

MIT Digital Currency Initiative

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Tokenized Securities & Commercial Real Estate

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EXECUTIVE SUMMARY

The following research investigates the application of security tokenization to commercial real estate assets. Primary research through interviews was conducted to uncover some of the most salient use cases and blockchain benefits for the space. The report explores three domains of blockchain application to real estate: (1) the application of blockchain to securities issuance and trading, (2) the application of blockchain to the real estate investment value chain, and (3) the application of blockchain to the representation of the physical assets themselves. Overall, we find that the value creation provided by tokenization can come in several layers, with some standalone benefits emerging by applying tokenization to each of the three domains in isolation. However, significant synergies can arise from combining these layers. As integration increases, additional features become possible. Our conclusion offers a general framework that can be used to perform future research on the tokenization of other types of assets and their related securities.

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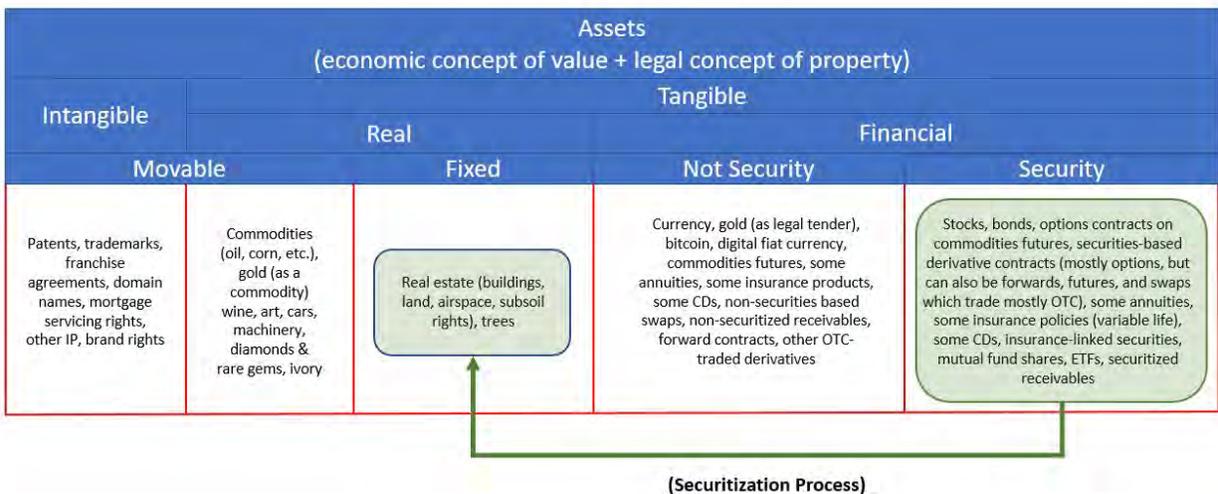
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INTRODUCTION

Asset tokenization is an area of explosive growth for the blockchain industry. Since Bitcoin’s earliest days, attempts have been made to use bitcoins as “tokens” to represent assets. Early on, this was done by leveraging a bitcoin’s metadata field to attach meaning to a bitcoin transaction (thereby creating a “colored coin¹”) and recognize the ownership of that coin as the ownership of some other asset. The bitcoin blockchain could then track ownership of a represented asset and enable secure and direct transfer of ownership. Since then, there has been a veritable Cambrian Explosion of protocols and blockchains that have been purpose-built for the representation and transfer of many types of assets.

Today, blockchain’s application to securities issuance and trading is well underway, and the benefits of its application to many types of securities is becoming better understood. As we set out on this project, we came to find an application that was not well understood: how will tokenization impact securities that have reference to real, physical assets? How can blockchain address, if at all, unique challenges that come with investing in those asset classes?

Project Focus: The Tokenization of Securities that Have Reference to Real, Fixed Assets

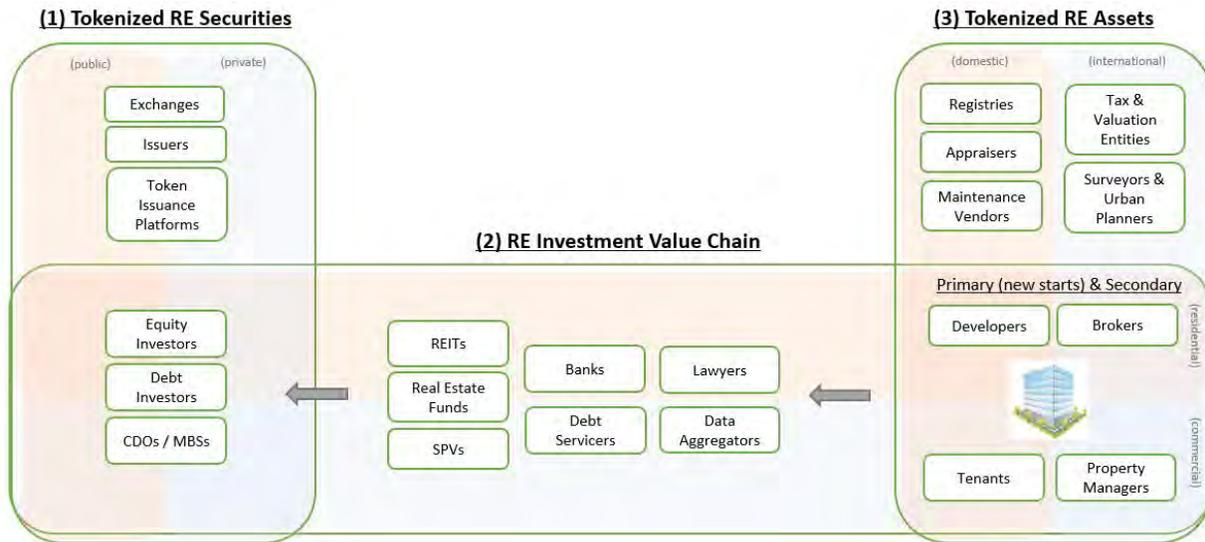


Real estate, a notoriously illiquid asset class, exhibits several characteristics that blockchain purports to address for other types of securities: novel forms of fundraising, more liquid markets, tamper proof ownership history, and streamlined payments, among other benefits. But does real estate as a category have properties that will prohibit some of these blockchain benefits from being realized? Or, conversely, does it exhibit other properties that provide fertile ground for novel applications of the technology?

¹ "Colored Coins" are a class of methods for representing and managing real world assets on top of the Bitcoin Blockchain.

Our research explores three domains of blockchain to real estate: (1) the application of tokenization to securities issuance and trading, (2) the application of blockchain to the real estate investment value chain, and (3) the application of blockchain to the representation of the physical assets themselves.

Three Domains of Blockchain Application to Real Estate



We have chosen in this report to focus on commercial real estate; however, many interesting applications and blockchain projects are also being launched in the residential space and for application to other types of real assets. Additionally, while the main focus of our paper is the tokenization of securities, we quickly found that when looking at this topic through the lens of the challenges faced by real estate securities specifically, investigating blockchain applications that extend beyond the realm “securities” (such as tokenizing the non-securitized buildings themselves) became relevant to understanding how tokenization benefits would ultimately emerge in real estate securities markets.

Finally, we attempt to remain technology-agnostic in this report and focus instead on the business processes to which “general blockchain benefits” may apply. We acknowledge that which benefits can be realized in any of these scenarios clearly depends in part on technology implementation decisions. Nevertheless, we have organized this report around several potential key blockchain benefits - access, liquidity, and transparency.

TOKENIZED SECURITIES

Definitions

Security - In the U.S., securities are defined in U.S. Code of Laws 15 §77b(a)(1)² as below. Securities and Exchange Commission (SEC) regulates and enforces federal securities law in the US. Additionally, each state has its own securities regulator who enforces securities sold or persons who sell them within each state.

*The term “security” means any **note, stock, treasury stock, security future, bond, debenture**, evidence of indebtedness, certificate of interest or participation in any profit sharing agreement, collateral-trust certificate, preorganization certificate or subscription, transferable share, investment contract, voting-trust certificate, certificate of deposit for a security, fractional undivided interest in oil, gas, or other mineral rights, any put, call, straddle, option, or privilege on any security, certificate of deposit, or group or index of securities (including any interest therein or based on the value thereof), or any put, call, straddle, option, or privilege entered into on a national securities exchange relating to foreign currency, or, in general, any interest or instrument commonly known as a “security”, or any certificate of interest or participation in, temporary or interim certificate for, receipt for, guarantee of, or warrant or right to subscribe to or purchase, any of the foregoing.”*

Tokens - For our purposes, a token is defined as a blockchain-based, digital representation of an asset³. In the U.S., much debate has taken place around the nature and categorization of various tokens as securities, property, commodities, or some other yet-to-be-defined type of asset that falls within the scope of a yet-to-be-determined regulatory regime.

The most popular classifications have been “money-like”, “utility token” and “security token”. Bitcoin can be classified as a “money-like” digital currency; as SEC Chairman Clayton clarified to the House Appropriations Committee last year, it is an example of a pure medium of exchange⁴. Utility tokens are tokens used solely in the functioning of a network and are not investment contracts. Security tokens, the focus of our report, warrant further elaboration.

Security Tokens - Security tokens on the other hand are digital, blockchain-based representations of securities. They share the same legal constructs as traditional

2 Govinfo.gov. (2019). [online] Available at: <https://www.govinfo.gov/content/pkg/USCODE-2010-title15/pdf/USCODE-2010-title15-chap2A-subchapl-sec77b.pdf> [Accessed 15 May 2019].

3 Deloitte. (2019). [online] Available at: <https://www2.deloitte.com/content/dam/Deloitte/lu/Documents/financial-services/lu-tokenization-of-assets-disrupting-financial-industry.pdf> [Accessed 15 May 2019].

4 Coin Center. (2019). SEC Chairman Clayton: Bitcoin is not a security. | Coin Center. [online] Available at: <https://coincenter.org/link/sec-chairman-clayton-bitcoin-is-not-a-security> [Accessed 15 May 2019].

securities but often enable additional technical features (such as automatic payments, transparent ownership history, and immutable ownership record) by virtue of being on the blockchain. To date, the U.S. CFTC, IRS, and SEC have provided some guidance around the status of digitally represented assets, but ambiguity remains.

In the U.S., the Howey test is a test used to determine whether certain transactions qualify as 'investment contract'. If so, the transaction falls under securities law and is therefore subject to the regulatory oversight of the SEC. The offer, sale, and distribution of securities is regulated in the U.S. and requires registration of both the security and the venues on which that security trades or to qualify for an exemption from registration. Recent SEC "Framework for 'Investment Contract' Analysis of Digital Assets"⁵ provides detailed guidance on the application of the Howey Test to digital assets. According to the framework, an investment contract exists when there is the investment of money in a common enterprise with a reasonable expectation of profits to be derived from the efforts of others. These are the four prongs of Howey Test: 1)The Investment of Money 2)Common Enterprise 3)Reasonable Expectation of Profits 4) Derived from Efforts of Others

It is important to note that securities regulation is typically technology agnostic. Anything that represents a security (whether a piece of paper, a record in a database, or a token on a blockchain) that is bought or sold falls by legal definition under securities law. Thus, "security token" is a token (technology implementation) that acts as a security (legal concept).

Other non-U.S. jurisdictions have issued guidance on their definitions of various types of tokens; however, differences exist depending on jurisdiction and different uses in terminology abound. Two examples below are from the Financial Conduct Authority (FCA), UK guidance from January, 2019 and the Swiss Financial Market Supervisory Authority (FINMA) guidance from February, 2018. They have primarily distinguished between 'utility token' and 'security / asset token':

- UK Financial Conduct Authority (2019):
"Security tokens are tokens with specific characteristics that mean they meet the definition of a Specified Investment like a share or a debt instrument as set out in the Regulated Activities Order, and are within the perimeter.

*While, utility tokens grant holders access to a current or prospective product or service but do not grant holders rights that are the same as those granted by Specified Investments."*⁶

⁵ SEC. (2019). SEC.gov | Framework for "Investment Contract" Analysis of Digital Assets. [online] Available at:

<https://www.sec.gov/corpfin/framework-investment-contract-analysis-digital-assets> [Accessed 15 May 2019].

⁶ FCA (2019). [online] Available at: <https://www.fca.org.uk/publication/consultation/cp19-03.pdf> [Accessed 15 May 2019].

- Swiss Financial Market Supervisory Authority (2018):
“Asset tokens represent assets such as participations in real physical underlyings, companies, or earnings streams, or an entitlement to dividends or interest payments. In terms of their economic function, the tokens are analogous to equities, bonds or derivatives.

While, Utility tokens are tokens which are intended to provide digital access to an application or service.”⁷

Security Tokens vs. Tokenized Security

We believe it is important to make a distinction between two types of blockchain-based representations of securities: “security tokens”, which are blockchain-native tokens are securities but do not exist outside of the blockchain, versus “tokenized securities”, which are blockchain-embedded representations of real world securities.

Both security tokens and tokenized securities can confer benefits over traditional means of representing securities, such as on paper, or digitally in siloed databases. However, they differ largely in the type of legal and regulatory frameworks they may require to achieve impactful adoption. Settlement finality is one example. Finality refers to a transaction being considered ‘final’ and it cannot be unwound. It is crucial that any transfer of payment or transfer of ownership of an asset has finality and is binding on both parties. As per the DTCC white paper⁸ titled ‘Guiding Principles for the Post-Trade Processing of Tokenized Securities’, the point at which settlement becomes final is determined by both the rules of the market (operational finality) and the governing legal framework in the relevant jurisdiction (legal finality).

Operational finality concerns would arise for both native and embedded securities and would be dependent on the consensus mechanism of the underlying blockchain. However, a framework to confer legal finality to the transfer of cryptographic keys may be needed to support the use of blockchain native securities. On the other hand, with tokenized securities, where existing processes are augmented using blockchain-based systems to represent securities during some or all points of the transfer of ownership process, clarity around legal finality is often aligned with current definitions.

⁷ FINMA, E. (2019). FINMA publishes ICO guidelines. [online] Eidgenössische Finanzmarktaufsicht FINMA. Available at: <https://www.finma.ch/en/news/2018/02/20180216-mm-ico-wegleitung/> [Accessed 15 May 2019].

⁸ DTCC. (2019). Guiding Principles for the Post-Trade Processing of Tokenized Securities | DTCC . [online] Available at: <http://www.dtcc.com/~media/Files/Downloads/WhitePapers/Crypto-Asset-Whitepaper-2019.pdf> [Accessed 15 May 2019].

The differences between security tokens and tokenized securities are outlined in the table below. Our research focuses primarily on tokenized securities given that many viable blockchain projects today augment rather than entirely replace the traditional market infrastructures for securities.

Security Token vs. Tokenized Security

Security Token	Tokenized Security
Blockchain native	Blockchain embedded
Token represents a security that doesn't exist outside of the blockchain (DAO, collateralized crypto loan, etc.)	Token represents a security that exists independent from a blockchain (Tokenized equity, debt, etc)
To date, security tokens have imitated traditional securities, although there is potential for disruption when structured products are layered on top	Traditional security achieves additional features (positive or negative) by being represented by a token, such as automatic payments
Similar to 'Bearer asset'	Similar to 'Depository receipt'

Tokenized Security vs. Tokenized Asset

Security tokenization is a subset of asset tokenization (all securities are assets but not all assets are securities). Our work focuses on the tokenization of securities that have reference to underlying real assets, specifically commercial real estate. For example, tokenization of an asset such as a land title is a tokenized asset, as opposed to the tokenization of an equity or debt share.

When Do Interests in Real Estate Become a Security?

Another important distinction is between the direct vs. the indirect ownership of real estate, which begs the question of when an interest in a real estate asset becomes a security. The SEC issued guidance on this topic in Release 33-5347 of the Securities Act of 1933, stating that “the offer of real estate as such, without any collateral arrangements with the seller or others, does not involve the offer of a security”⁹. However, real estate offerings can become a form of investment contract if offered in conjunction with certain services, with the definition of “investment contract” falling under the Howey Test. Typically, a real estate offering that is deemed a security typically trips part four of the Howey test as described earlier.

9 SEC. (2019). [online] Available at: <https://www.sec.gov/rules/interp/1973/33-5347.pdf> [Accessed 15 May 2019].

Potential Tokenization Benefits

The use of term ‘potential’ is deliberate. We believe that some of benefits that are cited for tokenized securities may not apply to commercial real estate or may not be achieved immediately. They may also differ depending on the type of underlying asset either being a real asset or financial asset. Additionally, some of these might only accrue to certain beneficiaries within a particular ecosystem: retail investors, institutional investors or intermediaries.

We identify the following general benefits of tokenization and will consider each via use case studies in the later part of the paper.

Potential benefits	Details
Fractionalization	<ul style="list-style-type: none"> Assets such as real estate have high barrier to entry due to large upfront capital required Fractionalizing such assets democratizes its access for smaller investors
Customizability	<ul style="list-style-type: none"> Tokenization enables exposure to individual real estate assets. Thus, instead of investing in the whole sector, portfolios can be customized down to single buildings.
Liquidity	<ul style="list-style-type: none"> Fractionalization increases the pool of potential investors and can unlock global investor base Secondary markets also facilitate additional liquidity Liquid assets command a premium and can increase asset value
Automation	<ul style="list-style-type: none"> Smart contracts can automate steps such as compliance, document verification, trading, an escrow Dividends and other cash flows can be programmatically paid when due
Cost Efficiency	<ul style="list-style-type: none"> By removing certain intermediaries and increasing efficiency of processes, costs can be lowered
Settlement Time	<ul style="list-style-type: none"> Tokens can settle in minutes or hours (depending on the underlying blockchain) This unlocks the capital that is tied in the market which currently settles at T+3/T+2

Data Transparency	<ul style="list-style-type: none"> • Secure and visible recordkeeping on blockchain can increase transparency to the underlying data • Especially for complex derivative products, the ability to clearly link a security to its underlying value drivers
Structured Products	<ul style="list-style-type: none"> • Additional value can be realized once assets are tokenized and that enables the creation of additional layered financial products such as basket of assets and derivatives • Since the underlying is tokenized, creating complex products becomes simpler through coded smart contracts

Security Tokenization Players

The following are the major types of entities currently shaping the tokenization landscape:

- **Issuance platforms:** They provide the necessary infrastructure to asset owners for launching their security tokens. These platforms range from white label service to private label provider.
- **Compliance providers:** Integrated with the issuance platform, these provide services such as KYC, anti-money laundering, maintaining a whitelist of investors, and asset transfer verification among other things.
- **Regulators:** In the US, on the federal level, the primary securities regulator is the Securities and Exchange Commission (SEC). Futures and some aspects of derivatives are regulated by the Commodity Futures Trading Commission (CFTC).
- **Broker-Dealers:** They are organizations which engage in the business of trading securities and facilitate it for large investors. When executing trades on behalf of a customer, the organization is called a broker. And when they execute it for their own account, they are called dealers.
- **Trading platforms:** These are registered exchanges for secondary trading of securities. They are regulated by the SEC and need an Alternate Trading System (ATS) license to trade securities.
- **Legal firms:** Law firms provide the legal structure and compliance with the necessary regulation for these token issuance deals. The most common

structure for real estate deals are special purpose vehicles (SPVs) and a majority of them are issued under Rule 506(c) of Reg D.

- **Custody:** These are third party providers who holds securities on behalf of investors. They are safekeepers of assets and minimize the risk of theft or loss. Custodial solutions are especially complicated when it comes to holding digital assets and involves complex key management for their customers.

Security Token Ecosystem¹⁰



10 Vertalo. (2018). Security Token Ecosystem. [online] Available at: <https://www.vertalo.com/st-ecosystem/> [Accessed 15 May 2019].

COMMERCIAL REAL ESTATE

Why Security Tokenization Applied to CRE?

Some of the current features of CRE make it particularly attractive for tokenization. In general, a single CRE transaction is characterized by large private market investment, in an opaque data environment. This leads to an investment ecosystem that is rife with slow transaction and settlement processes that include many intermediaries (agents, sellers, buyers, financiers, insurers, among others), redundant verification processes, and redundant information registered in isolated databases and registries. The situation is more complicated as one moves further down the value chain. Lease management, insurance, maintenance, payments from lessee to lessor, lessor to investors, and reporting are all cumbersome and time-consuming processes.

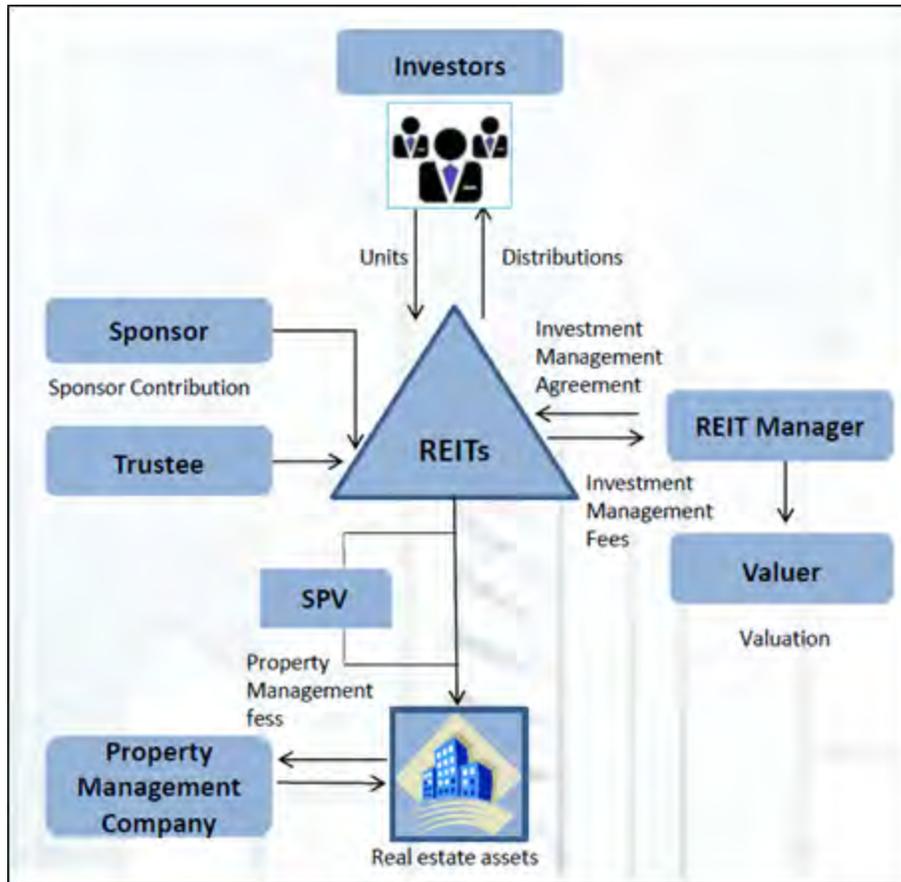
Given the market characteristics of the CRE space (large upfront investment, very low short term liquidity, management costs, among others), retail investors are usually precluded from investing directly in CRE. However, several financial instruments aim to reduce the frictions and costs associated with accessing CRE exposure for such investors by providing indirect investment opportunities. Among the most common are public and private real estate investment trusts (REITS), real estate investment funds (REIFs), Real Estate Exchange Traded Funds (ETFs) and since the passage of the Jump Start Our Business Act (JOBS Act), real estate crowdfunding.

A REIT is a company that owns, operates or finances income producing real estate, paying out at least 90% of income as dividends. In general, REITs invest in a portfolio of assets, providing a diversified source of income. Upon creation, REITs issue shares that are sold to investors in three ways. If the REIT is private, it's sold through a private placement to qualified investors (accredited investors or Qualified Institutional Buyers). If the REIT is public and listed on an exchange, it can be purchased through the exchange. If it's public but not listed, it can be purchased through a broker.

Public listed REITS and public not listed REITs (PNLRs) have the same reporting and disclosure requirements, but differ in transaction costs, pricing mechanisms and liquidity. Public listed REITs are purchased on a public exchange, and the transaction cost will depend on the fee paid to the broker (as low as 0%). Pricing will be based on the market price at the moment of transaction, and liquidity will depend on the overall market conditions, although given the existence of market makers, a retail investor would probably not face any trading restriction. In contrast, a PNLR is purchased on a private transaction through a broker, which receives a commission from the issuer (as high as 10%). Pricing will depend on either the Net Investment

Methodology or the Appraised Value Methodology (not the current market value), and liquidity will be restricted by the issuer, usually repurchasing shares at a discount.

Structure of REITs¹¹



A REIF is a mutual fund that invests mainly in securities offered by real estate companies and REITs. REIFs are not traded on exchanges and are only priced daily according to their Net Asset Value. An investor can purchase (or sell) a share of a REIF directly from the issuer or through a broker (who will charge a brokerage fee).

Listed instruments such as REITs, not only provide investors with the ability to liquidate their investments real-time at lower cost (both direct cost and price slippage), but also allows the investment vehicle to maintain less cash and higher investment rates. Non-listed instruments must maintain higher cash reserves to respond on investor redemptions.

Lastly, specialized crowdfunding platforms allow investors to directly pool resources in special purpose vehicles (SPVs), partnerships, and private REITs that invest in real

¹¹ . Rbsa.in. (2019). [online] Available at: https://rbsa.in/Newsletters/RBSA_Real%20Estate%20Investment%20Trust%20-%20REITs.pdf [Accessed 15 May 2019].

estate. Depending on the platform, an investor can choose to invest in a specific property, on a fixed portfolio of properties or on a managed portfolio of properties. These crowdfunded instruments (shares, units, or participation rights, depending on the investment vehicle) are not publicly traded, although some issuers have created private secondary markets to allow their investors to trade them (with the limitation of trading only being available on the proprietary platform). Most issuers also offer repurchases at a discount. Some of the potential benefits particular to this model of real estate investing are savings from eliminating intermediaries and the possibility of investing in specific properties, allowing the investor to customize their investment portfolio.

As an alternative approach to solving the informational and structural challenges of CRE investment is leveraging on blockchain technology to issue a token representing a financial instrument that invests in real estate. To date, the most common procedure is to tokenize all or a portion of shares in a SPV that owns all or a portion of a property. The shares of the SPV are held by a custodian who oversees the initial creation of the tokens. Tokens are then sold to investors (to date, only accredited investors) who in the future would be able to trade them according to applicable regulations.

In this setting, the issuer would have complete transparency as to the ownership of each token at any point in time. Information, payments, and request for votes could be transmitted to all token holders simultaneously through their blockchain address. Investors would be able to achieve greater diversification and customizability simply by purchasing property-specific tokens. Issuers could create different tokens for different assets pertaining to real estate investing (ownership of the land, use rights, infrastructure, cash-flows from leases, etc). The issuer could also create different classes within each type of token; for example, senior tokens on fixed lease payments and junior tokens for the variable component of commercial leases. The waterfall of payments can be hard-coded into the token's contracts, providing both a layer of transparency at creation and compliance and verification upon each payment.

Blockchain & the CRE Landscape

Tokenized CRE securities are a subset of the tokenized securities ecosystem, and therefore much of the ecosystem previously discussed also applies to the CRE space.

The core functions of each of the security tokenization players described above outline the minimum required features for a tokenized CRE issuance according to current regulations. Tokenization (issuance of token) refers to the creation of the smart contract that will create a token and its features. Identity, Compliance, and AML refer to validating the identity of an investor, along with the suitability of the investment (for example, accredited investor qualification) and their compliance with anti money laundering regulations. Primary issuance relates to the first

distribution of token to approved investors. This step can be performed by the issuer itself or delegated to a third party. With these three core features, a CRE token could (subject to the features enabled in the actual code of the contract) be traded peer to peer among a set of users that comply with the Identity/Compliance/AML process, without intervention of any third party (this could potentially enable a peer-led decentralized secondary market).

Example of CRE Tokenization: Aspen Coin

Elevated Returns LLC, a real estate asset management and advisory firm, issued a token that represents ownership of Aspen Digital Inc, a Maryland corporation formed with the sole purpose of owning the St. Regis Aspen Resort. The project raised \$18 million and the token issuer platform was Securitize (digital security issuance platform). Templum, a registered broker dealer and alternative trading system, managed the primary distribution, and Computershare (shareholder services) provided custodianship. Marketing was also supported by Indiegogo, a crowdfunding platform.

The tokenized securities were exempt of registration via Regulation D, and therefore were offered and sold only to accredited investors by means of a private placement memorandum. The minimum investment was set at \$10,000. Dividends are planned to be distributed on-chain to the token holder wallet using Ether. Secondary trading is provided¹² by Templum to whitelisted investors, and whitelisting is also provided by Templum¹².

Potential Benefits of Blockchain Infrastructure to CRE

As previously mentioned, the range and impact of benefits increases as blockchain adoption becomes more widespread and more supported with updated regulations. The core, or “layer one”, benefits granted by tokenized securities are marginal in comparison to the benefits of the full blockchain infrastructure.

For issuers, CRE tokenization potentially offers a lower issuance cost (allowing smaller issuances and single asset issuances); access to a new set of investors (early adopters and legacy investors looking to experiment on blockchain technologies in the US and potentially worldwide); improved investor management and information disclosure (as investors can be tracked in real time and information pushed directly to investor’s addresses); smart dividend distribution (based on smart-contracts and a predetermined blockchain-enabled means of payment, such as a cryptocurrency, stable coin, or token); and improved secondary trading (on a private market, ATS or peer to peer if enabled by token protocol), among other benefits.

¹² Alois, J. (2018). Aspen Coin: Elevated Returns is Tokenizing Real Estate Investments, Expects Marketing Partnership with Indiegogo to Grow. [online] Crowdfund Insider. Available at: <https://www.crowdfundinsider.com/2018/09/138839-aspen-coin-elevated-returns-is-tokenizing-real-estate-investments-expects-partnership-with-indiegogo-to-grow/> [Accessed 15 May 2019].

While some of these benefits also apply to investors, resulting in a better investment experience, others directly affect the possibility for investors to access new opportunities, customize in a more granular way their investment portfolio, and an overall reduction on the discount rate. Access can be improved by lowering the transaction cost, lowering investment minimums, and allowing international investments. Granular customization is the result of single asset tokenization. Lower discount rates are the result of lower risk premiums due to greater information transparency, higher expected liquidity, and improved portfolio management (as a result of granularity).

In the following sections we will expand on some of these key benefits in greater detail.

ACCESS

Real estate as an asset class has traditionally been transacted through private markets. The emergence of REITs came in the 1960s in the United States. At that time President Eisenhower signed into law the REIT Act to allow a greater investor pool to access the opportunity to invest in large-scale, diversified portfolios of real estate¹³. As of 2017, thirty-six countries have REIT legislation around the world¹⁴.

Today, more than 80 million Americans are exposed to REITs via retirement savings, mutual funds, and other investment funds. However, despite the growth of REITs as a means by which the investing public can gain exposure to real estate, much of the overall real estate market remains private. In North America, listed property as a percentage of the overall underlying real estate market was only 11.5%.

Listed Property Markets by Region¹⁵

Region	Underlying Property Market (\$bn)	Listed Property Market (\$bn)	Listed as a Percent of Underlying	Stock Market	Listed Property as a Percent of Stock Market
Europe	7,993.2	472.9	5.9	13,494	3.5
North-America	8,331.0	960.1	11.5	26,670	3.6
Asia-Pacific	4,335.1	869.9	20.1	12,551	6.9
Africa / Middle East	212.3	19.0	9.0	41	28.7
Global	\$19,719.85	\$2,271.76	11.5%	\$49,834	4.6%

Source: EPRA, property market data as of December 30, 2014, listed property and stock market data as of March 2015.

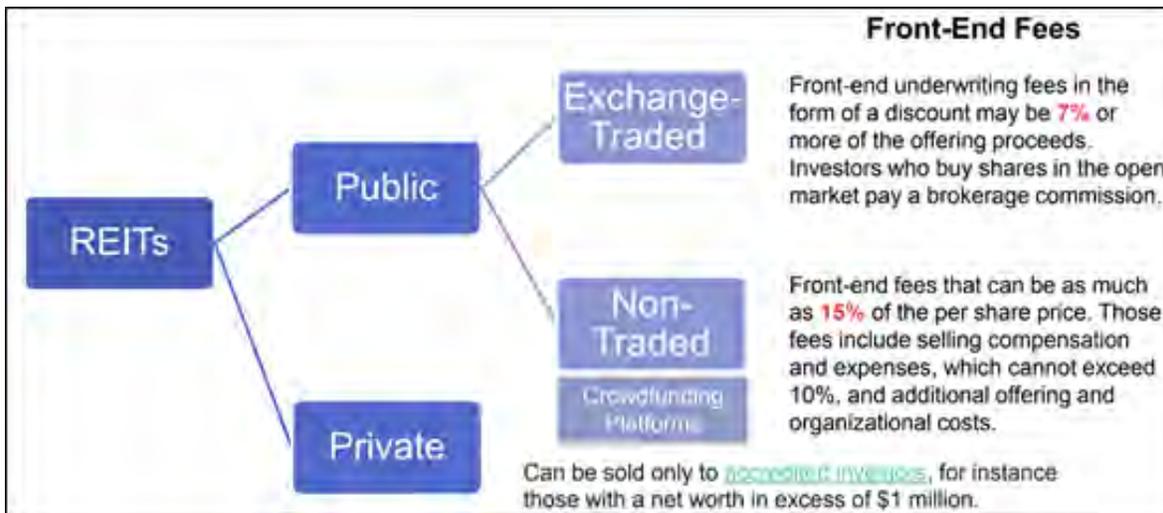
Globally, we have found the regulatory landscape around REITs and other types of real estate investment vehicles to be a main driver of potential for blockchain to facilitate better “access” for retail investors. REITs and other means of gaining exposure to real estate do not exist in many countries. Even in advanced economies, they have been introduced selectively and only more recently; for example, REITs weren’t available in Singapore until 2002 and in the UK until 2007. A comparison of REIT types found in the U.S. is below.

13 Nareit. (2019). REIT Industry Timeline. [online] Available at: <https://www.reit.com/investing/reit-basics/reit-industry-timeline#0> [Accessed 15 May 2019].

14 Nareit. (2019). REITs Around the World. [online] Available at: <https://www.reit.com/nareit/advocacy/reits-around-world> [Accessed 15 May 2019].

15 FTSE Russell. (2017). Diversification, liquidity and transparency in global-listed real estate. [online] Available at: <https://www.ftserussell.com/files/research/diversification-liquidity-and-transparency-global-listed-real-estate> [Accessed 15 May 2019].

Types of REITs



Issues with Traditional Forms of CRE Access

The two primary vehicles for retail investor access to CRE are Public listed REITs and Crowdfunding platforms (since the passage of JOBS Act). Both vehicles, however, have notable shortcomings in the access they provide to retail investors. Some of these, we believe, tokenization can help alleviate.

Publicly listed REITs

Historically, public REITs have underperformed private REITs. They also trade on an average at a premium to the underlying NAV. Thus, leaving retail investors with lower returns. Moreover, the total CRE market dollar value as estimated by NAREIT is between \$15-17 trillion¹⁶. While, public REITs' total market capitalization is only around \$1.2 trillion¹⁷. This means that a huge piece of possibly higher returning CRE assets (~93%) are beyond retail investors reach. Tokenizing these private deals and providing them to a broader set of investors bridges this gap. It gives retail investors access to these previously exclusive deals.

Retail investors are also at the mercy of REIT managers and do not have the option of customizing their real estate exposure. They might want access to a specific type of asset in a specific geography and currently REITs do not provide that level of granularity. Additionally, direct real estate investing has prohibitively large upfront capital requirements and makes diversification next to impossible. On the other hand, if real estate is fractionalized, these tokens would allow investors the flexibility

16 Nareit. (2019). Estimating the Size of the Commercial Real Estate Market in the U.S. [online] Available at: <https://www.reit.com/data-research/research/nareit-research/estimating-size-commercial-real-estate-market-us> [Accessed 15 May 2019].

17 Nareit. (2019). REIT Industry Financial Snapshot. [online] Available at: <https://www.reit.com/data-research/reit-market-data/reit-industry-financial-snapshot> [Accessed 15 May 2019].

to tweak their exposure to the underlying. Theoretically, an investor could hold a piece of many different properties across the globe even with a small capital.

Crowdfunding Platform

Real estate crowdfunding has failed to take off for multiple reasons. The biggest reason cited is that of adverse selection. This is when assets that were unable to raise capital through traditional means of financing end up on crowdfunding platforms. Thus, most of these platforms even though had the intention of providing access to lucrative commercial real estate market ended up with inferior assets. We don't claim blockchain can solve this problem, but rather we should be mindful of not repeating the mistakes of the past. For real estate tokenization to be successful will depend on the quality of assets tokenized.

Other issues with crowdfunding were multi-year lock in periods. This locks investor capital and even with some platforms providing a secondary market for these assets this reduces overall liquidity. Certain platforms allow investors to sell their holdings after one year but these secondary markets are siloed. One can only trade these investments on the platform that issued them and often at a huge discount. With blockchain technology, we need interoperability even if the assets end up being issues on multiple platforms. We need secondary exchanges that can trade these assets to be able to provide the access and liquidity that a retail investor needs.

Use Case: Fractional Ownership of Single Buildings

Fractional ownership of single buildings is an interesting use case that we considered throughout this study. Today, fractional ownership of single real estate assets by individuals most frequently occurs via condominiums, timeshares, and coops (as legal ownership structures). More rarely, institutional investors (such as REITs) may form joint ventures to own a fraction of a single commercial real estate asset¹⁸.

With respect to institutional ownership, we believe there are significant benefits and potential demand for fractional ownership. Today, professional investors who are looking to diversify their real estate portfolios to control for risk and maturity must often work through several brokers to achieve a desired level of diversification, incurring costs through each broker. The availability of tokens representing fractional shares of single assets, especially if obtained in a peer to peer manner that bypasses traditional brokers, could allow professional investors to fine-tune asset exposure and reduce overhead spent on brokerage fees.

However, a problem does arise with respect to property management. Direct owners of real estate assets, such as REITs, often work with property managers (either themselves or through a third party) to ensure their investment retains its value.

¹⁸ From interview with Matthew Doherty, MIT Sloan (formerly MFG Investments)

Tensions often exist between owners and property managers due to information asymmetries and misaligned incentives. Property managers, for example, are usually more often concerned with getting repairs done quickly rather than performing them in a way that maximizes the long-term value of the property as an investment. With fractional ownership, in the absence of a professional institutional investors, the property manager would likely be monitored by brokers or a delegated third party (as monitoring by individual retail investors would be prohibitively costly), therefore potentially negating the disintermediation and cost saving effects of implementing blockchain-based, peer-to-peer exchange of fractional shares.

For retail investors, the potential for investor demand and benefit from fractional ownership is perhaps less clear. We have made the following observations regarding the bull and bear theses for this application:

Bullish:

- Investors may possess bottom-up knowledge of buildings they frequently visit; demand of fractional ownership will represent a way for individuals to invest in properties they know well.
- Demographic shifts and aging populations will drive retail investor demand for these income-producing alternative investments.
- Offering fractional ownership of single assets helps retail investors clearly understand what they are investing in and requires less costly disclosures¹⁹.
- Some regulators (in the UK, for example) are more amenable to retail investor ownership of fractional shares in single buildings because of their clear investment value and disclosure requirements (as opposed to investments in REITS, which often perform functions beyond pure real estate asset ownership and therefore have value drivers which are more difficult to understand)

Bearish:

- Demand may be underwhelming, especially if the lack of retail investor demand for crowdfunded real estate funds is any indication; the exception to this may be demand for ownership of iconic buildings (such as the Empire Tower)
- There will likely be low liquidity and a high illiquidity premium for shares in single buildings due to the small market size
- Retail investors typically lack the skills to properly value real estate investments, even if the necessary data were available to them (and relevant data may be difficult to obtain)

19. From interviews with Rob Gould, IPSX.

Overall, differences in regulatory landscapes may be a critical driver of whether or not retail investor demand is present (or even possible) based on the availability of alternative opportunities to gain exposure to real estate as an asset class.

LIQUIDITY

What is Liquidity?

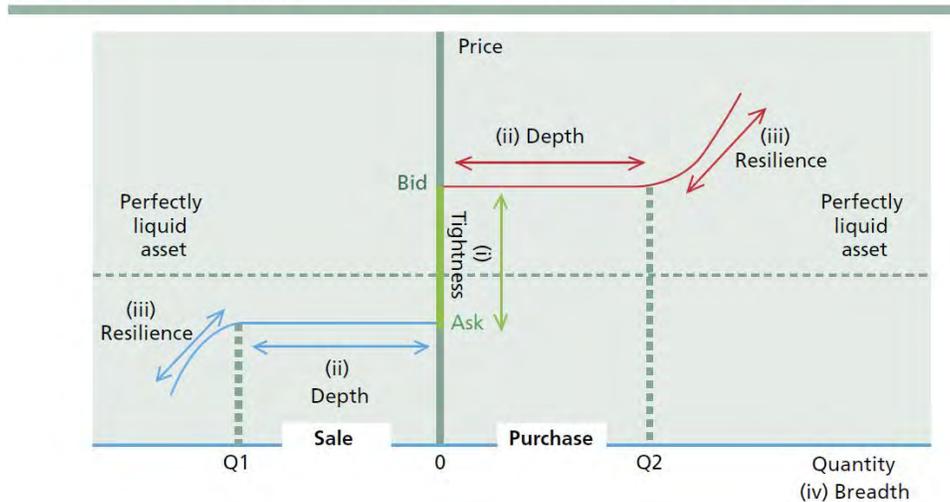
In traditional and non-traditional markets, market liquidity of an asset or a financial product is measured by five key parameters: (1) Tightness (bid-ask spread), (2) Depth (3) Resilience, (4) Breadth, and (5) Immediacy. The Basel Committee on Banking Supervision, in its report on Guidance for Supervisors on Market-Based Indicators of Liquidity²⁰ focuses on market liquidity defined as depth/price impact of trading, breadth, and immediacy. These parameters are rarely discussed within the traditional real estate investment realm.

Definitions of Liquidity Parameters:

Tightness	The narrower the bid-ask spread, the more liquid the instrument
Depth	The larger the size of a trade to impact an asset price, the more depth an asset/security has in the market
Resilience	Amount of time it takes for prices to return to equilibrium, after a drastic price fluctuation
Breadth	Diverse prices available, with different prices having larger volume available
Immediacy	Speed to which a trade can be executed and completed

²⁰ Bis.org. (2019). [online] Available at: <https://www.bis.org/publ/bcbs273.pdf> [Accessed 15 May 2019].

Dimensions of Market Liquidity²¹



Liquidity in Real Estate

The broader real estate asset class is notoriously illiquid, introducing difficulties to the wider investment community to achieve real estate exposure in investment portfolios. The typical holding period for real estate debt in the Fidelity Real Estate Income Fund, for example, is four to seven years. It is not uncommon for private equity real estate funds have lock-up periods of up to seven years. Public and private REITs, as an improvement, deliver a channel for both retail and institutional investors to gain indirect investment exposure to income delivered via commercial real estate, while avoiding the nuances of direct real estate exposure, such as extended lock-up periods, large minimum investments, and responsibility for property management (the global REITs market cap in the first half of 2018 was estimated to be \$1.7 trillion dollars²²). However, infant, emerging, and developed markets have all struggled to solidify more recognized REITs markets and still face regulatory and tax-code hurdles to gain access to the international investment community. For example, it is forbidden for foreigners to own real estate in Thailand without a Thai native owning at least 51% of the property. Additionally, non-Traded REITs still pose liquidity issues²³.

Real Estate holdings are typically illiquid for several reasons:

- **Lack of public markets:** most real estate transactions occur in private markets, where daily pricing and extensive information about an asset are not available. Private markets are priced on a “as-needed” basis, lack transparency, and are harder to access.

21 Ipof.org.uk. (2019). Estimating Liquidity in Real Estate Markets (February 2015) Literature Review. [online] Available at: <https://www.ipof.org.uk/resourceLibrary/estimating-liquidity-in-real-estate-markets-february-2015-literature-review.html> [Accessed 15 May 2019].
 22 Eyrhcevent-sf.ey.com. (2019). [online] Available at: <https://eyrhcevent-sf.ey.com/Source/2018%20Global%20REIT%20Report.pdf> [Accessed 15 May 2019].
 23 Investor.gov. (2019). Real Estate Investment Trusts (REITs) | Investor.gov. [online] Available at: <https://www.investor.gov/introduction-investing/basics/investment-products/real-estate-investment-trusts-reits> [Accessed 15 May 2019].

- **Difficulty of transacting:** Real estate deals require several parties and significant amounts of manually generated paperwork. The process of structuring an offering, arranging financing, and gathering necessary due diligence items often takes weeks or months.
- **Large minimum capital requirements:** Transactions move more slowly given that many CRE transactions require significant pooling of capital, in the form of both equity and debt. Additionally, during the operational phase, while equity owners may have difficulty finding a buyer for their respective interest, lenders may put covenants on how the property is managed financially²⁴.

Tokenization of real estate could introduce far-reaching liquidity solutions to the global real estate market, adding more flexibility and cost efficiency to investors. Retail investors face the challenge of entrance into real estate deals without minimum levels of capital. Tokenization breaks the investment further into fractional investment 'slices', and could allow for more liquid secondary trading of shares that fall well below maximum spend thresholds for the majority of retail investors.

Although we do not believe tokenization is guaranteed to deliver increased liquidity, it introduces the increased possibility to tap into pools of investment and buyers/sellers which were previously inaccessible. Blockchain networks typically run 24/7, rather than current U.S. market hours of 9:30am to 4:00 pm, Monday through Friday. Ease of creating markets, increases the parameters normally used to assess the liquidity of an asset or security, such as; narrowing of bid-ask spreads and increased depth. Currently, the process of property share exchanges is time-consuming and error-prone due to manual data entry mistakes. Blockchain technology will have the added benefits of easing ownership transfers.

Amy Kirsch, Director of Partnerships and Investor Relations at Harbor, has commented on the failure of traditional crowdfunding to add liquidity to the commercial real estate space. While user experience and manual processes were cited as flaws within most crowdfunding platforms, another major issue is that investments can only be traded on one specific platform, reducing the potential of a greater market for shares. Tokenization on more widely adopted networks would introduce a much more global audience that is not confined to a single platform.

Tokenization could also reduce the number of third parties involved (i.e. brokers, escrow agents, etc.) in the typical investment process. Reduction of third parties involvement naturally adds fluidity to the real estate investment process.

An example of added liquidity via tokenization for real estate was a recent luxury Manhattan condo development tokenized via Ethereum for approximately \$30

²⁴ Hoisager, C. (2019). Understanding Illiquidity in Real Estate Investing. [online] Realized1031.com. Available at: <https://www.realized1031.com/blog/understanding-illiquidity-in-real-estate-investing> [Accessed 15 May 2019].

million USD²⁵. Through tokenization of this project, the market of buyers and sellers increased, adding liquidity to the token. Propellr, the company behind the transaction, uses blockchain to enable firms to structure, raise, and service capital for discrete and pooled transactions. Todd Lippiatt, CEO of Propellr, recently commented:

“Traditional securities structures and issuance frameworks haven’t evolved in a long time. With blockchain technology, a transparent and trustless ecosystem can start to solve the information asymmetry that hinders the market’s potential for liquidity...”²⁶

Through this offering, previously sidelined investors were able to access this property in the New York real estate market, which even in times of recession has performed relatively well compared to the greater US real estate market. Additionally, by tapping into funding sources outside of traditional bank financing, developers face lower risks and can raise capital more quickly.

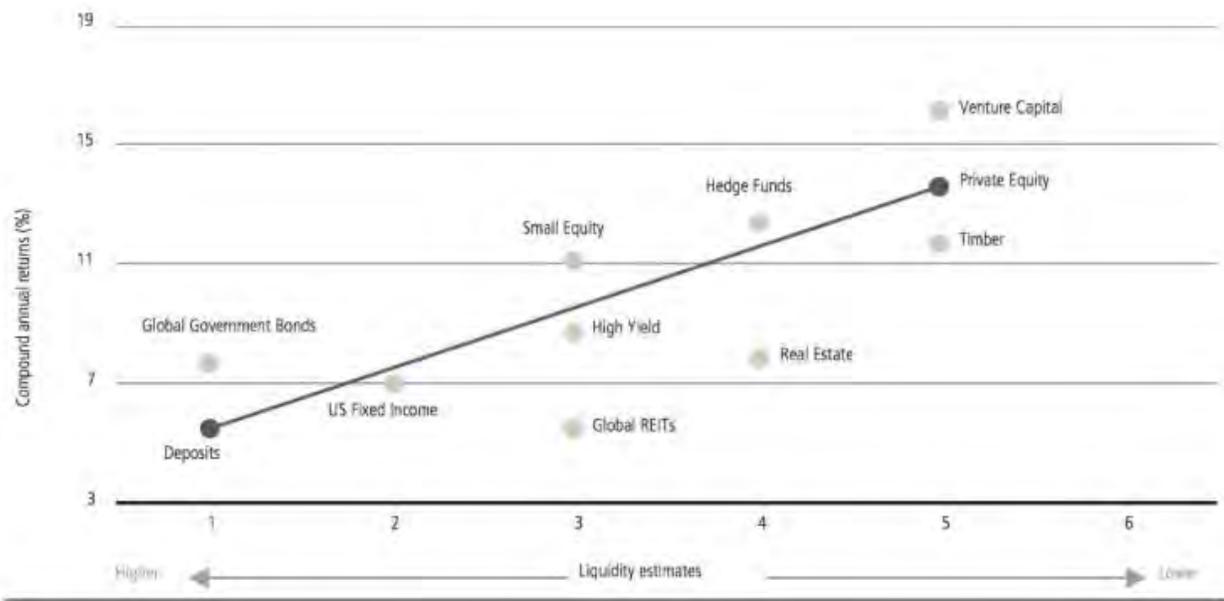
To be sure, simply tokenizing real estate securities will not automatically improve their liquidity. In fact, illiquidity has been touted as a benefit by public: non-listed REITs, by providing volatility protection, balance portfolio performance during a downturn as illiquid pricing lags behind the public market by two to five quarters on average. Events that impact the value of real estate investments - such as commercial tenant lease expirations - occur relatively infrequently. Therefore, catalysts for turnover in these income-producing assets are relatively few. Additionally, less liquid investments can often demand an illiquidity premium as illiquid assets have historically produced higher returns than more liquid ones²⁷:

25 Forbes.com. (2019). A First For Manhattan: \$30M Real Estate Property Tokenized With Blockchain. [online] Available at: <https://www.forbes.com/sites/rachelwolfson/2018/10/03/a-first-for-manhattan-30m-real-estate-property-tokenized-with-blockchain/#321560804895> [Accessed 15 May 2019].

26. Forbes.com. (2019). A First For Manhattan: \$30M Real Estate Property Tokenized With Blockchain. [online] Available at: <https://www.forbes.com/sites/rachelwolfson/2018/10/03/a-first-for-manhattan-30m-real-estate-property-tokenized-with-blockchain/#366774a48957> [Accessed 15 May 2019].

27 Hoisager, C. (2019). Understanding Illiquidity in Real Estate Investing. [online] Realized1031.com. Available at: <https://www.realized1031.com/blog/understanding-illiquidity-in-real-estate-investing> [Accessed 15 May 2019].

Expected Asset Class Returns vs Liquidity²⁸



For these reasons, we predict that many real estate tokenization projects may never go on to generate secondary markets that are liquid relative to, for example, public equities. However, 24/7 platforms, new pools of investors, lower upfront costs of financing, easier due diligence processes, lower transaction costs, and better visibility into the value of underlying assets may together serve to generate significant liquidity improvements for the real estate sector²⁹.

²⁸ "Expected Returns", by Antti Ilmanen, 2011. Scatterplotting average asset returns 1990-2009 on (subjective) illiquidity estimates. Sources: Bloomberg, MSCI Barra, Ken French's website, Citigroup, Barclays Capital, J.P Morgan, Bank of America Merrill Lynch, S&P GSCI, MIT-CRE, FTSE, Global Property Research, UBS, NCREIF, Hedge Fund Research, Cambridge Associates.

²⁹ Propertyshark.com. (2019). Help - Real Estate FAQ | PropertyShark. [online] Available at: https://www.propertyshark.com/mason/text/help-manual/pshark_faq.html [Accessed 15 May 2019].

TRANSPARENCY

Real estate transparency is a gauge of how accessible and reliable real estate information is in a city or country. Lack of transparency causes tensions and across the industry. Banks fear that incomplete or outdated information about properties will cause them to overvalue a property meant to serve as collateral for a loan. Wary investors who are unable or unwilling to perform deep due diligence on real estate portfolios may significantly under- or over-value asset values (REITs in the UK, for example, trade on average at the 36% discount to NAV³⁰; the exception to this are REITs with very limited and clear investment theses and holdings, such as a warehouse-only REIT, which trades at a slight premium). Equity investors in a development project may demand costly and time-consuming financial controls, reporting, auditing. These tensions, which exist in part due to the difficulty to obtaining timely information about the state of a real estate asset, persist throughout the lifecycle of a property from construction (architectural designs are often difficult to obtain) to sales and leasing (portfolio managers at a real estate mutual fund, for example, may find out that a major tenant has defaulted as long as 30-60 days after its occurrence).

In 1999, Jones Lang LaSalle's created the first Global Real Estate Transparency Index (GRET³¹), which is updated every two years. The index presented a minor solution to what is a traditionally opaque investment class and allowed investors to turn to it as an agreed upon industry 'transparency' benchmark. This index is compiled via a 20-question survey which is sent to JLL and LaSalle Investment Management teams globally. The survey consists of 186 scoring factors broken into both quantitative and qualitative variables which are focused on the following parameters: (1) Performance Measurement, (2) Market Fundamentals, (3) Governance of Listed Vehicles, (4) Regulatory and Legal Environment, (5) Transaction Process, and (6) Environmental Stability³².

Jeremy Kelly, Director of Global Research at JLL believes increased levels of transparency, continue to be more crucial to the real estate market; "Transparency is increasingly important for commercial real estate, where investors are allocating even more capital. The availability and quality of information from prices to ownership is crucial when trying to make investment decisions especially in new markets." Transparency in real estate adds increased investor confidence, a factor that is key to the growth and liquidity of the asset class.

³⁰ From interviews with Rob Bould, IPSX.

³¹ <http://greti.jll.com/greti>

³² JLL. (2019). Rankings. [online] Available at: <http://greti.jll.com/greti/rankings> [Accessed 15 May 2019].

JLL. (2019). [online] Available at: <http://greti.jll.com/greti/Documents/greti-revamp/JLL-Transparency-Report-2018-FINAL-Reports.pdf> [Accessed 15 May 2019].

Improving Transparency in Real Estate

Visibility into data about real estate assets remains a significant issue at a time when investor demand for exposure to real estate is increasing. For example, several types of documentation are required for a REIT investor to perform due diligence on a potential acquisition. These include:

- Title
- Maintenance history
- Cap rates
- Occupancy rates
- Insurance records
- Building compliance records
- Fire code
- Elevator inspection
- Ownership history
- Tenant history
- Comparable rents in the area

For professional investors, traditional real estate maintenance records are ‘spotty’ and there is often a need to regularly physically inspect properties in which they invest³³. Currently, sourcing this data is a difficult, costly, and time-intensive process. PropertyShark, a popular real estate data provider, allows users to access information related to larger metropolitan cities in the United States. It is heavily relied on in both the commercial and retail spaces, providing property reports, pre-foreclosure and foreclosure information, sales comparables, maps, building photos, as well as sale and lease listings. Numerous parties such as tax authorities, appraisers, and banks rely on the accuracy of this data. Although PropertyShark is considered one of the leading data providers, the cost per user per year can be very high: roughly \$2,000. The service provides detailed information related to only a select few cities (depending on the tiered plan chosen). PropertyShark data is collected from both public and proprietary sources, with data being updated “as frequently as possible, usually daily, but sometimes weekly, monthly, quarterly, or annually”. Information that is ever-evolving, like transactions and distressed assets, is updated with the highest frequency; however, the lag in data update frequency can impact the investment and transaction process dramatically.³⁴

Applying Blockchain for CRE Transparency

³³ From interview with Mark Snyderman, Fidelity.

³⁴ Propertyshark.com. (2019). Help - Real Estate FAQ | PropertyShark. [online] Available at: https://www.propertyshark.com/mason/text/help-manual/pshark_faq.html [Accessed 15 May 2019].

Blockchain technology could address a number of data transparency issues in the real estate space, providing investors the information needed to invest more quickly and more confidently. Property DNA is one start-up using blockchain to address this problem. Commercial property investing involves multiple parties - tenants, owners, investors, and banks etc. - making it crucial for information between parties to be both clear and consistent. Property DNA is using blockchain to update and store data related to property from inception until present, creating what is analogous to a Carfax for commercial real estate properties. Each property is assigned a unique ID, and information is accessible via blockchain, which can be viewed and edited according to various permissions. This integration allows multiple entities to access a tamper-resistant, single source of truth regarding the state of an asset. The data collected will include records such as title history, insurance claims, financial information, debt associated with a property, purchase agreements, brokerage agreements, rental contracts and (potentially) a plethora of other information previously unattainable or found from multiple disparate sources³⁵. Property DNA's model claims to provide a more frequently updated and live data flow than existing data providers.

Tokenization of titles and deeds are also on the horizon. There are several blockchain startups working to improve property titling. Medici Land Governance, for example, has recently signed a deal with Mexico to apply Medici's blockchain technology to build a digital land record system.³⁶ The company's primary goal is to use blockchain to create tamper-resistant proof of record in order to help individuals in developing countries establish formal ownership of their property³⁷.

Greater visibility into real estate assets also grants property owners more confidence to lease, buy, build or manage properties. Information related to the supply, demand, and cost of real estate allows investors to properly assess and analyze the value of both the real estate asset itself and the securities which rely on the real estate for their value. Without accurate and timely information, significant price dislocations, increased transaction fees, and lengthier transaction periods occur. Additional levels of transparency across global real estate markets could be a catalyst for improving investor confidence to pursue investment opportunities in previously unreachable real estate markets, particularly internationally.

Transparency in Debt Markets

³⁵ Meridio. (2019). Real estate transparency leads to better cities—here's how blockchain helps. [online] Available at:

<https://medium.com/@Meridio/real-estate-transparency-leads-to-better-cities-heres-how-blockchain-helps-b015d28ae2> [Accessed 15 May 2019].

³⁶ CoinDesk. (2019). Overstock's Medici Land Governance Inks Deal for Local Land Registry in Mexico - CoinDesk. [online] Available at:

<https://www.coindesk.com/overstocks-medici-inks-deal-for-local-land-registry-in-mexico> [Accessed 15 May 2019].

³⁷ <https://www.mediciland.com/about/>

Debt markets are an area of great focus in the security tokenization space, including debt markets for commercial real estate. 70% of fixed income volume today is traded over the phone (vs. 98% of public trades occurring over centralized in equity markets). Currently, information lifecycle events for debt securities (origination, distribution, tracking ownership, etc.) is scattered across organizations in different data formats using different tools (PDF, Word, Excel, etc.). Therefore, reference data related to debt securities is prone to error and delay. For commercial real estate debt, there is a 30 to 60 day lag between cash flows from tenant payments and the packaging of payment information that informs the prices of those assets³⁸.

Programmatically issued dividends via blockchain-based smart contracts could standardize data formats, drastically lowering the administration costs of servicing debt and providing more readily accessible information with respect to real estate securities valuations. Fluidity Factora, a blockchain startup working with banks to streamline large structured finance deals (roughly \$100 million and above), is building smart contracts to standardize workflow and significantly reduce overhead costs of these transactions. With their technology, banks will be charged on a fee basis rather than on a percentage of deal size, allowing a back office employee to process an estimated 25-30 deals per month vs. 3-5 deals today. Payments to debt holders are automatically disbursed in a cost efficient way³⁹.

Debt Security Servicing

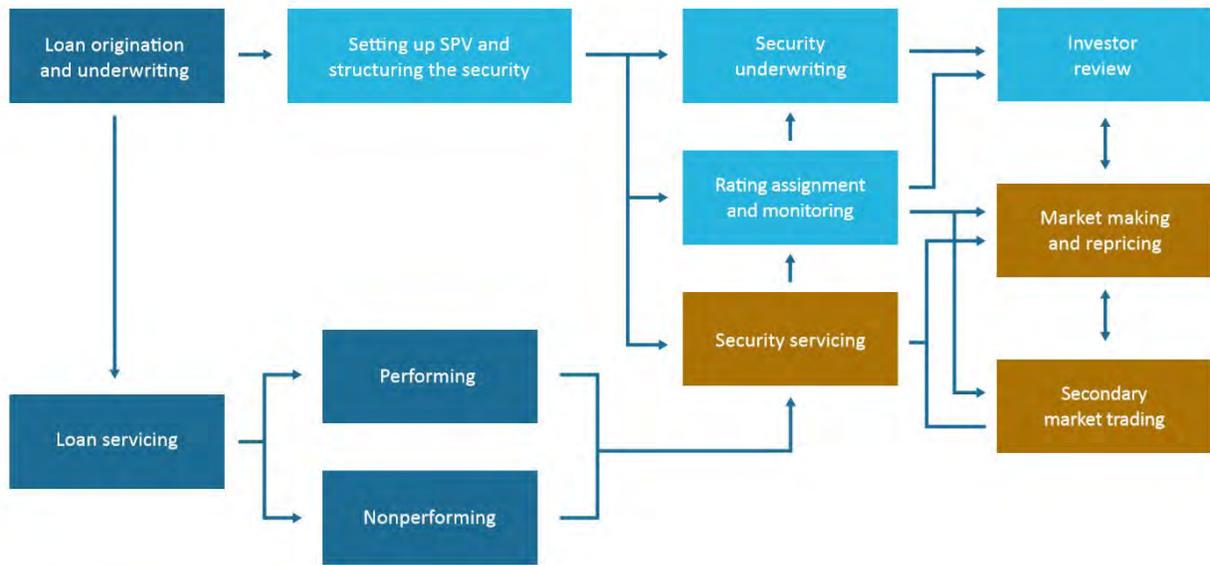
The securitization process is comprised of three parts⁴⁰: (1) Loan origination, underwriting, and servicing, (2) Structuring the security, and (3) Servicing and trading the security. We will focus on part (3).

³⁸ From interviews with blockchain startup Bond.One

³⁹ From interviews with Fluidity Factora

⁴⁰ Deloitte and Structured Finance Industry Group

Securitization Process⁴¹



Source: Deloitte Development LLC, 2017 and Structured Finance Industry Group, Inc. Copyright © 2017 Deloitte Development LLC. All rights reserved © Copyright 2017 Structured Finance Industry Group. All rights reserved

Mortgage Servicing Market & Cost

Mortgage servicers are individuals or companies who are hired to collect payments from borrowers, remit principal and interest to investors for securitized loans, remit property tax and insurance premiums from escrow funds, and perform collection. The mortgage servicing industry in the United States has seen dramatic changes since the financial crisis in 2008. Servicers are under new regulations for operational, capital, and liquidity requirements. For this section, we have chosen to focus primarily on residential-related loan servicing information as a proxy for the CRE loan servicing environment, which is likely smaller but faces similar pressures.

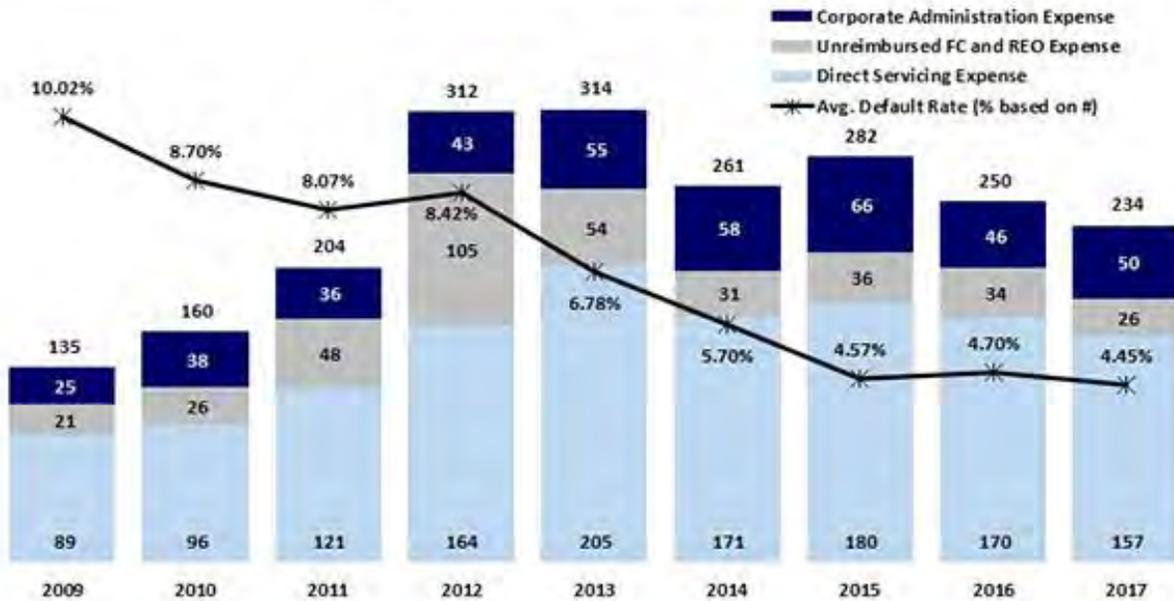
Depending on the servicer type (non-banks vs. national banks), servicers must comply with the constraints of multiple regulators, including the CFPB, FDIC, Federal Reserve, OCC, FHFA, and GSEs. The CFPB specifically was granted direct supervisory authority of all banks with more than \$10 billion in assets and over all non-banks, regardless of size, engaged in residential mortgage markets.

These regulatory changes have increased the cost to service a performing loan. The following diagram shows servicing costs for single-family loans. Although the data refers to residential properties, CRE faces similar challenges and inefficiencies. As the cost decreased in 2017 to \$234 per loan, an overall trend has been exhibited since the financial crisis. The cost peaked in 2013 as more regulations were introduced to the

41 Deloitte. (2019). [online] Available at: <https://www2.deloitte.com/content/dam/Deloitte/us/Documents/regulatory/us-sfig-report-applying-blockchain-in-securitization-opportunities-for-reinventon.pdf> [Accessed 15 May 2019].

market. Although some servicers have attempted to mitigate these cost-to-service through technological innovations and advancements, many process still remain on legacy platforms, requiring time-consuming and manual processes.

Average Servicing Costs per Loan⁴²



The industry’s average cost-to-service has increased since 2008 with the addition of regulatory, compliance, and operational expenditures.

The typical costs of mortgage servicings are as follows:

- Customer Service: Statements and Billings
- Customer Service: Call Center
- New Loan Set-Up and Transfers
- Payoff/Lien Release
- Escrow
- Cashiering
- Investor Reporting
- Collections
- Loss Mitigation
- Bankruptcy
- Foreclosures

42 Mba.org. (2019). MBA Chart of the Week: Average Servicing Costs Per Loan | Mortgage Bankers Association. [online] Available at: <https://www.mba.org/publications/insights/archive/mba-insights-archive/2018/mba-chart-of-the-week-average-servicing-costs-per-loan> [Accessed 15 May 2019].

- REO (Real Estate Owned)
- Other Default
- Servicing Systems
- Quality Assurance
- Record Retention
- Executive Management and Specialized Functions

Use Case: Payment Management

Payments of monthly rents present a challenge for both tenants and property owners. Usually, tenants pay via monthly checks, imposing tedious manual processes on property managers to collect payments, reconcile the amounts with lease agreements, deposit checks at bank accounts, and record and track outstanding tenant payments. According to Phil Renzie, a third-party property manager, the national average of paper-based payments among property managers is 40%, which requires numerous individuals to ‘touch’ the check before it is finally deposited. Phil alluded to managing as many as 800 units of condos, requiring several hours per week of manual check reconciliation.

Property managers also still have difficulty handling numerous bank accounts. Massachusetts Chapter 183A of General Laws requires each property to have its own operating and savings accounts. Property managers therefore need to create and manage different bank accounts for each property, each with its own Bank ID and password. Funds cannot be co-mingled and pooled, so governance and audits are required of property managers to ensure that funds are handled appropriately. Moreover, bank accounts usually belong in name to the property’s owner or board of trustees, with property managers as the signers. Each month, financial statements are prepared and sent to the boards for review. These processes represent a large amount of complexity and overhead cost for property managers.

Despite still high levels of paper-based payments, the property management industry has seen large gains from the adoption of new software solutions such as RentManager⁴³, Appfolio⁴⁴, and YARDI⁴⁵. While the evolution of payment processing from from paper to electronic has helped property managers significantly, blockchain-based smart contracts could be the next step to achieving more streamlined management of payments and management of bank accounts.

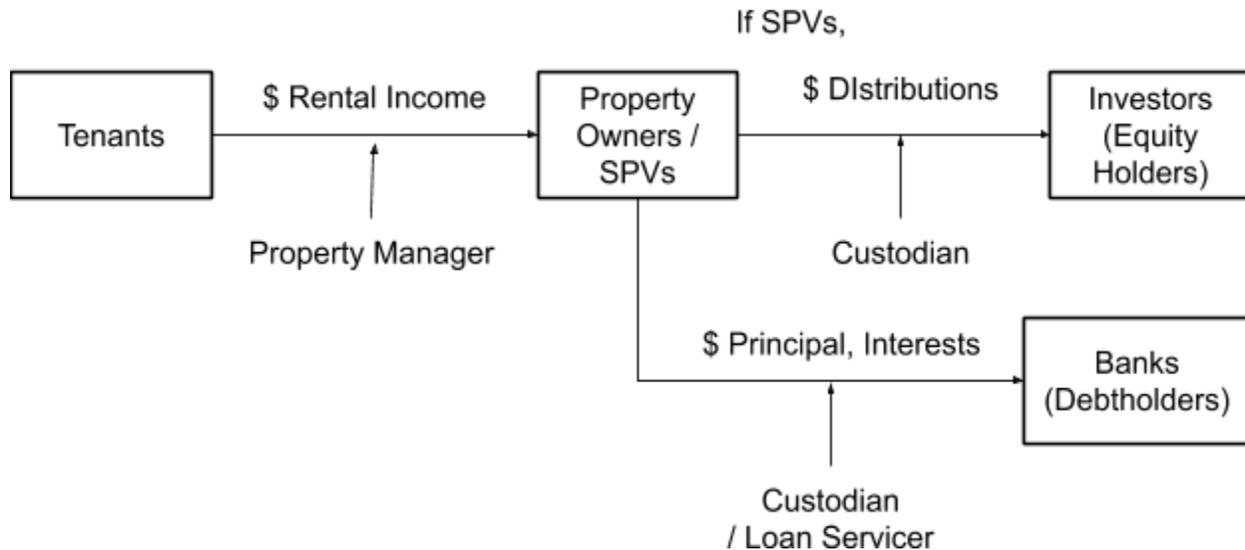
For example, all relevant payment information related to a loan could be recorded on a blockchain. Tokens will work as a payment vehicle to deliver rents from tenants to property owners. Investors could provide data storage for payment history, which

⁴³ <https://www.rentmanager.com/>

⁴⁴ <https://www.appfolio.com/>

⁴⁵ <https://www.yardi.com/>

could be recorded automatically as to whether the borrower has made payments. This will assist loan servicing decisions (especially when tenants fail to pay) and, accordingly, investment decisions. A token serves as both an investment vehicle such as a SPV (Special Purpose Vehicle) and an immutable source of payment history.



Use Case: Lease Management

Lease management is an additional area ripe for blockchain application. Today, servicers need to review leases and lease-related documents, register documents into a database through scanning all documents, maintain documents, update critical dates, analyze optionality in lease, administer subleases, and receive audits. CBRE, the largest entity in the commercial lease management space, confirmed that lease administration and audit still have inefficiencies and require optimization. Although lease management software is advancing, leasing management is still subject to paper-based workflows, with tenants indirectly paying the cost.

Lease contracts are programmable and smart contracts present a solution to this inefficiency. A token could serve as a transparent medium to record lease contracts. Rent payments would be recorded, allowing servicers to easily reconcile the terms of contract and payment history. This application of blockchain to the areas of loan origination and servicing will benefit downstream investors, who could then follow the full lifecycle of a loan from issuance to maturity. Additionally, blockchain could give auditors visible and traceable access to modifications made throughout the term of the loan.

CONCLUSION

Clear benefits exist from applying blockchain to securities trading; but with respect to securities that derive underlying value from real, physical assets, the tokenization of those physical assets for the purpose of standardized, transparent and tamper-proof record keeping has the potential, we think, to drive significant value for investors. This will, for example, accelerate due diligence processes and prevent significant price dislocations due to lack of transparency to the value drivers of the underlying physical asset (such as occupancy rates and maintenance history). In short, it's not just about tokenizing the securities, but also tokenizing the physical assets - we believe powerful benefits can be realized by tokenizing both and connecting the two.

Summary of Benefits

Blockchain Benefits:

1. Liquidity
2. Access
3. Fractionalization & Customizability

Example workflows / processes:

1. Security token issuance
2. Security token trading
3. P2P transfer of (securitized) debt and equity
4. KYC / AML (reg-aware tokens)

Blockchain Benefits:

1. Automatic / frictionless payments
2. Data transparency / traceability

Example workflows / processes:

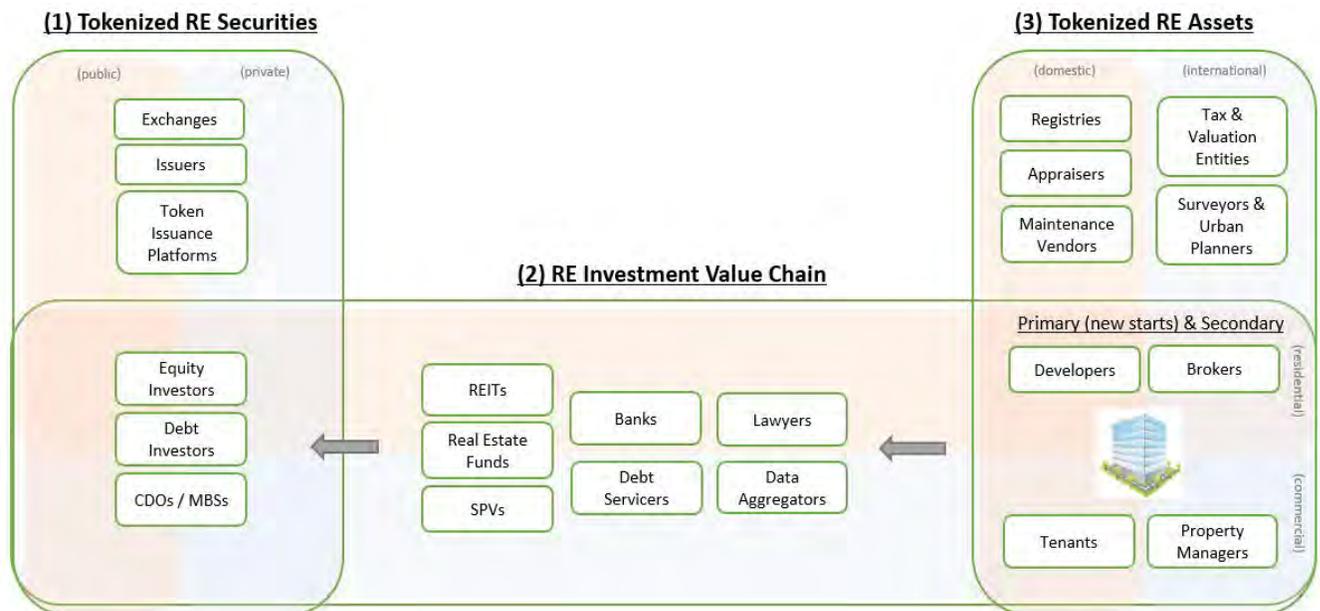
1. Loan syndication
2. Investment due diligence
3. Debt servicing / lease administration

Blockchain Benefits:

1. Secure recordkeeping

Example workflow / processes:

1. P2P transfer of (non-securitized) ownership
2. Title verification
3. Disintermediated home sharing



Future State of Blockchain in Real Estate

We expect the long term adoption cycle to work from right to left, with security tokenization (1) happening first, followed by specific applications to the real estate investment value chain (2), and finally wider asset tokenization as identity for things takes off (3).

In the first stage of security tokenization, we see blockchain applying to an increasing number of layers and steps in the trading and compliance process. Most exchanges (particularly decentralized exchanges), which are currently focused on equity trading, will need to gain additional capabilities to handle features of debt securities (such as accrued interest). On-chain payments will allow smart contracts to route payments to wallets automatically, allowing for the creation of additional financial instruments based on those payments (splitting the flow of payments into strips, for example).

We believe the industry will likely go through a risky phase of duplicate infrastructure as blockchain systems are built to conform to existing processes and regulations. During a transition period, ecosystems will experiment with the technology's features, such as multi-platform / multi-peer secondary trading, issuance of a token of tokens (tokens created by smart contracts that represent portfolios of tokenized securities and/or assets), automated portfolio rebalancing, on-chain regulation, and streamlined cash-flows through the use of crypto-native currencies or stablecoins. Tipping points may be reached where blockchain capabilities become uncompliant or incompatible with existing infrastructure, driving adoption toward full adoption and a phasing out of legacy technology.

The development of blockchain-based infrastructure for digital identity - identity of people and of things - will also unlock degrees of freedom within the blockchain ecosystem. With digital identity, decentralized exchanges would have a reduced burden to perform KYC/AML functions. Additionally, identity for things would allow for unique, authoritative digital representations of assets (like buildings) to emerge, providing an industry-wide reference point for data about those assets.

Negative Impacts for Some Players in CRE

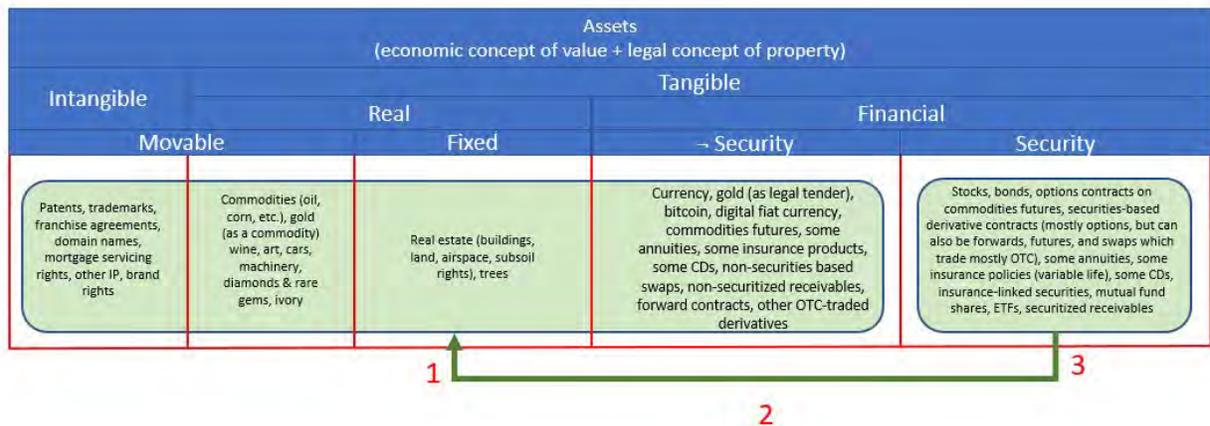
More data transparency and more efficient debt payment streams will negatively impact certain players in the space:

- Larger institutional investors currently have the scale to complete more frequent physical inspection of properties; smaller players who are able to gain access to more information will benefit most from more transparent data.

- Debt servicers will likely be negatively impacted as automated payment streams to debt holders are implemented.
- Brokers are currently a major intermediary and holder of information about commercial real estate properties; their position and leverage may be somewhat eroded should data transparency be increased.
- Title insurers and appraisers may also face pressure to reduce the cost of their services in light of better record keeping.
- Law firms that charge fees as a percentage of real estate financing transaction costs may find their work increasingly automated through standardized smart contracts; entrants that charge on a fixed-fee basis may gain an upper hand.

General Framework

Over the course of writing this report, we were able to develop many lines of inquiry that helped uncover the details most relevant to our understanding of the opportunities and challenges that exist in applying tokenization to the commercial real estate realm. We propose the following general framework as a guide for future research into the tokenization of other types of assets and their related securities.



<p>1. Questions Regarding the Asset</p>	<ul style="list-style-type: none"> •What is the assets main purpose (use, store of value, etc.)? •How does the asset come into existence? (is it built, mined, claimed, created) •Who has information about the asset? Where is the information stored? How is it shared, if at all? What is the process by which information about the asset is represented digitally? •Is information about the asset represented within multiple entities (owners, brokers, tax authorities, regulatory bodies, appraisers, property managers, vendors, custodians, lenders, etc.)?
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	<ul style="list-style-type: none"> ·How do those entities acquire information about the asset? What is the relationship of the entities to the asset? ·How are transfers of ownership facilitated? Who facilitates or brokers the transfer of ownership? ·Is the asset a homogeneous good?
<p>2. Questions Regarding the Securitization Process</p>	<ul style="list-style-type: none"> ·Is the asset frequently securitized today? ·What is the process by which the asset is securitized? ·What entities are needed to complete the securitization? Is funding typically needed? ·Are there custodian requirements? Are there laws around custodianship?
<p>3. Questions Regarding the Securitized Asset</p>	<ul style="list-style-type: none"> ·Where are the securities based on the asset traded? What is the process to get those securities listed? ·What are the reporting and disclosure requirements for the type of security? ·How do investors access information about the underlying asset? Does information change frequently or not? ·How do investors value the security? ·What are the factors that impact the liquidity of the market for the securitized asset? ·What type of investment strategy category doe the asset typically fall into? ·How fungible are the securities being traded?
<p>4. Questions Regarding the Ecosystem</p>	<ul style="list-style-type: none"> ·Who are the main entities involved in the creation, purchase, sale, custody, distribution, valuation, taxation, and/or maintenance of the asset? Are there any other services which depend on markets for this asset? ·How fragmented is the market for a particular asset? ·What monopolies exist in the space (natural or unnatural)? ·Are there laws or regulations that apply to the transfers of ownership or are there laws that dictate what kind of people or entities can own a particular asset? ·How competitive is the market for the asset or data about the asset? ·How fast or slow is the industry to adopt new technology? ·How pressured is the industry currently by technological change? ·What are the forces currently affecting prospects for markets of the asset? ·What are the power dynamics an dependencies currently in industries related to the asset?

SUMMARY

With respect to securities that derive underlying value from real, physical assets, the tokenization those physical assets for the purpose of standardized, transparent and tamper-proof recordkeeping has the potential to drive significant value for investors. This will, for example, accelerate due diligence processes and prevent significant price dislocations due to lack of transparency into the value drivers of the underlying physical asset (such as occupancy rates and maintenance history). In short, it's not just about tokenizing the securities, but also tokenizing the physical assets; powerful benefits can be realized by tokenizing and connecting the two.

INTERVIEWEES

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- Amy Kirsh, Director of Partnerships and Investor Relations at Harbor
- Asha Dakshinamoorthy, Product Lead of Asset Digitalization at AlphaPoint
- Chris Chrysostom, Senior Software Engineer at Medici Land Governance
- David Gentler, Professor of Real Estate Finance at MIT
- George Famutimi, Regulatory Analyst at Circle
- Henry Elder, President at IBREA
- Jase Wilson, CEO at Neighborly
- John Mizzi, Chief Strategy Officer at Bond.One
- Mark Snyderman, Portfolio Manager at Fidelity
- Matt Doherty, MIT Sloan
- Nariman Noursalehi, SVP of Product Management at tZERO
- Phil Renzi, Founder at Renzi Bulger Group
- Rob Bould, Director at IPSX
- Steve Weikal, CRE Tech Lead at the MIT Real Estate Innovation Lab
- Ted Winston, Vice President at CBRE
- Todd Liapette, CEO at Fluidity Factora

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