Tokenized Real Estate

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Abstract— **Real estate provides consistent returns and a significant tax advantage to those who hold long-term. On the other hand, real estate investments are illiquid assets that need a lengthy transaction procedure and lack transparency between buyers and sellers. Tokenized real estate presents potential solutions to the friction in the real estate market. We will explore critical elements of tokenized real estate, including industry dynamics, advantages, challenges and development, and its use cases. Tokenizing a security like real estate has the potential to improve liquidity, provide transparency, lower fees, and speed up transactions in the industry. This paper aims to educate readers and facilitate the discussion of institutional adoption of tokenized real estate and its future use-cases.**

Keywords: Real Estate, Tokenization, Blockchain

I. INTRODUCTION

Historically, real estate has been a safe investment. Regardless of what happens in the stock market, people will always need a place to live, rent, and work. The market value of the global commercial real estate market was approximately $32.6 trillion in 2020 (Statista, 2021). Technology has played a significant role in the substantial growth of the real estate industry. Information is readily available to people looking to buy and sell properties. Despite the substantial growth of the industry, real estate transactions are highly illiquid. It can take months or even years to sell a property on the market. The current technology used for real estate is focused mainly on connecting buyers and sellers. It does not address all of the market's liquidity issues. Real estate tokens could make it easier to buy and sell real estate and more readily assembled into the types of structured portfolios that institutional investors prefer.

II. DIFFERENT TOKEN STANDARDS

Before further discussion, we believe it is necessary to explain the different token standards pertinent to tokenized securities.

Token standards are blueprints for smart contracts that mint and manage token transactions. The most common standards on the Ethereum blockchain are ERC-20s (fungible tokens) and ERC-721s (non-fungible tokens). The ERC-1400 standard, which is the most commonly used for security tokens, has fungible and non-fungible attributes. It can limit the usage of a token based on the user's identity, location, and asset class. The security token issuer can force and execute trades, burn, and mint tokens - even in secondary markets (CodeFi, 2021).

A. *Security Token*

The tokenized securities market is a new phenomenon extending the number of investment opportunities available to investors. As shown in Table 1, the market cap for security tokens has increased by 644.808% from May 2020 to June 2020. A tokenized security is an on-chain representation of an off-chain security. These securities are represented on-chain by security tokens. A *security token* is a brand new asset class that must comply with the U.S. Securities and Exchange Commission regulations.

In traditional finance, a Howey Test would be used to determine if something would be considered a security or not. The Howey Test classifies an asset as a security if money is deposited into a common enterprise, profits are expected from the investment, and the profits come from someone or something other than the investor's efforts. The same applies to tokenized securities. Since regulations differ between localities, token standards can vary widely. So, there is no one size fits all approach to issuing security tokens.

III. TOKENIZED REAL ESTATE

When a real estate property is tokenized, a security token is used to represent it. Real estate

Fig. 1.

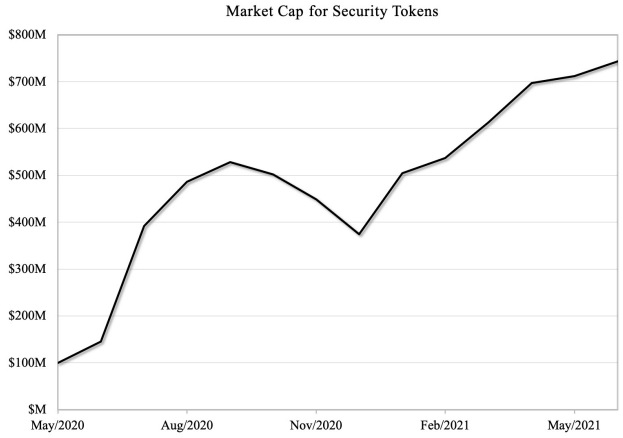


Fig. 2.

tokens are security tokens, as the token itself represents full or partial ownership of the underlying property. One of the major benefits real estate tokens have is the flexibility to allow for fractional ownership while maintaining their unique properties.

Assume a company wanted to issue a real estate token worth $10 million for a commercial real estate building. The company could tokenize the building, issue a security token, break the token up into one million real estate (security) tokens, and sell each token at $10 on the secondary market. Fractionalization allows proprietors to sell their security tokens at a lower cost to a broader range of potential buyers, enormously increasing liquidity in the real estate market.

In June 2021, the total market cap of tokenized real estate was equal to $32,783,381.27 (STM, 2021). Table 2 shows the market cap for tokenized real estate over the past seven months. We predict that tokenized real estate platforms will continue to impact the global real estate market heavily.

IV. Advantages of Tokenized Real Estate

A. Transparency, Liquidity, and Lower Fees

Each block embedded into the blockchain can store information such as the legal rights to a property - which is typically kept offline in traditional real estate. Therefore, information is not stored with a central entity. Instead, it is spread across each block on the network where anyone in the world can view transactions. This decentralized ledger enhances transparency since anyone can verify the rights to a property.

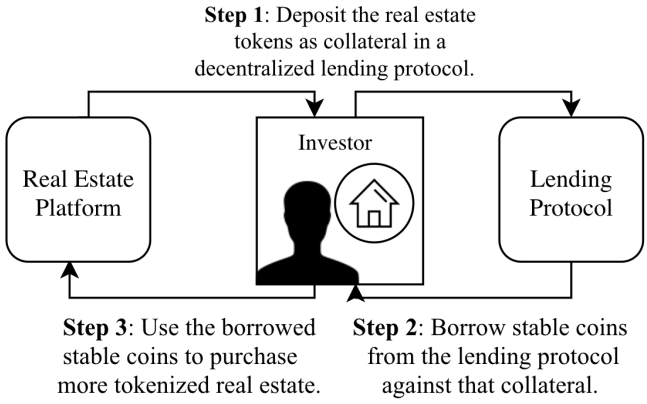
The blockchain ledger is immutable, indicating that malicious attackers cannot alter the previous on-chain information. Individuals can use the blockchain network to ensure that the real estate they purchase or invest in is free of fraud. In addition to this, the smart contract would replace most of the legal paperwork required in real estate transactions. Smart contracts have the advantage of not having to be constantly negotiated because they operate based on conditional statements and are implemented automatically on the blockchain. Blockchain technology could reduce the time of transactions and ultimately lower fees.

A real estate token could be split up into multiple fungible tokens, creating lower capital requirements in private equity and allowing for decentralized crowdfunding. Lower capital requirements bring democratization to smaller investors without sufficient capital. These smaller investors will be able to invest in high-value properties themselves. The current real estate market is confined by the real estate assets' location and regulations. Since the blockchain acts as a shared database on the network, anybody in the world may access the public data from the smart contract. Because the network is available 24 hours a day, seven days a week, and to everyone on the globe, it could include a plethora of participants, raising the amount of money and liquidity available in the market.

B. Leverage

Real estate investors often take out loans to purchase properties that they would otherwise be unable to afford with only the cash they have on hand. This process, known as leverage, increases

investor exposure to fluctuations in real estate valuations without increasing the initial investment. Tokenized real estate along with decentralized lending protocols allow investors to obtain leverage without applying for a loan from a centralized bank.



Suppose an investor who already had a real estate token wanted to obtain leverage. A three step process that can be repeated arbitrarily many times can be used to achieve this:

1) Deposit the real estate tokens as collateral in a decentralized lending protocol.
2) Borrow stable coins from the lending protocol against that collateral.
3) Use the borrowed stable coins to purchase more tokenized real estate.

They can then repeat this process as many times as they want. The total loan size is limited only because decentralized lending protocols require overcollateralization, so the value of each additional loan trends geometrically to zero according to the collateralization ratio. Hence, we use the geometric series formula to calculate the maximum total loan size possible on a decentralized lending protocol given the principle and collateralization ratio.

In order to calculate the total amount of money used to take out a loan, we need to take the collateralization percentage from the decentralized lending protocol and turn it into a collateralization rate represented as C. r is the multiplicative inverse of C.

$$\begin{aligned} \alpha &= \text{principal} \\ C &= \text{collateralization rate} \\ r &= \frac{1}{C} \end{aligned}$$

Total loan size can be represented as the sum of n geometrically decaying terms, where n is the number of times the process is repeated. The closed-form solution to a finite geometric sum of n terms is:

$$\sum_{k=1}^{n} r^k = \frac{1 - r^{n+1}}{1 - r} \tag{1}$$

Since there is no limit on the number of times the investor can repeat the process, we are interested in the limit as n – the number of times the investor repeats the process – approaches ∞:

$$\sum_{k=1}^{\infty} r^k = \lim_{n\to\infty}\left[\sum_{k=1}^{n} r^k\right] = \lim_{n\to\infty}\left[\frac{1 - r^{n+1}}{1 - r}\right] \tag{2}$$

Now we use r^{n+1} tends to 0 as n tends to infinity while the other terms remain constant, so replacing the r^{n+1} term with 0 resolves the limit, and we get:

$$\lim_{n\to\infty}\left[\frac{1 - r^{n+1}}{1 - r}\right] = \frac{1 - 0}{1 - r} = \frac{1}{1 - r} \tag{3}$$

Given $0 < \boldsymbol{r} < 1$, the infinite series has a total loan sum:

$$\sum_{k=0}^{\infty} \alpha r^k = \alpha \sum_{k=0}^{\infty} r^k = \frac{\alpha}{1 - r} \tag{4}$$

For example, an investor who held $1,000,000 in tokenized real estate could deposit it into a decentralized lending protocol. The collateralization rate would be 125%, so $C = 1.25$, and $r = \frac{1}{c} = .80$. The investor can borrow up to $800,000 in stable coins against his collateral in the first stage. He then repeats this process as many times as he wants to get a loan size of up to $5,000,000.

$$\sum_{k=0}^{\infty} 1,000,000(0.8)^k = \frac{1,000,000}{1 - 0.8} \tag{5}$$

$$= \frac{1,000,000}{0.2} \tag{6}$$

$$= \$5,000,000 \tag{7}$$

V. Crowdfunding

A. REITs

Real estate investment trusts (REITs) are a common way for traditional investors to own equity in a large-scale real estate company without having to buy a property. REITs are companies that own and sometimes manage income-producing real estate properties. These properties can include apartments, malls, warehouses, and hotels. An investor would traditionally go through an exchange to buy a share of the REIT and would be paid out in high-earning dividends. There are also mortgage REITs where the company does not own the underlying property but instead owns the mortgage and collects payments. This process has made it easier for investors to have a diversified portfolio. But investors do not have actual ownership of the underlying properties themselves or influence over their maintenance. RealToken Inc addresses these problems in real estate.

Case Study: RealT

RealT is a crowdfunding platform that manages ownership of real estate properties, rights, and dividends using blockchain technology. Real Token Inc. offers fractional ownership of tokenized real estate on the Ethereum blockchain. Real Token LLC is an umbrella company registered in Delaware and thereby serves as a legal entity that creates a Series LLC for each individual tokenized building. Investors can purchase security tokens representing fractional ownership or rights in the LLC that owns the deed to the property. The company hires a property manager to upkeep the property and manage all landlord responsibilities. Investors and property managers are paid a portion of the rent that is collected from the tenant. These payments are weekly in the form of a stable coin.

B. Private Equity Real Estate

Private equity real estate firms pool together capital from investors to purchase and develop properties before selling them. These investors only include high net worth individuals, accredited investors, and institutions. Therefore, these funds are not publicly traded. General Partners (GP's) manage the private equity fund and limited partners (LP's) invest funds. Investments in private equity real estate are highly illiquid, considering it is limited to high-profile investors, and the funds are locked up for a significant amount of time.

If a private equity real estate company were to tokenize a property's funds, they could ultimately optimize their procedures - particularly for smaller private companies. A security token representing each fund would be split up into multiple fungible tokens at a lower price and sold on the public market, bringing in additional liquidity. Additionally, the private equity company could issue as many tokens as they would like and set the price of each share, providing more flexibility in the process. The distribution of these security tokens could increase capital and lower the transaction fees for GP's and LP's.

Case Study: Mata Capital

Mata Capital, a French private equity real estate company, utilizes blockchain technology to optimize the distribution of funds and modernize its procedures. According to CodeFi, Mata Capital's long-term goal is to reduce the minimum investment required from €100,000 to €1. In 2019, they decided to partner with ConsenSys CodeFi to create security tokens for three distinct projects totaling €350 million (2020). Codefi used the ERC1400 standard to issue these security tokens. Mata Capital aims to lower the minimum upfront cost to attract a broader range of shareholders.

VI. Challenges and Development

A. Legality

Security tokens cannot be issued or traded in the United States without being registered with the Securities and Exchange Commission (SEC) unless they qualify for an exception (Dilendorf Law Firm, 2021). Failure to report tokens to the SEC may result in penalties. More decentralized firms are expected to need some form of identity to issue security tokens, which might involve KYC[1]

The regulations for virtual tokens may be influenced by the type of investment and the legal

[1]Know Your Customer (KYC) processes are in place to identify and confirm that a customer is whom they claim to be. KYC allows for financial services firms to assign customers a risk value based on their susceptibility to commit a financial crime.

organization that owns the property. Certain jurisdictions are implementing laws to legally recognize security tokens and eliminate restrictions on blockchain technology (Deloitte, 2020). Tokenization has the best chance of gaining traction quickly in the world of real estate when the legal framework is already in place. Therefore, we need developers and regulators on the same page to minimize money laundering and enhance market efficiency.

B. Security Token Offerings

A security token offering (STO) allows companies to raise funds using one of the SEC's registration exemptions while adhering to U.S. securities rules and regulations (Dilendorf Law Firm, 2021). The degree of due diligence required for an STO varies depending on the jurisdiction.

Initial Coin Offerings (ICOs) are similar to STOs because they rely on blockchain technology and smart contracts to distribute tokens. ICOs lower the barriers to entry, allowing investors to invest in cryptocurrency or fiat in exchange for the company's token. These tokens are used as utility tokens. STOs, on the other hand, are considered a type of investment because their value is derived from the underlying securities.

Real estate platforms can use security tokens to create transparent, easily transferable, and divisible real estate shares that comply with the laws. But it is required for security tokens to be issued under the Securities and Commodities Authority.

Security tokens can ensure that their users are in compliance since the protocol can create, delete, force trades, and issue tokens based on the user's identity. A real estate company must implement KYC to comply with the anti-money laundering and other cybersecurity laws.

Case Study: Aqarchain

C. Wyoming State Laws

Wyoming recently passed a bill that grants decentralized autonomous organizations (DAOs) the opportunity to register as a limited liability company (LLC) in the state. This legislation predominantly establishes developers' protection by limiting charges against them and protecting their rights as legal entities in court. This law also allows cryptocurrency firms to apply for a special purpose depository institution (SPDI) license in Wyoming, thereby creating a new type of banking institution. These new cryptocurrency banks are legally required to keep a hundred percent reserves of deposited fiat currency (Krakenfx, 2021). Wyoming's new laws may attract new businesses looking to be involved in the decentralized industry.

VII. Conclusion

Real estate investments are illiquid assets with lengthy transactions that sometimes lack transparency between buyers and sellers. There are numerous documents to sign, regulations to be aware of, and intermediaries to deal with. Tokenization could bring liquidity, transparency, and lower friction to this market. Our analysis suggests that the adoption of tokenized real estate will continue to grow as long as regulators, issuers, and exchanges continue to push for tokenization.

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