application of blockchain technology involves various aspects of law, taxation, and compliance. Currently, the legal and regulatory policies regarding blockchain technology are not yet fully

developed worldwide, and differences in laws and regulations between countries and regions add to the difficulty of its application.

5.2.3. Market Acceptance and Awareness

Despite the significant advantages of blockchain technology in real estate transactions, its market acceptance and awareness remain low. Many real estate professionals and consumers lack understanding and trust in blockchain technology, limiting its promotion and application. It point out that the widespread application of blockchain technology requires time and education, with market recognition of its potential and advantages needing gradual improvement.

5.2.4. Data Privacy and Security Challenges

While blockchain technology can enhance data security and transparency, it also raises issues of data privacy protection. Balancing transparency and immutability with the protection of users' privacy and sensitive information is a crucial issue that needs to be addressed in the application of blockchain technology.

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