



Saïd
Business
School



University of Oxford Research

Tokenisation: the future of real estate investment?



Tokenisation – The Future of Real Estate Investment?

Andrew Baum
The Future of Real Estate Initiative
Saïd Business School
University of Oxford

With major contributions by Alexander Appelmans, FIBREE, BCLP, CBRE and EY

January 2020

The Oxford **Future of Real Estate Initiative** is supported by Arcadis, BCLP, CBRE, EY, Grosvenor, Nuveen, Redevco, The Crown Estate and UBS

Tokenisation – The Future of Real Estate investment?

In January 2020 Placetech (2020) publicised the flotation of IPSX's first asset, The Mailbox in Birmingham, UK, the home of Harvey Nichols and the BBC's Birmingham's home, and one of the largest mixed-use property assets outside London, with 700,000 sq ft of shops, restaurants and offices. In the same month, it was reported that BrickMark purchased a prime commercial building from RFR Holding in Zurich in a share deal in which a significant part of the purchase price of around €120m was paid in BrickMark tokens.

The fractionalisation and tokenisation of real estate and real assets is a hot topic, with many schemes being discussed and a few executed. The launch of IPSX in London is an example of a proposal to enable the fractionalisation of real estate assets; there are several more radical propositions to split ownership via digital tokens, employing distributed ledger technology to register ownership and track trades. There is a clear shortage of objective commentary available to guide this market.

In the current real estate technology world, tokenisation is a term with two meanings: it can be used to mean the fractionalisation of property rights; or it can refer to the digital representation of asset ownership.

We prefer to use the term to combine these usages, following typical pitchdecks issued by technology platforms working in the field. Here is a good example:

Tokenisation is the process of representing fractional ownership interest in an asset with a blockchain-based token (Domus)

The purpose of this paper is to objectively examine the mechanisms now available to tokenise real asset ownership and to create active secondary markets in tokenised or fractionalised units.

We focus on the fractionalisation and tokenisation of single assets, debt and funds. The geographical focus is Europe, plus some global references. We explore the practical issues underlying the functioning and regulation of tokenisation, report the activity level to date and comment on the factors likely to drive or inhibit the success of these initiatives.

While our primary motivation is to examine tokenisation in an investment context, we are drawn sideways into a few related topics. We examine various non-digital fractionalisation alternatives en route to our material on tokenised fractionalisation. We also discuss utility tokens, which are not to do with ownership or investment, but are drawn into our field of scope through the medium of hybrid tokens (which are).

It is a difficult challenge in a report like this which combines finance, law and real estate to avoid over-complication while at the same preventing over-simplification. This challenge is amplified many times when adopting a global perspective. There are many different systems controlling land ownership; different approaches to investment regulation; varying appetites amongst governments to promote digitalisation for commercial advantage; different tax and accounting regimes; and a myriad of structures underpinning investment vehicles. To attempt to extract some global truths from this web could be regarded as over-ambitious.

In deliberately adopting such a global perspective, we must acknowledge the lens through which we view this world, which has been developed in the UK, the U.S., continental Europe and Asia, in that order. The U.S., and to a greater extent Europe, is itself fractionalised, with many fast-moving parts, so that there can always be an exception to our generalisations.

The case for the digital tokenisation of single real estate assets is that real estate is lumpy and illiquid, and that investors should be able to participate in the ownership of a broader universe of assets, hitherto confined to the wealthy and institutions, and to build diversified portfolios with modest sums of money. The challenge for proponents of the digital tokenisation of single real estate assets is that two radical developments have to be simultaneously accepted. First, there needs to be an expressed demand for the fractionalisation of single real estate assets. Evidence of this is at best sketchy, both through history and in the current period. Second, market participants need to be comfortable with blockchain, the digital underpinning of tokenisation.

Connected to this is the cost of fractionalisation and the cost of tokenisation. In many land markets, fractionalisation requires an intermediate structure to be established because the direct ownership of land cannot be split into many pieces. Even where this is not the case, agreement needs to be reached regarding the control of fractionalised assets. For certainty and risk control, not to mention regulatory compliance, it makes sense to reproduce existing structures which have been proven to govern fractionalised investments. Globally, these appear to be limited companies or LLCs, partnerships, trusts or dedicated contractual systems.

Hence we conclude that an intermediate structure is likely to be both necessary and convenient when fractionalising a single asset. This both increases the cost of tokenisation and reduces the extent to which a digital post-GFC democratisation ideal can be promoted.

Given that an intermediate structure is likely to be both necessary and convenient, it seems clear that tokenisation has the greatest chance of making immediate progress in the world of funds, where (i) that structure is already in place and (ii) there is already an expressed demand for fractionalisation.

We can see how debt contracts could also be suitable for tokenisation. The contractual structures controlling debt investments are reasonably standardised by banks and others, and CMBS and RMBS structures have evidenced an expressed demand for the fractionalisation of these assets (if only as a stepping stone to the creation of diversified pools).

It is quite possible that larger assets (The Empire State Building and others), which are already held in fund structures, will be tokenised successfully; there may also be an alternative market for tokenised residential, social impact or community assets where investment regulation and risk/return are not the main drivers of behaviour.

In conclusion, tokenisation offers exciting possibilities for the real estate investment market. It is, however, at an early stage of its development, and real estate applications will take time to develop and become accepted. There is a clear danger that innovation will be set back by years and possibly decades if attention is focussed solely on the digital fractionalisation of single assets, for which the demand may be limited, the economics unconvincing and the obstacles significant. Funds and debt offer immediate opportunities to establish the credibility of tokenised real estate

applications; utility tokens for building users and hybrid tokens for residential co-ownership and community assets may well follow; and, in time, there may be some successful trophy asset tokenisations. The mass market for the tokenisation of single commercial real estate assets, however, may be some way down the road.

Part 1: context

Chapter 1: Real estate, the low risk asset class, meets fintech, the speed merchant

1.1 Real estate as an asset

1.2 Real estate fintech

Crowdfunding

1.3 Liquidity in primary market and secondary markets: a good thing?

1.4 Real estate funds

Chapter 2: The context - real estate fractionalisation

2.1 Fractionalising real estate – splitting a big lumpy asset into smaller pieces

Joint ownership

Physical sub-division

Time shares

Freehold/leasehold

Tranching

Syndication

2.2 Fund structures

Intermediate ownership forms

2.3 A history of real estate fractionalisation

2.4 IPSX: the latest attempt to split lumpy assets into smaller pieces

Who will be the buyers?

Who will be the sellers?

Liquidity and volatility

Chapter 3: Fractionalisation, digitalisation and blockchain

3.1 Fractionalisation through tokenisation

3.2 Blockchain and DLT

Part 2: real estate tokenisation

Chapter 4: How real estate tokenisation works

4.1 Security and utility tokens

4.2 Single assets

4.3 Hybrid tokens

4.4 Debt tokenisation

4.5 Fund tokenisation

Chapter 5: How real estate tokenisation is regulated

5.1 Introduction

5.2 Regulatory issues

Regulated activity (UK)

Financial Stability Board

UCITS

Security tokens and tokenised securities

Chapter 6: Trading, valuation and accounting issues

6.1 Valuing fractional interests

6.2 Setting trading prices for digital assets/instruments/funds

6.3 Accounting issues

Chapter 7: Real estate tokenisation – the story so far

7.1 The first trade: Aspen Coin

7.2 FIBREE/CBRE/Oxford survey evidence

7.3 Pipeline

7.4 Failed transactions

Part 3: the future and conclusions

Chapter 8: The future of real estate tokenisation

8.1 Structured transactions

8.2 Single asset exchanges (IPSX)

8.3 Fund exchanges

8.4 Hybrid tokens

Chapter 9: Conclusions

9.1 What does tokenisation deliver?

9.2 Security tokens for single assets

9.3 Utility and hybrid tokens

9.4 Debt securitisation and tranching

9.5 Tokenising funds

9.6 Summary

Thanks to:

Alexander Appelmans, University of Leuven
Anne-Marie Lusty, BCLP
Daniel Csefalvay, BCLP
Eva Holden, BCLP
Richard Werner, BCLP
Victoria Duxbury, BCLP
Ying Hong, EY
Julie Green, EY
Russell Gardner, EY
Samuel Davies, EY
Megan Hanney, CBRE
Thomas Herr, CBRE
Richard Holberton, CBRE
Paul Robinson, CBRE
Rafael Stocco, CRE
Hannu Ylipaavalniemi, CBRE
Daniel Coheur, Tokeny
Gonzalo Sanchez Slik, Brickblock
Stephan Rind, BrickMark
Alpesh Doshi, Fintricity
Stephen Ashworth, Digital Fund Exchange
Jo Bronckers, FIBREE
Achim Jedelsky, FIBREE
Rob Bould, IPSX
Roger Clarke, IPSX
Tim Simmonds, Osborne Clarke
William Maycock, Osborne Clarke
Keith Breslauer, Patron Capital
David Schrier, SBS Oxford
Christopher Chang, SBS Oxford
Sheila Khakali, SBS Oxford
John Kabanda, SBS Oxford

With special thanks to BCLP, CBRE and EY; and to FIBREE (the Foundation for International Blockchain and Real Estate Expertise) and Alexander Appelmans. Your input has been invaluable.

All views expressed in this report (other than quotations from other sources) are the sole responsibility of the author.

Tokenisation – The Future of Real Estate investment?

Part 1: context

Chapter 1: Real estate, the low risk asset class, meets fintech, the speed merchant

Summary: real estate investment suffers from illiquidity and lumpiness. There have been attempts to overcome these problems through primary and secondary market innovation (crowdfunding, for example). There is also a need to improve liquidity mechanisms in real estate funds. Fintech offers opportunities.

1.1 Real estate as an asset

Real estate is an interesting asset class. Direct property indexes suggest that the typical institutional real estate portfolio offers moderate returns for low risk with reasonable diversification prospects, and that these three characteristics make a strong case for a significant real estate allocation.

The result of using UK or U.S. return, risk and correlation data (capital market assumptions, or CMA) in a modern portfolio theory framework is a very high property allocation – as much as 30-60% (Baum and Hartzell, 2012). Yet the actual allocation for institutional investors in 2019 was around 10%, around one quarter to one sixth of the optimised level. What explains the huge difference between unconstrained theory and practice?

The answer probably lies in the way in which property investment strategies can pragmatically be executed. These execution strategies involve problems that are not measured in the CMA data. One of these problems is illiquidity. Real estate, unlike securities, is not a liquid asset class: transactions are slow (SBS, 2019), and the costs of trading (both direct and indirect) are very high.

The introduction of liquidity into a property structure is an extremely tempting proposition. Surely the asset class would be much more attractive if it could be traded quickly and at low cost. Could the digitalised world offer real estate investors real estate transactions that are as painless as dealing with Amazon, PayPal or Airbnb? Could real estate titles be digitalised?

Real estate also suffers from 'lumpiness' – a high value per unit and an uneven distribution of values – which limits the potential effective demand for an asset and at the same time prevents efficient diversification. As a result, real estate investors of almost any scale are forced to suffer non-diversifiable risk.

If real estate assets were to be easily unitised, or fractionalised, this would surely improve the risk-return characteristics of typical real estate portfolios, while at the same time the liquidity of a typical asset would increase. One of the advantages of distributed ledger technology, including blockchain, is the potential for dividing assets and facilitating or replicating transactions through the medium of a smart contract.

Technology therefore appears to offer the prospect of more efficient and deeper markets for real estate (and other private) assets. The primary market could be improved by the

introduction of more effective demand via fractionalization, supported by smart contracts, and the secondary market could be enabled by blockchain-based ownership records. Both primary and secondary real asset markets could in theory be transformed by financial technology in the way that online retailing and hospitality have been.

1.2 Real estate fintech

In the proptech wave of 2014-2019, there have been many innovations including online mortgage brokers, house purchase websites, rental brokers and some products aimed directly at the intending owner occupier short of adequate equity or debt finance. Such innovations have included crowdfunding and peer-to-peer lending. Equity is generally more time consuming to raise than debt, so we have observed some tech-driven entrepreneurial activity in the raising of equity. Capital raising in the private markets remains, however, a vital but difficult activity.

Crowdfunding

Real estate crowdfunding, which some see as an idealistic model driven by a thirst for democratisation, and others regard as the result of stricter solvency regulations for banks and a growing demand from investors looking for alternatives to low yielding savings accounts, has captured the imagination of young entrepreneurs and SME developers. Crowdfunding has the potential to resolve the capital requirement problem for less financially capable buyers, but also to remove geographical barriers in capital raising. Also, reducing the minimum deal size for an investor should widen the potential buyer base and the pool of available capital.

Capital raisers, including UK start-ups Brickvest (now declared insolvent), Property Partner, CapitalRise, Property Crowd, Property Moose, Piggyback and Mashvisor, have claimed (in the somewhat patronising yet hopeful words of the latter) to *“let average people become savvy individual investors to make profitable real estate investments and rental strategy decisions through an online platform that instantly aggregates real estate data”*. Increasingly, UK platforms such as Riverside Capital, Cogress or Shojin are using their own crowdfunding solutions as a retail distribution channel to fund unregulated single property investments and developments.






Since launching in 2014, the CrowdStreet Marketplace claims to have published over 361 U.S. commercial real estate investment offerings. To date, \$807m has been raised and 17 of those 361 offerings have been fully realized (source: www.crowdstreet.com). Other U.S. examples include Fundrise, Realty Mogul, AcreTrader, Rich Uncles, EQUITYMULTIPLE, PeerStreet and Patch of Land. The mechanism used for more sophisticated investments involves retail investors being grouped into one limited partnership, advised by the platform. Whether good advice is being provided by professionals in these platforms is at best unclear.

From Factornerd.com, European real estate crowdfunding platforms focused on the residential market include Brickstarter, British Pearl, Housers and Reinvest24. Real estate crowdfunding platforms focused on property development projects include Brickowner, Bulkestate, Crowdproperty, Crowdestate, Estate Guru, Grupeer, Homegrown, Landlord Invest, Profitus, Rendity, Rontgen, Tessin, and The House Crowd (see Table 1).

Debt crowdfunding and mortgage platforms including the UK's Trussle and peer-to-peer real estate lending platforms such as LendInvest and Assetz are also in place.

However, the crowdfunding and peer-to-peer lending markets have since seen several failures and evidence of real scale is elusive.

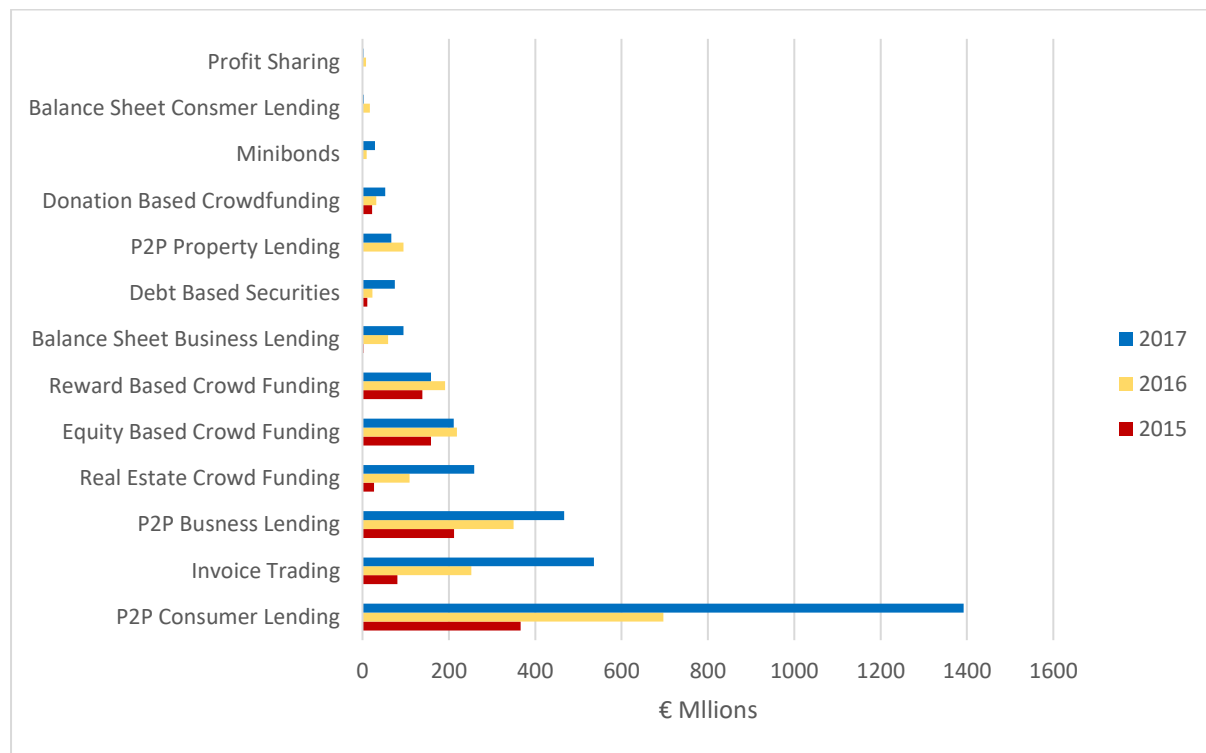
Table 1: Real estate crowdfunding platforms in Europe (examples)

	<ul style="list-style-type: none"> On average: 20.54% Min. investment: € 100 Buyback guarantee: No – but loans are secured with a first-rank mortgage Started: 2014 Loan types: Real estate, corporate finance, and mortgage loans
	<ul style="list-style-type: none"> On average: 12.29% Min. investment: € 50 Buyback guarantee: No – but all the loans are backed with a mortgage Started: 2014 Loan types: Mortgage
	<ul style="list-style-type: none"> On average: 13-18% Min. investment: € 50 Buyback guarantee: No – but there are various securities to protect your investment Started: 2018 Loan types: Real estate, business, transport, and startup projects
	<ul style="list-style-type: none"> On average: 14.6% Min. investment: € 100 Buyback guarantee: No – but all the loans are backed with a mortgage Started: 2018 Loan types: Real estate
	<ul style="list-style-type: none"> On average: 14.32% Min. investment: € 50 Buyback guarantee: No – but all the loans are backed with a mortgage Started: 2016 Loan types: Real estate projects

Source: Factornerd.com

The Cambridge Alternative Finance Report (CCAF, published by Cambridge Alternative Finance, 2018) measured the European alternative finance market at €3.3billion – dominated by the UK – in 2017. CCAF noted that while the European alternative finance market is smaller than the markets in Asia and North America, Europe's per-annum growth has been far steadier, increasing by 79% annually on average between 2013 and 2017. See Table 2, and also p2pmarketdata.com/crowdfunding-europe.

Real estate (property) crowdfunding explained 8% of the total volume of European alternative finance, or €259m, in 2017. Given that the UK alone (say 10% of the global market) sees real estate transactions of around £50bn in a typical single year, crowdfunding's share is estimated at somewhere between 0.1% and 0.25% of all capital raised, not yet a runaway success, somewhat illustrated by the failure, pivot or downsizing of many pioneer companies such as Property Partner or Brickvest.

Figure 1: Annual volumes, 2015-2017, alternative finance, Europe

Source: Cambridge Alternative Finance

1.3 Liquidity in primary market and secondary markets: a good thing?

It would make sense for tech platforms to develop deep primary and secondary markets for real estate assets and also for real estate funds. CBRE's Property Match has made some inroads in the fund market, but there is considerable dissatisfaction with the way unlisted fund managers can make it difficult for investors to control their return of capital and no technical reason why a deeper and broader secondary marketplace for units in funds should not follow. Primary market capital raising is also hugely inefficient, and technology platforms are available to facilitate fundraising for real estate assets and real estate funds (see, for example, www.sourcecentral.co).

In 2019 we heard a lot about asset tokenisation (digitalisation) and the liquidity improvements that might follow via both primary and secondary markets and through fractionalisation; if this idea gains traction, fund tokenisation and the digitalisation of debt could both develop. However, real estate professionals and academics make the point that the introduction of liquidity could significantly change the return characteristics of real estate, even to the point that it ceases to be attractive. How can this be?

In the 1990s and early 2000s, participants in the property investment market became fascinated by the potential for the securitisation or unitisation of real estate. REITs became popular, as did the CMBS structure. It became easier to raise – and offload – debt. The result was a huge financial crash and the insolvency of many banks, driven by much greater downside volatility in real estate prices than we had been expecting. Arguably, therefore, illiquidity is a necessary evil in justifying the defensive role of real estate. As theory suggests that the illiquidity of property means that its required – and expected – return is higher than it would otherwise be, introducing liquidity to property may damage returns, as the illiquidity premium may be eroded.

This belief seems to be widely held by professionals. Real estate market participants often demonstrate what might appear to be a curious belief in the superiority of an ‘off-market’ transaction. This practice clashes with millennial expectations of shared economies and the ‘democratisation’ of assets. To a less experienced or less conflicted group, suspicions arise of closed shops designed to protect the market dominance of a small number of advisors/brokers and buyers/sellers without achieving the best price that – theoretically at least – exposure to a larger pool of potential demand would deliver.

Surely wider distribution of a product offering should be both fair and effective in producing a better selling price; and if at the same time we can split the asset into smaller pieces, we will increase effective demand. A wider secondary market will also increase effective demand in the primary market and improve the perceived quality of the asset.

Crowdfunding technology is certainly available to distribute investment offerings to a wider pool. Distributed ledger technology is an ideal mechanism for asset fractionalisation. Is this the future of real estate investment? Can we achieve more liquidity through innovation? If we can, will there be any negative or unintended consequences?

1.4 Real estate funds

For funds, the same arguments apply. An efficient on-line distribution platform backed up by a secondary market facility will surely help to improve the efficiency of the capital raising process and draw more investors towards a hitherto less available asset class. It should be added that this is a more natural development than single asset fractionalisation, because investors in real estate funds already hold fractionalised interests.

There is little doubt that the primary market through which first-time capital is raised for funds is hugely inefficient. One well-known fund manager reported that in the process of raising around \$900m for the platform’s fourth fund, he attended 497 meetings. Another held 160 meetings before any capital was committed to his (eventually successful) fund. There is little or no automation of this process.

Secondary market liquidity is also an issue, dependent on the structure employed. There are three popular structures in use in the global property fund market. These are (i) listed REITs and investment funds; (ii) unlisted open-ended funds; and (iii) unlisted closed ended funds. A REIT or listed fund can usually be traded quickly on a major stock exchange, but an unlisted fund cannot. Investors in unlisted funds need to know how they can get their money back, and how much they will receive.

Open-ended funds allow investments and dispositions (redemptions) at any time. They also have an indefinite life. There is therefore some liquidity in open-ended private equity funds, provided through manager-controlled redemptions, often after an initial lockup period. There may also be a secondary market which matches buyers and sellers. Hence, the open-ended structure can benefit from twin liquidity mechanisms. Investors can redeem units in return for cash from the manager at a given bid price relative to NAV, but may also be able to sell units in the secondary market for a higher price. However, the redemption facility is sometimes suspended (see Baum and Hartzell, 2012) and the UK has seen this happen in 2007-8, 2016 and

2019. An efficient solution to secondary market liquidity (albeit at a price) is way overdue.

Closed-ended funds inhabit the higher risk end of the real estate fund spectrum. A closed-ended fund raises capital from investors before investments are made, and generally prescribes a specific investment period and fund termination period. Once the investment period is over, the fund usually has another three to seven years before the termination period expires, at which time the fund must distribute all cash flows (including sales receipts) back to investors. Sometimes there is an active secondary market for units in larger, widely held closed-ended funds; often there is not, with a small pool of investors and restrictions on trading.

Liquidity in unlisted funds is therefore generally limited, although there is an increasingly active secondary market in European closed-ended funds. CBRE, Tullett Prebon and JLL all offer secondary market deals in unlisted funds. However, this market is not technologically sophisticated and requires broker involvement. Why not offer fund investors a digital platform through which they can buy or sell units?

Chapter 2: The context - real estate fractionalisation

Summary: There are several ways in which a real estate asset can be split into smaller component parts, or fractionalised. Fractionalisation does, however, pose problems of control, which intermediate ownership forms such as partnerships are set up to solve. History shows that there have been several previous failed attempts to fractionalise single property assets and cheap and easy routes to this solution do not exist.

2.1 Fractionalising real estate – splitting a big lumpy asset into smaller pieces

There are several ways in which a real estate asset can be (or has been) split into component parts, or fractionalised. We could split the freehold ownership between several legal persons (in the UK that would mean a maximum of four holding the legal title, and more elsewhere). We could sub-divide the building physically (vertically, horizontally or both, including flying freehold or strata title). We could create a time share structure through which ‘owners’ have the right to use the property for a certain amount of time each year. We could create leasehold and sub-leasehold interests. We could use tranching, a way of splitting the entitlement to income receipts from an asset: this is best exemplified by securitisation structures, but also includes the current fashion for income stripping (allocating lease income to one legal owner, while another legal owner retains the residual property interest). Finally, we could syndicate ownership of the asset, as has commonly been tried in jurisdictions including the UK, US and Australia.

These examples – joint ownership, physical sub-division, time shares, leaseholds, tranching and syndication – have different legal implications.

Joint ownership

In the UK, the Trustee Act 1925 limits the number of legal owners of real property to four; this is typically the case in countries and U.S. states which follow common law (law developed by judges through decisions of courts and similar tribunals - case law - rather than through legislative statutes or executive branch action). In civil code systems (originally Roman, and later developed in countries including Germany and France) this is not the case. In France and Belgium, for example, there is no limit to the number of owners of real property. Clearly, therefore, whole-asset fractionalisation looks easier in civil code jurisdictions, which include Switzerland, where tokenisation has been promoted for some time. However, in civil code jurisdictions the transfer of a share is very complex, involving a notary.

In France and other southern European countries, assets can be jointly owned. In these jurisdictions, it is also possible to have the right of exclusive and unlimited usership to a property without being its owner. Each purchaser owns his share of the property in accordance with his financial contribution to the purchase (30/70, 40/60, 50/50, etc.), without there being any material distinction between the different shares. Once the asset has been purchased, each of the owners (known as joint owners or *indivisaires*) has rights over the whole asset. The most important decisions must be taken unanimously (unless there are exceptional circumstances). In the event of a disagreement, this can quickly lead to an impasse.

Furthermore, each joint owner is required to pay the debts that relate to the asset (taxes or essential works, for example), in proportion to her share of the asset. It goes without saying that it is essential to assess the risks of disagreement before the purchase is made.

Finally, the rules governing ownership in undivided shares assume that the situation is provisional. The law has laid down the principle that "nobody can be required to remain an owner of an asset in undivided shares". If one of the joint owners decides to sell her share, the others, who cannot object to this, have a right of pre-emption over the share to be sold. Unless the share is purchased (by another joint owner or by a third party), the asset must be sold. The insecurity of this situation can be avoided by signing a *jointly owned in undivided shares agreement*, which must be prepared in writing, on pain of being held null and void. It must list the items that are owned in undivided shares and specify the rights of each joint owner. If the agreement relates to real estate, it must also be drafted by a notary, and registered with the land charges registry.

The purpose of the 'jointly owned in undivided shares agreement' is to determine how the joint ownership will be managed and to lay down the rules that will apply. The joint owners may determine how the expenses will be divided, appoint a manager (who may, but need not be one of them), determine the amount of any occupation rent (if one of them occupies the property alone), and so on.

When the agreement has been entered into for an indefinite term, none of the joint owners can require the property to be sold in order to recover their share. When the sale of an asset that is owned in undivided shares has been blocked by one of the joint owners, the other joint owners, representing at least two thirds of the undivided rights, may seek authorisation to sell from the regional court [*tribunal de grande instance*]. These proceedings must involve a notaire.

Physical sub-division

Subject of course to its physical design, an asset can usually be sub-divided vertically to create several new legal titles. Horizontally divided strata title is less straightforward legally, having been first introduced in New South Wales in 1961 and requiring a change in property law to make it possible.

Other countries that have adopted the Australian system (or a similar variant) of apartment ownership include Canada, Fiji, India, Indonesia, Malaysia, New Zealand, the Philippines, Singapore, South Africa and the United Arab Emirates. The UK allows the concept of horizontal division – often referred to as a flying freehold, most commonly found where a building juts out over bare land in separate ownership or in terraces – but the wholesale division of airspace title is inhibited by the perceived need to retain control of the asset for management and maintenance purposes. In the UK, freeholders have traditionally preferred freehold and leasehold structures to facilitate horizontal sub-division (see below).

Time shares

Again, time shares (sometimes also called 'multi-ownership' in Europe) are not naturally permitted as legal ownership sub-divisions without an overt change in regulation. It is much easier to conceive of a time share as a licence or right to occupy a property for a given amount of time each year (a simple contract); but some

jurisdictions (examples include Florida) have introduced a form of timeshare ownership.

Freehold/leasehold

Popular mainly in the UK, the horizontal sub-division of legal ownership dates from feudal times and the lord/vassal relationship (the term freehold itself implying that mere subjects can hold land free of charge from the King or Queen). The freeholder, who has a perpetual interest, grants a lease (usually) to a prospective occupier, whose leasehold interest is for a term of years. Freehold/leasehold structures have a clear use in sub-divisions, as responsibility for maintaining the exterior and common parts of a multi storey building in multiple occupation can be retained by one party (the freeholder) rather than exposed to argument by all owner/occupiers. However, frustration with the often-abused power of the more powerful freeholder to impose unfair terms on leaseholders, coupled with the depreciation of time-limited leasehold interests, led to the introduction of (unsuccessful to date) commonhold tenure and to continuing calls for reform.

Introduced in 2002 as a co-operative form of ownership, commonhold title makes fractional owners members of a company that owns and manages the shared areas and structure of a building. There is no landlord. However, fewer than 20 commonholds have been created. The system has been criticised for lacking the flexibility required for larger developments and for converting existing leases into commonholds. Mortgage lenders have also proved reluctant to provide loans against commonhold properties.

Tranching

Freehold ownership of an office building leased to a bank for 10 years for \$1m annually can be thought of as having at least two valuable components. The first is the lease rent, or an annuity; and the second is the residual interest in the building and land when the lease ends. The annuity could be further split vertically into a low risk income of \$250,000 (it would be easy to re-lease the space at this rent if the bank went bust) and a higher risk \$750,000. These two income streams are known as tranches (from the French word for slice or portion). Slicing real estate income into tranches can be achieved via the property owner designing and agreeing appropriate contracts, rather than through splitting the legal ownership of the asset. We are more likely to encounter tranching in the context of securitisation, when income streams are bundled into different classes of bond with different interest rates and priorities (for example, commercial mortgage backed securities).

Syndication

Syndication, which has been especially common for decades in the US and Australia, involves an agreement between a sponsor and a single investor or group of investors. The sponsor finds and manages the asset, while the investors simply invest money. Both get a share of the profits based on the time input and the money invested.

Syndications are usually structured in the U.S. as an LLC (limited liability company) or LP (limited partnership) with the sponsor participating as the general partner or manager and the investors participating as limited partners or passive members. In the UK, the limited partnership (sometimes called a private property partnership) is the

structure of choice. The rights of the sponsor and investors, including rights to distributions, voting rights, and the sponsor's rights to fees for managing the investment, are agreed and set out in the LLC operating agreement or LP partnership agreement. In continental Europe, syndication is not a well-recognised term. French law, for example, uses co-ownership agreements. For blocks of flats, there is specific legislation (providing for a council of co-owners, etc).

From these examples, we can conclude that there are likely to be three possibilities for the legal fractionalisation of real assets.

1. The fractionalisation scheme is already permitted by the relevant land law (for example, splitting the title to an asset between four owners in the UK).
2. The fractionalisation scheme is made possible by a specific change in land law (for example, the introduction of strata title in New South Wales and timeshare in Florida).
3. The fractionalisation scheme sits outside the realm of land law and requires a form of contract between property owners and those entitled to enjoy a benefit from the property (for example, time share in many markets and tranching) or an intermediate ownership form (for example, syndication).

We can also infer that a key issue influencing or limiting the physical fractionalisation scheme is control of the entire non-divided asset. If a property is divided into 1,000 parts, who pays for repairing the roof? Who pays for maintenance of the elevator – does that include those on lower floors? What happens when the value of the whole is bigger than the sum of the parts and one person refuses to sell?

2.2 Fund structures

The syndication structure referred to above is a useful introduction to the concept of intermediate ownership. While less than ideal for someone who wants to achieve pure ownership of a fractionalised and more liquid property asset, intermediate ownership can in principle cope with any of the problems discussed above. If ownership is limited to a small number of title owners, no matter: they can hold in trust for many others. If roof repairs or lift maintenance are difficult issues, no matter: a general partner appointed by an intermediate owner or LLP will take responsibility. If the value of the whole is bigger than the sum of the parts and one person refuses to sell, no matter: a company can be the intermediate owner, and company law will tell us exactly how to deal with (overcome, in this case) minority rights.

Intermediate ownership forms

Globally, there appear to be four broad structures which are used to standardise the manager/investor relationship within the framework of a well understood body of common law or statute. These are the company (including a simple joint venture and, in the U.S., the limited liability company or LLC); the partnership (including limited partnerships and limited liability partnerships); the trust; and (in Germany) the Kapitalverwaltungsgesellschaft or KVG, a regulated contract defined by the Kapitalanlagegesetzbuch or KAGB law.

In a company structure, the shareholders' agreement will govern the relationship between the investors, one of whom may take a managing role. In a simple joint venture, one shareholder will likely be passive and the other active. We know how shareholders' rights are protected, how directors are appointed to represent shareholders, the responsibilities of a board, and so on. Companies have limited appeal as investment vehicles, however, as corporate profits are generally taxed, as are dividend distributions, creating a double tax problem.

In a partnership, we will observe one partner acting as (the active) general partner, and the other investors(s) having no responsibility for decision-making. Partnerships are usually tax transparent, avoiding the double tax problem suffered by company structures. A unit in a limited partnership provides beneficial but not legal ownership in English law, and the GP holds assets on trust for the beneficiary LPs.

In a trust, we will see trustees (managers) appointed to act in the best interests of beneficiaries (investors). This structure facilitates the split of the legal interest in land from the beneficial ownership. As an example, the Belgian Real Estate Certificate splits legal and economic ownership, which is unusual in civil law jurisdictions. In a PAIF and other fund structures, a trustee or depositary holds the legal title.

In the German KAGB, open-ended and closed-ended investment funds and their managers are regulated under a special body of law.

2.3 A history of real estate fractionalisation

In the UK in the mid to late 1980s several attempts were made to create popular vehicles for the unitisation or what we would now call fractionalisation of single property assets. These included SPOTs – single property ownership trusts - which encountered tax problems and were dropped in 1988; SAPCos - single asset property companies – which saw the successful flotation of Billingsgate City Securities, but then faded from view; and PINCs, contracts which separated the right to income and capital gain and were probably just too complex (Barter, 1989). All three were not helped by the collapse of demand for property in 1990; there were also more technical concerns about the relationship of property valuations and market prices for the divided units (see Roche, 1995).

Subsequently, led by the U.S., attempts to innovate focussed largely on loan securitisation, the creation of tranches backed by pooled mortgages, and, in the UK, a property derivatives market. Early attempts to establish such a market were unable to achieve critical mass or trading volume. However, by 2005 most of the regulatory restrictions on the development of a property derivatives market had been lifted, and the market achieved considerable volume; but the market collapse of 2008 effectively killed this development.

None of these attempts to create fractionalised or synthetic property exposures have succeeded, and all were brought down by low demand for real estate investments at times of extreme market weakness. The exception is the REIT, a sustainable form of publicly traded company which invests in real estate assets and (as a regulated vehicle) avoids the double taxation problems suffered by other corporate investment structures. Why not simply put a single property into a REIT format and trade the shares? PwC (2017) summarises the regulations governing REIT regimes, in most of which (but not all) there are diversification requirements. In the UK, for example, a

REIT must own at least three income-generating assets, limiting the appeal of this structure for asset fractionalisation.

2.4 IPSX: the latest attempt to split lumpy assets into smaller pieces

On January 9th 2019, London-based IPSX (the International Property Securities Exchange) achieved recognised investment exchange status and became the world's first regulated securities exchange dedicated to the initial public offering and secondary market trading of companies owning single and multiple institutional grade real estate assets. On January 24th 2019, HMRC tax approval meant that the assets traded could be tax-transparent single asset REITs.

The second Markets In Financial Instruments Directive (MiFID2), which came into effect in 2018, imposes more reporting requirements and tests on exchanges in order to increase transparency and reduces the use of dark pools (private financial exchanges that allow investors to trade without revealing their identities) and over-the-counter (OTC) trading. IPSX appears to be approved for the purposes of MiFID2. IPSX is also subject to the takeover code (the blue book), insider trading rules and so on, and to that extent is a fully regulated exchange that can trade shares in single property assets, as long as at least 25 per cent of the shares to be admitted to the exchange are in public hands (a minimum free float).

In an interview with IPSX leadership in summer 2019, we established that the annual fee asked of investors at the time was 2% of the income generated by the listed portion of the asset. So if we list a £100m building, earning a yield of 4%, with the minimum free float of 25%, we pay 2% of 4% of £25m = £20,000 annually, plus a listing fee of 75bps of the IPO capital raise (£187,500). Investors pay c.£15 per trade and avoid stamp duty land tax as they are buying a security and pay the much less punitive stamp duty reserve tax.

In January 2020 Placetech (2020) publicised the flotation of IPSX's first asset, The Mailbox in Birmingham, UK, the home of Harvey Nichols and the BBC's Birmingham's operations, and one of the largest mixed-use property assets outside London, with 700,000 sq ft of shops, restaurants and offices.

Foster (2019), in a brokers' note issued by Hardman and Co in June 2019, introduces the benefits of the IPSX system as follows.

This is the first and only regulated securities exchange – anywhere in the world – dedicated entirely to real estate. It will be the venue for investors to trade shares in single-asset-owning real estate companies, or multi-asset real estate companies where there is commonality in the assets. For simplicity, we refer in this document to single-asset real estate companies as SARCs. The unique benefits of SARCs are increased transparency and cost efficiency, in contrast to wider-ranging REITs (Real Estate Investment Trusts). IPSX has explicit and robust requirements of issuers as regards initial and ongoing disclosure, as well as transparency and board governance. Investors and issuers will be excited by the new opportunity that IPSX will provide. In short, IPSX reimagines real estate investing.

The note goes on to promote the benefits of IPSX as follows:

The reassurance of a Recognised Investment Exchange

The Financial Conduct Authority (FCA) approved IPSX in January 2019 after a long process that included examination of IPSX's infrastructure, trading and settlement processes, and outsourced partners.

Wide appeal

The fractional ownership of 'quasi-direct property' through IPSX will attract the widest range of investors, e.g. retail investors will be able to access what is effectively a new asset class. Family offices have a clear preference for direct property ownership. Institutional investors will value the chance not just to consider a wider pool of assets, but also to use SARCs as part of a strategy to improve liquidity in Open Ended Investment Companies (OEICs).

Secure assets

IPSX quoted companies will own completed, fully-let, long-lease real estate developments, providing a secure income, as well as an opportunity for capital growth. A minimum of 25% of the shares will be available to new investors, and gearing will be capped at 40% on listing.

Low operating costs

By focusing on single assets or multiple assets with commonality, SARCs should have very low running costs.

Low transaction costs and faster completions

Deals in the direct property market can take six months to complete and incur substantial costs (Stamp Duty Land Tax alone can be 5%). IPSX offers investors exposure to proxies for direct property at a fraction of the cost and with completion in a matter of days.

Investors appreciate focused real estate

While even well-regarded generalist REITs can trade at wide discounts to Net Asset Value (NAV), market appetite for specialist REITs means that their share prices currently trade at a small premium, on average. SARCs will enable investors to take this focus even further.

Liquidity and low correlation

By bringing to the table investors with differing strategies and time horizons, IPSX should see strong levels of liquidity. We argue that, given the nature of some likely investors on IPSX, SARCs may have even lower correlations to other assets than existing property – another attraction for some investors.

An attractive venue for issuers

IPSX will generate wide interest among issuers. Just one example illustrates this: we might see generalist REITs 'spin off' part ownership of an asset to demonstrate to the market that they deserve a smaller discount to NAV.

Who will be the buyers?

Based on our discussions with the IPSX leadership and referring again to Foster (2019), investors in REITs, and by extension properties listed on IPSX or SARCs, are expected to fall into the following categories:

Institutional investors: the key attraction of core real estate assets to smaller institutions or those without specialist property fund management arms is likely to be income in a doggedly low interest world. If these investors can be attracted single real estate assets via IPSX in addition to (or rather than) diversified funds or REITs, this will bring significant capital with a long term focus.

Index trackers: these are investors forced into the bigger REITs simply because the REITs are part of the S&P or FTSE indexes. These are not likely investors in single assets, unless the assets are huge.

Noise traders: these are investors who make decisions regarding buy and sell trades without the support of professional advice or advanced fundamental analysis. Critics suggest that trading by noise traders tends to be impulsive and can be based on irrational exuberance, fear or greed; many investors think they have a good feel for the property market, but are often too late to buy or sell. Whether this criticism is fair or not, these are potential users of the IPSX platform.

Wealth managers: these investors have a preference for listed products, and avoid private assets. They might, therefore, be attracted to IPSX assets. They would need to develop asset selection skills, but these skills could be bought in or sub-contracted.

Retail property funds: property funds sold to the public, especially unlisted open-ended funds, ideally need liquid property-related assets to provide short term liquidity for investors wishing to redeem their investment. However, would managers take on the specific risk offered by a single asset when they can park cash in a large diversified REIT? And will single assets traded on IPSX provide better liquidity than a large REIT? This depends on how deep the secondary market is likely to be for a single asset, and there is well-grounded scepticism about this.

Direct retail investors: these will also be target investors.

Not only will IPSX offer retail investors an alternative way to participate in the returns from property assets, but they are likely to be encouraged to be involved. IPSX is keen to see the involvement of retail investors in book building for its IPOs and, it is believed, is keen to encourage retail participation via several platforms (from Foster, 2019).

Structured products: IPSX could offer a route to the sale of an income strip, and then to the creation of structured products (see Chapter 8).

Who will be the sellers?

Those likely to use IPSX to sell shares in assets will include anyone wishing to raise capital while retaining asset management fees and control. With the exception of very large assets, it is not obvious that a REIT, unlisted property company or fund would prefer to sell part of an asset unless they retained control. The required sale of 25% will theoretically inhibit this, although in practice the retention of 51% will provide adequate control.

Owner-occupiers whose main business is not real estate investment may see this as a useful option. If I run a supermarket chain, for example, my options as an owner wishing to raise capital are to sell; to sell and lease back; to raise debt; to set up a corporate joint venture or GP/LP structure; or, maybe now, to use IPSX.

Asset owners intending to sell 100% of an asset may see IPSX as an alternative to a private sale process, and will use the IPSX platform if pricing is better than by private treaty. In the ideal world, more liquidity will be available without driving excessive volatility, pushing prices to a premium over that of a undivided share. Could that happen?

Liquidity and volatility

These are complex issues, and the big unknowns. Daily pricing coupled with real liquidity (buyers and sellers prepared to trade and thereby to make gains and losses) should lead to pricing volatility. Pricing volatility can then support more liquidity, as sellers will cash in trading gains. However, the history of similar ventures (see, for example, SPOTs, SAPCos and PINCs in the UK) suggests a red flag here. Will the psychology of buyers, sellers and market makers lead to a large bid-offer spread and/or a persistent pricing discount? Is a fraction of an asset worth more or less than its fair share of the whole? Will information asymmetry (sellers knowing, or perceived to know, more than buyers) move all IPSX assets to discounts to the net asset value (NAV) of the undivided share? IPSX is unlikely to thrive if potential buyers see the value of previously floated assets fall to a discount to the advertised NAV.

We interviewed a London-based expert on these topics, whose edited (and somewhat critical) views are reproduced below.

My issues relate to the fractionalisation of assets in the format proposed by IPSX. My first point is a regulatory issue and specifically as it relates to 'insider dealing'. Let's say the asset being fractionalised is an office building with four tenants. Now let's say that someone at JLL, CBRE or Cushman has been approached by a tenant of that building to look for alternative accommodation. By default they are insiders because they know the tenant plans to vacate which in the context of a single asset is material. Any rent review, any letting, will be material: can you imagine trying to lease a building and having to ask the prospective tenant to become an insider and comply with the obligations inherent in being inside? The only single asset I know that is listed is the Empire State Building and I think the asset needs to be of that size for individual leasing events not to be material.

The second problem with IPSX is they are promoting it as a fractional interest in property, but what is being sold is not a property, it's a perpetual equity structure. At no point can you touch property value - it's an equity and there is a difference. Hopefully there will be squeeze out provisions as in other listed markets so it is possible to take the asset private, but nobody has explained to me how you take it private to access the undivided value. Furthermore, property is both a depreciating and operating asset: where does the money come from to refurbish a building; or to pay an inducement to a tenant to take on a new lease? Does this require a rights issue? We saw all these problems with single assets held in EIS structures for tax purposes. When 2008/2009 came they breached their loan covenants and had no effective means of raising capital, with enormous tax penalties for some. It was a disaster.

Then we come to the point about specific risk. Why do I want to spend countless hours looking at individual asset offerings? Why not just buy a REIT where I have a manager that picks the stock?

Finally, we come to the point of liquidity. In my opinion the deeper the pool of buyers, the deeper the liquidity and vice versa. I would expect these instruments to have a shallow pool, a massive bid offer spread and in the context of a REIT market trading at discounts to NAV I can't see why they would trade anywhere near par. Who is going to provide the liquidity? Just because you list something it doesn't make it liquid.

Countering some of these points, buyers of assets listed on IPSX may be long term holders, interested primarily in income. This would greatly limit volatility. Given attractive yields relative to other assets (in a continuing low interest rate world), liquidity might be adequate, provided to a large extent by existing investors in the asset, and supported by a broad base of investors.

In January 2020 Placetech (2020) publicised the flotation of IPSX's first asset. Conservatism and risk aversion in the investment management and real estate industries make these innovations extremely difficult to get off the ground. A typical attitude is wait and see, creating a logjam which is difficult to clear. Hence a degree of inside help may be needed to launch a new product. In the case of the London Fox Futures market in 1990, this went too far and the market was closed down because trading volumes were shown to be boosted by artificial trades. The first IPSX asset is, perhaps unsurprisingly, offered for sale by M7, a shareholder on the IPSX platform.

This will be the first test of investors' appetite for the IPSX concept and platform. The jury is still out on IPSX, and it is unclear as yet whether market conditions in early 2020 have improved following the political uncertainty which made 2019 a very difficult year for equity capital markets. Perhaps luck will be on the side of IPSX, and history will give this thoughtful development due credit as the precursor to a tokenised market for real estate assets.

Chapter 3: Fractionalisation, digitalisation and blockchain

Summary: digital asset fractionalisation, or tokenisation, has been successfully achieved in limited scale in fine art and machinery, and the real estate market offers a huge and irresistible opportunity to further develop and apply this technology in large scale. Blockchain applications are becoming fit for the purpose of underpinning a tokenised market.

3.1 Fractionalisation through tokenisation

In this chapter, we introduce tokenisation, initially defined as a blockchain-based, digital representation of an asset (MIT Digital Currency Initiative, 2019). We then deal with the connection between blockchain and tokenisation. We will also encounter distributed ledger technology, crypto-currency and security token offerings or STOs, which have broadly replaced initial coin offerings or ICOs.

Fractional asset ownership seen as emerging alternative investment option for institutions

Fractional ownership of properties, yachts and private jets isn't new, nor is the idea of companies that specialize in, and profit from, putting fractional buyers and sellers together.

What is new, though – or new-ish – is the idea that institutional investors might benefit from a new generation of fractional ownership structures, which typically employ blockchain technology, and in some cases a centralized, regulated share-trading “exchange...”

Helen Burggraf Editor, American Expat Financial News Journal

NetJets is the largest private jet aircraft operator in the world, with a fleet of more than 700 planes owned by more than 7,000 fractional owners. Recently a new fashion for fractional ownership of other assets has begun to emerge, fueled in particular by blockchain technology. This is regarded as an especially cost- and time-efficient way of gaining exposure to real assets. This technology is seen as having made it possible for the first time for ordinary investors to access cost-efficient exposure to fine art.

“The problem with fine art as an asset class is that, although it’s very interesting from an investment perspective – given its performance over the last decade, and the fact that it is uncorrelated to almost every other asset class you could name – until now, the only way anyone could participate was if they happened to have a couple of million dollars available to buy a painting,” explained Scott Lynn, the founder and chief executive of Masterworks, a fine art fractional investment house based in New York. “What we’re doing is making it possible for anyone to invest in what we call blue chip artwork, by buying up and securitizing some of the world’s greatest pieces of art, filing them with the Securities and Exchange Commission, and then selling shares to both larger institutional investors as well as retail investors,” Lynn added.

Around 12 months ago Masterworks became the first company ever to file a painting with the SEC when it listed Andy Warhol’s ‘Colored Marilyn’. Masterworks offered 99,825 shares in that painting, at a price of \$20 each, with around 87% spoken for at the time of going to press; shares in a Claude Monet painting, ‘Coup de Vent,’ are also on offer through Masterworks, also for a minimum investment of \$20. The

Masterwork shares are bought and sold through a system that makes use of the Ethereum blockchain. A blockchain-based tokenised market should deliver more efficient, fractionalised, primary and secondary investments. Table 2 lists some platforms set up to achieve this.

Table 2: new generation fractional asset ownership companies

HQ	Company name, website	Sector
London	International Property Security Exchange www.ipsx.com	Real estate
New York	Masterworks www.masterworks.io	Fine art
New York/ Singapore	Maecenas www.maecenas.co	Fine art
San Francisco, California	Harbor Platform Inc. www.harbor.com	Various (blockchain-based tokenization of assets)
London	Feral Horses www.feralhorses.co.uk	Fine art
Bellevue, Washington	Look Lateral/ Fimart www.looklateral.com	Fine art
Zug, Switzerland	TEND Swiss www.tend.swiss	Fractional ownership stakes in various luxury items, including sports cars, fine art, vineyards

Source: Helen Burggraf

So, the argument goes, if it works for art, it can work for real estate. A blockchain-based tokenised real estate market should deliver more efficient, fractionalised, primary and secondary markets. Templum Markets (<https://www.templuminc.com>) is an example of a registered broker-dealer and SEC approved Alternative Trading System (ATS) for private, unregistered digital assets, including real estate. Other platforms based in Europe include Tokenestate, Blockstate, Raay Estate, Exporo, Brickblock and Tokeny.

Tokenisation is being used loosely to describe any use of blockchain to represent an interest in another asset. However, that interest may or may not be direct. By way of example, it could mean holding a beneficial interest in real estate (on the basis that legally only four owners can hold registered title) with the token being evidence of ownership. Voting and income would flow directly through the token. On the other hand the token might actually represent owning a share/unit in an entity which then owns the real estate itself; a more indirect investment. Both could be referred to as tokenisation of real estate. So we think it is just a buzzword being used to describe anything which seeks to introduce blockchain into the investment structure.

London-based law firm

In a typical pitchbook issued by a startup promoting a tokenisation platform, it is commonly claimed that tokenisation could avoid regulation; avoid tax (especially stamp duty land tax in the UK); reduce fees, achieve disintermediation; speed up

transactions; avoid public information being made available; exploit the efficiencies of blockchain; and enable crypto currency trades. How likely is it that these benefits will flow?

Why real estate tokens?

Real estate tokens are digital securities - financial instruments represented using blockchain tokens - granting exposure to an underlying real estate asset or real estate development project. With real estate tokens have all the benefits of digital securities: they are cheap to issue, can be sold directly to investors, and help provide much needed liquidity. We're working with selected companies to help them issue their Digital Security and raise capital from retail and accredited investors internationally. Our clients have access to our full expertise in digital securities, get legal documents & KYC services from our partners, and access to the Tokenestate Platform to efficiently raise funds from thousands of investors.

(Tokenestate website)

We note that an artwork does not typically suffer depreciation or obsolescence, or need refurbishment, or deliver income, making it somewhat less complex as a fractionalised asset than real estate. However, David Schrier makes the case for the tokenisation of real estate. He notes that legal registration systems are being made tech-compatible by several smaller countries – Malta, Mauritius, Cyprus and others – suggesting regulatory arbitrage, risk of mis-selling and a race to the bottom. Tellingly, he uses the example of fractionalising his local coffee shop. Like art, maybe pride of ownership and not risk/return is the driving impulse. He does, however, list plenty of convincing advantages of the digitalised asset class.

Real estate is a massive asset class, representing more than £228 trillion in value (Savills, 2018), but until recently it was subject to transacting in large, ungainly portions (when have you ever heard of someone legitimately buying £10 of real estate?). With blockchain and tokenisation, we can reduce real estate into micro fractional elements, and open it up for investment, asset transfer and economic analysis. The individual consumer could own a portion of his or her favourite local coffee shop. The small real estate investor could have a more diversified portfolio, or one constructed on novel insights about real estate assets. New kinds of derivatives could be created to introduce greater stability or control around risk.

The transactions involved in the purchase and sale of real estate hold the potential for massive simplification and cost reduction in the blockchain era. For example, many real estate transactions today require title insurance and clarity around chain-of-title. Both considerable expense and delay are an accepted reality of real estate transactions for even the simplest of home purchases, much less multi-lot, mixed-use development projects. Other data needs to be tied to the real estate transaction as well, such as environmental assessments and financial records searches. A properly constructed blockchain-based system could greatly mitigate the complexity and sluggish speed of the average real estate transaction.

In the commercial real estate (CRE) world, blockchain can help automate the entire transaction process. Searching for properties is a laborious and data-inefficient process, with multiple and sometimes conflicting data sets that could be harmonised

through a distributed ledger. Time and effort are expended with pre-transaction due diligence. A variety of disparate data needs to be compiled, synthesised and distributed in a controlled fashion. Take, for example, an environmental report detailing whether a building has toxic chemicals stored underneath it or asbestos in its walls. If such things existed in the past but were remediated, one needs to know when this action was taken, what kind of action was taken, by whom, and who has certified that the building is now safe? There are reams upon reams of documents to consider, and a blockchain could help navigate this complexity. Blockchain systems could potentially assist with the organisation and data management of access control, distribution and validation of information quality.

Given that considerable expense and delay are associated with real estate transactions, will blockchain-based systems drive a significant reduction in transaction costs? This depends on what is being tokenised.

Tokenisation is developing as a way of connoting and trading units of beneficial ownership in a property or a fund. Some of us might remember purchasing software held in CDs in a box from a computer shop. To install the software on a device would require a password, or digital token, to be entered before the software became operational. Assuming that a system of unique building identification can underpin a blockchain-based ownership register, why not expand this idea to provide proof of ownership of any asset, including real estate? If we do not trust the supplier of the property to act fairly, why not distribute the proof of ownership to all users? If we wish to transfer our ownership to someone else, surely this distributed ledger technology and digital (smart) contracts can be used to make this happen quickly and cheaply (see Baum and Saull, 2019). And if we wished to divide our asset into many small pieces, surely this could be achieved digitally far more efficiently than by employing traditional legal processes.

“...the concept of tokenisation as a mechanism for exchange is preferable to the archaic mechanisms for settling transfers in unlisted funds today. There are some challenges that need to be overcome or better thought through, but I am sure they are surmountable. Tokenisation would also provide a ledger of transactions thereby adding transparency.”

(London property adviser)

The McKinsey three-horizon theory is relevant in this context. (In this construct, Horizon 1 ideas provide continuous innovation to a company's existing business model and core capabilities in the short-term; Horizon 2 ideas extend a company's existing business model and core capabilities to new customers, markets, or targets; and Horizon 3 is the creation of new capabilities and new business to take advantage of or respond to disruptive opportunities or to counter disruption.)

The third horizon might show the way ahead for the market. But to get there the market should start by developing fundamental digitalisation solutions (the first horizon). Only time will tell how fast the evolution to Horizon 3 will proceed.

The acid test lies, as ever, in economics. What capital investment is required to establish an efficient tokenisation platform? What will be the running and transaction costs compared to conventional fractionalisation? What demand will there be for the product, and will there be enough transactional velocity to amortise the development costs?

3.2 Blockchain and DLT

It is important to understand the nature of a token, which may be denominated in a fiat currency such as Euros, or alternatively in a crypto-currency.

The concept of tokenisation is closely linked with the emergence of blockchain technology. The practice of issuing 'coins' via 'initial coin offerings' (or these days STOs) became the preferred way of fundraising for blockchain startups. Simply put, a legal entity (or even a natural person) issues its own coin or so-called 'token' that offers either rights to a specific service (utility token) or represents some type of investment security (security token). This could be part of the company's equity (an equity token) or a type of debt (a debt token). Tokens are often issued and traded via blockchain or its less ambitious sister, distributed ledger technology (DLT). There is a clear resemblance with 'initial public offerings' (IPOs) and other crowdfunding mechanisms. The main point of innovation is the lack of involvement from a classic middleman such as an investment bank or regulated stock market.

The connection between Blockchain and Bitcoin, a crypto-currency, has negative connotations for many, based on the volatility of Bitcoin, suspicions of illicit activities and the power needed to drive the computing processes of the large number of distributed machines needed to approve a Bitcoin trade. We have also seen over-optimistic business models connecting real estate investment with crypto currencies and ICOs. It seemed feasible in 2017 to raise capital (in Bitcoin, or fiat currency) and to use this capital to buy real estate, thereby taking out the volatility of crypto investment. Because the target investors were crypto-savvy, and preferred to avoid the conventional financial markets, it made sense to issue tokens denominated in a new crypto currency (Propcoin, for example). This turned out to be unrealistic, partly because of Bitcoin's fall in value. New tokenisation schemes using STOs continue to be offered, however: an example is the 2020 Brickmark deal referred to in Chapter 7.

However, connecting blockchain and real estate is by no means fanciful. In a discussion with Samuel Davies, EY's blockchain technical lead in London, we learned that ICOs and cryptocurrencies should be seen as the best proof of concept of blockchain and an example of tokenisation that works very well, with no recorded hacking. The negative connotations mean a limited future for pure crypto-currencies meaning that we are more likely to see fiat-backed digital currencies (such as Facebook's Libra).

DLT is a limited form of digital transaction facilitation. Blockchain is a wider system implying the collation and storage of more (even non-digitalised) information in a decentralised database. The major recent advance is the probability that private blockchains will not be necessary because one open source, public Ethereum-based system will facilitate private transactions via smart contracts. There will be many nodes approving payments, but the details of the parties involved can be hidden from all but those who need to know (this is known as a shield contract). JP Morgan's Quorum system is an example – see below. Blockchains have been too slow and power hungry in processing transactions, but both of these issues are likely to be solved through batch processing.

It is important to think about the tokenisation of property rights in the context of use rather ownership. The work needed to justify the digitalisation of data requires velocity

of transactions, so that the use of a building - security passes, use of power, meeting rooms and so on, which is already fractionalised - will provide more transactions and is likely to be more relevant than the simple tokenisation of ownership. Blockchain and tokenisation can be used to control the right to occupy and use space; this may be the first step before ownership rights are connected to the same system.

JPMorgan Chase's blockchain team has developed a privacy feature for ethereum-based blockchains, obscuring not only how much money is being sent but who is sending it. Revealed exclusively to CoinDesk, JPMorgan has built an extension to the Zether protocol, a fully decentralized, cryptographic protocol for confidential payments, compatible with ethereum and other smart contract platforms and designed to add a further layer of anonymity to transactions. Explaining what the new extension does, Oli Harris, JPM's head of Quorum and crypto-assets strategy, told CoinDesk: "In the basic Zether, the account balances and the transfer accounts are concealed but the participants' identities are not. So we have solved that. In our implementation, we provide a proof protocol for the anonymous extension in which the sender may hide herself and the transactions recipients in a larger group of parties."

One drawback of complex zero-knowledge proving schemes is the amount of computation they eat, potentially slowing down blockchains. But Harris said the extra dose of cryptography to obfuscate participant identities didn't appear to have that effect with Zether.

www.coindesk.com

How would real estate tokenisation work? How would it be regulated? We deal with these issues in Part 2.

Part 2: real estate tokenisation

Chapter 4: How real estate tokenisation works

Summary: tokens are classified as security tokens giving access to ownership, utility tokens providing access to use, or hybrids giving access to both. There have been examples of security tokens being used to fractionalise single property assets, but always involving an intermediate ownership structure, thereby creating a high-cost and regulated investment. The tokenisation of real estate funds is the most natural of all real estate tokenisation endeavours.

4.1 Security and utility tokens

Real estate tokenisation is a broad term and can take several forms. It might refer to representing shares in a real estate investment trust with tokens; or using a token to represent debt secured against a single property; or converting a single property into 100,000 tokens. All these approaches to real estate tokenisation could be more commonly referred to as the digitalisation of assets. For the purposes of this report, real estate tokenisation means the digital fractionalisation of real estate assets, debt and funds. Given the foregoing chapters, we suggest that in practice this is likely to mean the digital fractionalisation of a company, partnership, trust or contract unless or until major jurisdictions fully digitalise their land registry systems, permit multiple ownership of assets and standardise control rights.

We now need to consider the broader taxonomy of tokens (for a fuller description, see Untitled Inc, 2019). There is a difference between security or investment tokens and utility tokens. Within the world of security tokens we should make another distinction, between equity tokens (comparable to traditional shares) and debt tokens (the blockchain equivalent to bonds). A utility token, on the other hand, offers the holder the rights to a specific service, for example building access, the use of meeting rooms, cloud storage and so on. In this report we focus mainly on security tokens, although we can see how building-related utility tokens could become more useful and a standard means of accessing space and being charged for that usage.

Our discussion with EY used the example of tractors owned and used by a farm co-operative in Australia, where the main business issue concerns the financial rights and obligations prompted by the use of the tractors. The work needed to justify the digitalisation of data requires considerable velocity of transactions, so that the use of a building – security passes, use of power, meeting rooms, etc, which is already fractionalised - will be more relevant than simple tokenisation of ownership. Blockchain and tokenisation can be used to control rights to occupy and use space; this may be the first step before ownership rights are connected to the same system.

According to FIBREE, where there are only a few transactions of large value, the involvement of (expensive) middlemen is justifiable. Compare this to the (near) future situation of a complex administrative structure with many short leases and multiple additional services, resulting in many transactions of low value where hiring expensive middlemen outweighs the value they add. This future needs digitalisation, and tokenising real estate could be the key solution to enable it.

Once a real estate asset is represented by a digital security token and governed by the transactional rules of a blockchain, the many frictions of transacting between two

or more parties are considerably reduced. Tokenisation appears to offer investors a solution that allows customisable diversification, transactional efficiency, low fees, online secondary market trading, fractional stakes, risk control, more transparency, portfolio automation, and last but not least higher liquidity due to the fact that the tokenised assets have the potential to become exposed to a global economy.

Raise, a financial technology company, announced a version of its security token platform for testing at Africa Tech Summit in Kigali, Rwanda in 2019. Security tokens are blockchain-based digital representations of financial instruments such as securities, real estate, debt and commodities.

Raise is a software as a service tool for funds, companies and law firms to securely digitize share certificates, partnership units, and real estate assets. The platform creates customized digital securities that can be programmed with custom data, key performance indicators, and shareholder or limited partnership information. The software is built to simplify company ownership with the power of assets, data, and documents in one secure place. Raise's is the first security token product announced on the continent.

A security token is a digital representation of a real-world financial asset (such as a share certificate, loan or land title). They are built with blockchain-based technology, making them highly secure digital assets. Security tokens dramatically improve the security of digital assets, ease fundraising and reduce the costs of cross-border transfer and compliance. Security tokens are gaining in popularity around the world – for their potential to improve capital markets and financial inclusion. NASDAQ recently referred to 2019 as the “Year of the Security Tokens”.

Raise's platform is targeted for the private capital markets industry and is working with a list of companies, private funds and law firms for the launch of the stable software later this year. Raise previously announced partnerships with an association of 16 corporate law firms, the Africa Legal Network, to create a continental regulatory framework for security tokens and launched the African Digital Asset Framework, a project to create open source standards for blockchain technologies. The Framework project is supported by Ambassadors from the African Union, African Development Bank and the Inter-American Development Bank.

4.2 Single asset tokenisation

Aspencoins are tokens which represent the fractional equity ownership of the luxury St. Regis Aspen Resort in Colorado, U.S. These digital assets were sold to investors through a security token offering (STO) which was originally promoted by crowdfunding business Indiegogo and issued by Templum. The offering— an SEC compliant regulated security - had a reported valuation of \$18 million. This single asset transaction is often cited as the first real estate security tokenisation. After the Aspencoin capital raise in October 2018, tokenisation quickly became the talk of the town.

Another of the first tokenised properties is allegedly a parking space in Tech Park Ljubljana (Slovenia, EU). Taken from the project's report (Blocksquare, 2019), “*the tiny property had been sitting on the market for almost 6 months, while tokenisation allowed the issuer to sell it in 16 days and even create a premium on the valuation. The tokens of this property have been trading on a dedicated decentralized exchange since November 2018, while the 20+ token holders have been receiving monthly dividend payouts deriving from the rents generated, all achieved through blockchain and smart contract technology, without traditional banking.*”

However, it should be clear from the preceding chapters in this report that the idea of a tokenised Nirvana is misleading and/or incomplete. The asset itself cannot easily be tokenised without digitalised land title and (in most cases) a change in property law.

Even where that is possible, control issues will need to be negotiated. Existing mechanisms like GP/LP structures and companies deal with this well enough. In the case of Aspencoin, the tokenised asset was common shares in a single asset real estate investment trust, or REIT, much like the assets designed to be traded on IPSX. Figure 2 illustrates this, the most likely route to tokenised real estate.

Figure 2: Tokenising real estate through an intermediate structure



Source: www.medium.com

To spread ownership more widely requires an intermediate structure – a company, a partnership, or a trust. This is likely to put the investment into the regulated world (see Chapter 5).

In addition, tokenisation will not significantly reduce transaction costs where real estate transactions are heavily taxed. In the UK, for example, we might pay as much as 6.75% in purchase costs; tokenisation might reduce this but the majority of the transaction cost will be unavoidable transfer tax of 5%.

4.3 Hybrid tokens

The crowdfunding world was somewhat kick-started by non-investment – meaning that the primary objective of the investors in many early crowdfunded equity raises was not to make money or returns. The objective might have been social or charitable (save the village shop or pub; renovate a dilapidated hostel for the homeless) and the returns zero, negligible or ‘psychic’; or a muddle of do-gooding and investment, where the return on offer might come in the form of free coffee, use of meeting rooms, investor parties and so on.

Real estate assets can be guaranteed to generate such hybrid opportunities, where the benefits earned are not necessarily charitable but are a combination of a utility (the use of space) and a return (income and/or capital). A good example with strong growth potential is the fractionalisation of private residential property, where rent/buy hybrid structures can be partially financed through hybrid tokens. Using these tokens, an occupier of living space can also be an investor in the block, rather than the largely debt-financed 100% owner of an individual apartment.

The combination of a utility and a security token in a what some call a ‘community-token’ is also possible. For example Primalbase (see: www.primalbase.com) is a flex-office concept where token-owners get free-access to every Primal-base location in the world, all token-holders decide together about expanding the community to new locations in the world, provide equity and receive an income return from renting out vacant space to third parties. Hence hybrid tokens have at least two potential applications, and residential shared ownership schemes and community facilities appear to be the more obvious examples.

4.4 Debt tokenisation

Debt markets are an area of great focus in the security tokenisation space, including debt markets for commercial real estate. According to MIT (2019): *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 assets. 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.*

OpenLTV is an open, tokenised passive investment platform where investors can invest in loans backed by U.S. real estate debt, get a token, earn passive income and, in some cases, sell the token on an exchange. Creating a security token based on debt has an enormous advantage over equity, as there is much reduced uncertainty over pricing. Arguments about the value of the asset and whether the secondary market will create a discount to net asset value are largely null and void. In addition, there is no need to be unclear about the nature of the asset ownership being securitised. Debt is arranged as a contract between a lender and borrower. An unregulated contractual arrangement issued by an SPV secured against the asset - which could be a divisible smart contract – can be tokenised and a secondary market established. Once the contracts have been developed and standardised, the debt can be split (or tokenised). As ever, the key to success of such a market will be economics, and in particular the demand for the asset.

It would also be possible to pool different debt security tokens, repackaging their cash flows and rights and creating new securities such as commercial mortgage backed securities with different credit ratings. Synthetic equity can also be developed using a debt plus derivative contract. We return to this issue in Chapter 8.

4.5 Fund tokenisation

Jakob Drzazga is co-founder and CEO of Brickblock Ltd., a real estate-focused blockchain startup based in Germany. The company's software is behind what it claims to be the world's first blockchain-powered real estate fund, launched by Peakside Capital.

Peakside Income Fund 1 aims to raise €200 million to invest in core and core-plus office properties in first- and second-tier German cities, with a focus on assets ranging from €15

million to €75 million. The fund employs Brickblock's ScalingFunds platform to allow investors to make their investments online on a self-checkout basis, permitting trading of fund shares nearly instantly, according to Brickblock.

S&P Global Market Intelligence spoke with Drzazga following the launch of the fund about why he established the company and what it plans to do next.

S&P Global Market Intelligence: What inspired you to set up Brickblock?

Jakob Drzazga: I started the company with co-founder Martin Mischke in 2017 out of a real need, because when I was a real estate developer, I wanted to raise my own real estate fund and encountered many, many problems. These included the very complex, paper-based process, and also the lack of liquidity for investors when they buy a fund share that they cannot really trade out of. And I said, there needs to be a way to make the process more efficient and attractive for investors and fund managers. This is how it was triggered.

It has taken two years for Brickblock to see a client launch a fund using its technology. What were the challenges encountered in getting to this point?

We put a lot of work into really making a stable system. The fund area is not easy because you have to arrange a lot of services with regulated entities. We are working with solarisBank AG, with JTC PLC, which are regulated entities. You have to explain things a thousand times to make sure that everything is compliant, that everything is cleared from all parties, and also make sure that the tech works exactly like it should. It took a long time, there was a lot of work that went into it, but finally we are done and we are live.

The technology Brickblock uses is obviously the most intriguing part of the business for investors. Can you explain some of the challenges you've faced with the technology Brickblock's ScalingFunds platform is based on?

The most important part of our tech, which we have been devoting a lot of time to, is the blockchain technology because it is rather new, having only existed for around 10 years. We wanted to make sure that everything there is executed in the right way, and we spent a lot of time engaging our auditors...to verify that our tech is safe. This is a very important part of what we have been building.

We had to build three portals or entry points for users of our software. One for the investor, who goes through the investor journey and does the know-your-customer process, identification, digital contract signing, and also receiving the digital share. On the other side, you have the fund manager, who can then track to make sure that all of the investors are getting through the process, and can review where they are and see if they need any help. And then the third party ... is the central administrator, in this case, Sanne Group PLC, [which] also needs its own way in so they can see who the investors are and if they are cleared for anti-money laundering.

Brickblock used the blockchain technology it developed to tokenize a number of real estate assets in the months prior to the launch of Peakside's fund on the ScalingFunds platform? Is this an area Brickblock is interested in growing its business?

The tokenization of these assets was a kind of pre-step to making the Peakside fund actually work. You cannot go from zero to 100; you have to take some steps in between because otherwise, it wouldn't work.

We have decided internally that the funds are the ultimate goal and we should have our sole focus on this in 2019 and 2020. We are here for real estate funds and also in the future for other funds, but primarily for real estate funds and we don't want to be distracted with anything else. If there are some other projects which are interesting that would allow us to build relationships, then we would consider it. Because building relationships is a big part of what we do. We're building trust structures so people can actually see how it works with single real estate assets and then get convinced to do something bigger.

So you don't foresee the tokenization of real estate assets becoming a big part of Brickblock's business?

Maybe in the future when we have [standardized] everything and we know everything inside out about how people want their fund to be structured, and we have run through 30, 40, 50 customers, then we might want to focus on another part of the real estate sector and move this forward. But this is future talk. Currently, we are just for the tokenization of funds.

So the market is already there for tokenised real estate funds, and the capital raising or primary market is already being supported by this technology. As another example, the fund manager Franklin Templeton filed a prospectus with the U.S. SEC for a digital USD multi-manager fund in September 2019. The underlying blockchain used is Stellar, a public blockchain. However, there will be no ability to transfer units between investors without going through the manager. There are good reasons for this; the required KYC process means that investors have to be qualified to participate in the investment offering, and the manager will naturally wish to control this process. However, the introduction of secondary market liquidity is a pre-requisite to real innovation.

We discussed this possibility with Brickblock. Having examined and rejected the idea of tokenising assets as a first step into this market (because economics does not support the idea), Brickblock worked with Peakside to develop a digital blockchain platform for capital raising and the KYC process for a fund. Funds often have minimum investment sizes, because the cost of taking on and servicing a client is too high; an automated platform for taking on and qualifying an investor (subject to manager veto) can reduce this cost and thereby reduce the minimum initial investment size. However, the secondary market is only marginally helped; the system is closed to new investors, due to the need for KYC checks. So an internal market is supported, but liquidity is not significant until a much wider platform is agreed and utilised by many managers.

The digital traded fund market place being developed by Synrex is aiming to develop such a secondary market platform. According to Stephen Ashworth, this is *“designed to make less liquid real estate funds more attractive to investors through cost efficiencies and increased liquidity, made possible by using digital ledger technology as the main fund register. We are looking to achieve an evolution of the existing open ended fund structures into digital traded funds, like ETFs in many ways but trading in their own fund industry ecosystem, a specifically designed B2B market venue, linked into the existing mutual fund market infrastructure and distribution channels. Over the summer we have been working closely with a mutual fund industry group who manage the technology infrastructure linking all managers to all investors to handle their mutual*

fund order flows. This group has brought together a consortium of global investment managers looking at the ways new digital technology can be applied in investment management.”

The tokenisation of real estate funds is the most natural of all real estate tokenisation endeavours. The property fund is already in an appropriate legal form so ‘tokenisation’ is just a way of organising distribution and a secondary market. This is because the investor base is already fractionalised; because professional fund managers, who are probably regulated, will be responsible for performance, reporting and so on; and because there is a very inefficient secondary market for fund units. Crucially, the legal entitlements of the fund investors have already been established, as the investable entity will likely be a corporate structure or REIT, a trust, or a limited partnership.

Successfully tokenising a single asset, on the other hand, requires the creation of an untested market for units in single assets; it requires confidence in the platform or promoter, which could be a start-up; it requires a belief in blockchain technology; and it will require the transfer of the asset into a corporate structure or REIT, or trust, or limited partnership, in order that shares or the trust or partnership units can be traded. Is there really enough effective demand to buy units in buildings to justify this expense and overcome the risk of an untried platform? The world of funds, on the other hand, is clearly in urgent need of reform, and the Brickblock business plan is a wise step in this direction.

As we suggested in the opening chapter, it would make sense for tech platforms to develop deep primary and secondary markets for real estate assets and real estate funds. Primary market capital raising is hugely inefficient, as is the exit process for closed-ended fund investors, and the technology is available to improve both processes; technology platforms are already available to facilitate fundraising for real estate funds. For funds, an efficient on-line distribution platform backed up by a secondary market facility will surely help to improve the efficiency of the capital raising process and draw more investors towards a hitherto less available asset class.

Chapter 5: How tokenisation is regulated

Summary: a token which facilitates the trading of units of beneficial ownership in a property or a fund will be regarded by stronger regulatory regimes as a security token and will be subject to investment regulation. Regulatory arbitrage suggests that lighter regulatory regimes will attempt to attract digital business, but it is easier to develop a tokenised security (a real estate company, trust or partnership, or a fund) than to create a security token out of a physical asset like real estate, limiting the scope of such arbitrage.

5.1 Introduction

Anything connoting and/or facilitating the trading units of beneficial ownership in a property or a fund will be regarded by stronger regulatory regimes as a security token. While tokenised debt structures are generally less hindered by regulatory restrictions than other token offerings, a strong regime like the U.S. takes a hard line and generally regards tokens as securities and regulates them as such. The EU takes a more pragmatic view; Switzerland is more relaxed. In the EU, tokens are defined either as utility tokens and unregulated, or as security tokens and regulated. MIFID is highly relevant, and investment managers will be unable to circumvent these regulations.

The UK will assume most investment-oriented crowdfunding ventures to be collective investment schemes, and treat the tokens as securities. They may otherwise be structured as loans, in which case they will be covered by deposit regulations. Because blockchains run globally, there is an issue with conflicts of laws, specifically regarding which national laws should apply to a certain token. The best phrase to describe this condition is regulatory uncertainty, which reduces development and creativity, and increases the costs and risks of doing business. What room exists for regulatory arbitrage can only be imagined as Singapore, Switzerland, Lichtenstein, Luxembourg and many other smaller regimes market themselves aggressively to attract new business. It is clear that unnecessary restrictions on the digital representation of ownership are being cleared away, but the major limitations remain in place.

Liechtenstein's Blockchain Act receives global attention

21.10.2019

With the new “Blockchain Act”, Liechtenstein is assuming a pioneering role in the Token Economy. The law was presented to the public and media on Friday.

With its new Law on Tokens and TT Service Providers (German: Das Token- und VT-Dienstleistungsgesetz [TVGT]), otherwise known as the “Blockchain Act”, Liechtenstein has become the first country in the world to adopt a legal basis for the Token Economy. The law was promulgated two weeks ago. Prime Minister Adrian Hasler and Mauro Casellini, Board Member of the Crypto Country Association ([CCA](#)) and CEO of [Bitcoin Suisse](#) (Liechtenstein), presented the “Blockchain Act” to the public and media on Friday.

Trustworthy Technologies (TT) are aimed at guaranteeing the integrity of tokens. These tokens are data stored on a TT system that represents acceptable legal or membership claims. In terms of digital representation, they function as proof of ownership, for example for works of art, real estate or corporate shareholdings. The Token Economy facilitates the breakdown of assets

among many different owners without the need for central administrative functionalities. Thanks to Blockchain technology, tokens are practically unfalsifiable, rendering a centralized authority as the basis for trust superfluous.

Mauro Casellini comments: “With the Blockchain Act, or TVTG, Liechtenstein is offering the legal basis for the Token Economy and has already received global attention with this legislation”. Profound expertise in this promising future technology is also a precondition for creating attractive jobs in Liechtenstein and securing future prosperity. It will now be important to educate and further train those responsible for enforcing this law. In the subsequent podium discussion, the participants were unanimous in their agreement that implementation of the TVTG represents a key element of the government’s financial sector strategy. The new legislation allows Liechtenstein to position itself as an innovative and legally-watertight location for companies working in the Token Economy.

Generally, real estate is not a regulated asset (this is the view of the FCA in the UK, and the SEC in the U.S.), but a tokenised security offering access to a real estate asset, to debt or a fund will be.

ICOs Are Securities, and That’s Great for Real Estate

The wild world of cryptocurrency is feeling the squeeze from regulators and corporations alike. The SEC has come out saying that they consider all ICOs securities and therefore put them under the jurisdiction of their oversight. They have even created a fake ICO website to troll for potential patsies. Add to that the fact that Facebook, Google, and Twitter all have banned cryptocurrency advertisements, likely because they don’t want to be liable for anyone breaking securities laws.

Now that ICOs are a security, the SEC has added a list of legal requirements about the way that coins and tokens can be formed, reported and advertised. But it also created a clear path towards the acceptance of the fungibility of a digital asset that is valued through an exchange. This would allow security tokens for assets like real estate to be legally traded with an electronic token, eliminating a lot of legal paperwork, broker commissions, and compliance cost.

Harbor is a blockchain company focused creating compliance for digital securitized assets. They were recently featured in an article by Fortune where their CEO Josh Stein had some interesting things to say about how the investment industry is reacting to the SEC’s decision: “There’s a misconception that there’s a regulatory problem or that somehow the regulations need to change. They don’t. You need to comply with rules around the world. If the compliance doesn’t work, nothing else can happen.”

We followed up with Josh and he was kind enough to give us his take on how using blockchain to tokenize securities could benefit the real estate investment world:

“Real estate companies are highly sensitive to the cost of capital and therefore among the best first use cases for tokenization of private securities. Real estate companies also want to diversify their base of investors outside of the usually narrow group of institutional players they commonly deal with. Tokenization can make it easier to reach international investors and lower the investment minimums to reach a broader investor pool.”

When asked what types of real estate would benefit the most from being able to be sold as a token he pointed to the benefits of having a private fund that could still be sold publicly:

“Private equity real estate funds are also a good candidate for tokenization, particularly those overseas and those structured to avoid the liquidity issues that come with the publicly traded partnership rules.”

Propmodo, May 21 2018

In the crypto-world it is often believed that the lack of a regulatory framework offers an advantage in cost and speed, as traditional mechanisms are circumvented. However, it is clear that these ICOs and tokenisations do not operate in a legal vacuum. There is an abundance of financial regulation, tax compliance, property, contract and company law that has to be respected. The ground-breaking Aspencoin security token, for example, was a single asset REIT and an SEC-compliant regulated security.

Many different financial supervisors have now issued statements on token sales, first defining the security token very broadly and secondly making sure that security tokens are treated like any security for regulatory purposes.

5.2 Regulatory issues

Regulated activity (UK)

Under the ‘general prohibition’ set out in the UK Financial Services and Markets Act 2000, no person may carry on, or purport to carry on, a ‘regulated activity’, by way of business, in the UK unless it is an authorised person, or an exemption applies. Regulated activities include dealing (buying, selling, subscribing for or underwriting) in securities, as principal or agent, and arranging deals in securities. If a regulated activity is being carried on in the UK, and no exemption is available, an FCA-authorised person must be engaged. Hence any idea that a tokenisation scheme can circumvent the conventional blockages has to be forgotten, as anything that looks, smells or behaves like a security will be labelled as such.

Financial Stability Board

The Financial Stability Board (FSB), an international body that monitors and makes recommendations about the global financial system, came out with a report (on June 6th 2019) on the financial stability, and regulatory and governance implications of decentralised financial technologies.

The report concludes that If tokenisation were adopted more broadly it is possible that it might create an appearance of liquidity in assets that are inherently illiquid and hard to value.

This may also have negative implications for financial stability. In particular, risks could arise where there is a liquidity mismatch between the token and the underlying asset, or where investors have limited understanding of products packaged into a token. For example, the tokenisation of real estate (were it to become widespread over a large geographic area) might threaten investor confidence in certain areas were investors to overestimate the degree to which the underlying assets could be sold at (or close to) prevailing market prices during periods of stress. The FSB is not convinced that just because something is tokenised and tradeable on the blockchain, its liquidity cannot be dangerously overestimated by the market.

The FSB suggests that it is important that regulators continue to assess the degree to which current rules provide adequate safeguards in the case of tokenisation. The shift towards smart contracts and self-executing code could also create specific governance and accountability issues. These include the question of whether – and to what extent – software developers, system operators or users can be held responsible if contracts do not function as intended.

UCITS

The Undertakings for the Collective Investment in Transferable Securities (UCITS) is a regulatory framework of the European Commission that creates a harmonised regime throughout Europe for the management and sale of mutual funds. UCITS funds can be registered in Europe and sold to investors worldwide using unified regulatory and investor protection requirements. UCITS fund providers who meet the standards are exempt from national regulation in individual European countries. UCITS V, or Directive 2014/91/EU, which came into force in March 2016, aligns fund depositories' duties and responsibilities and fund managers' remuneration requirements with those of the Alternative Investment Fund Managers Directive (AIFMD).

Because they are seen as very safe and well-regulated, UCITS funds are very popular investments. According to the European Commission, they account for around 75% of all collective investments by small investors in Europe. Many mutual fund providers use an expression such as 'UCITS-compliant' as part of their marketing strategy. While the funds are regulated in Europe, buyers from all over the world can invest in UCITS funds. At the end of 2017, the total net assets of European investment funds reached EUR 15.6 trillion. Close to 32,000 of these funds were UCITS compliant and about 28,300 of these funds were Alternative Investment Funds, according to the European Fund and Asset Management Association. UCITS compliance will be a key issue for intending issuers of tokenised real estate seeking scale economies.

Regulation crowdfunding (U.S.)

In the U.S., Regulation Crowdfunding (SEC, 2019) enables eligible companies to offer and sell securities through crowdfunding. The rules require transactions to take place online through an SEC-registered intermediary, either a broker-dealer or a funding portal; permit a company to raise a maximum aggregate amount of \$1,070,000 through crowdfunding offerings in a 12-month period; limit the amount individual investors can invest across all crowdfunding offerings in a 12-month period; and require disclosure of information in filings with the SEC and to investors and the intermediary facilitating the offering.

Security tokens and tokenised securities

MIT Digital Currency Initiative (2019) makes a further distinction between *security tokens* and tokenised *securities*, as follows.

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 paper 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.

In other words: it is easier to develop a tokenised security (a real estate company, trust or partnership, or a fund) than to create a security token out of a physical asset like real estate. We believe that this is a significant finding that should guide future activity from the possible to the pragmatic.

Chapter 6: Trading, valuation and accounting issues

Summary: there are no significant tax, accounting or valuation issues likely to impede the development of tokenised real estate securities. However, a tokenised secondary market is very unlikely to offer strong liquidity at a price which reflects the relevant proportion of net asset value, greatly limiting the appeal of tokenisation schemes for single real estate investment assets.

6.1 Valuing fractional interests

There is no specific mention of valuations of fractionalised interests in any valuation guidance issued by bodies such as the RICS, IVSC or TEGoVA other than guidance such as “the interest should be valued as a *pro rata* fraction of the entire [issued share capital]” (IVSC, 2017). However, it is recommended that “*valuation should consider the rights of each different class*”: this could lead to interesting questions being asked about fractional ownership and the potentially different rights different fractionalised interests convey. Should smaller units be worth more than NAV because they are affordable and liquid? Or less, because they confer no control?

At best, a fractionalised market can help real estate valuers by providing a more constant stream of transaction evidence. Transactions of trivial amounts will not provide significant market evidence, but larger and more observable total volumes or individual transactions of larger amounts could serve the conventional real estate market and valuers very well.

However, marriage value will become a complex problem. For assets other than those that are highly liquid, it is clear from previous attempts at fractionalisation that there is a large risk of fractional interests trading at large discounts to the value of an undivided whole. Fractionalised instruments are expected by some experts to trade very infrequently, and at a large bid-offer spread. If this is the case, how will the value created by the potential merger of interests be apportioned by valuers?

The management of real estate valuations in the context of public markets where such information is share price sensitive needs to be considered. In the case of publicly listed real estate companies and the valuation services provided to them, pre-knowledge of a valuation outcome is confidential and in the wrong hands can cause harm to the public. In large listed companies these problems are managed. Moving to smaller assets and different structures, problems will start to arise, opening up the possibility that well advised sellers might dump overvalued shares on unsuspecting buyers. The need for real time transparency will not initially be matched by standard disclosure processes and information asymmetry will be a problem.

6.2 Setting trading prices for digital assets/instruments/funds

Any market place for trading financial instruments needs a mechanism enabling price matching to happen. Different asset classes and instrument types have adopted different approaches to meet their needs.

Two key factors dictate the optimal mechanism: these are frequency of trading activity and transparency of information. More transparent and frequently traded instruments (for example, equities listed on a major stock exchange) are more likely to be traded electronically using a central limit order book or CLOB (see below). Less frequently

traded and less transparent instruments, including bonds and real estate, are suited to more bespoke broking or matching platforms relying upon indications of interest. As the take up of digital investments develops, the increased ease of tradeability built into these instruments will logically push them towards an electronic style trading market. However, this does not mean that CLOB will offer the optimal approach for digital assets or funds with real estate portfolios.

A CLOB system produces a live, fully lit market, usually open for most of the day. This means there is full transparency concerning trading volumes and prices in the order book and any order entered into the market can be filled instantly if there is a match. Market makers play a key role facilitating liquidity via their commitment to make a firm bid and offer for a defined and usually small trading size. As flows change, so do the market makers' prices, which drives volatility intra day and from close to close.

A CLOB market will trade to the highest or lowest marginal price. This means it is possible that a small order size at the marginal high or low price can set the snapshot market value of a business or asset. This approach works well with good transparency of information and a good frequency of volume of trading. However, where there is liquidity, this system will tend to encourage volatility.

Investors in real estate funds tend to prefer these fund instruments because, historically, they have low price volatility. However, in moving towards the greater tradeability offered by digital funds, we open the door to more price volatility. What is the optimal price matching mechanism for such a market?

Most of the time, in any given day or week, we would not expect real estate to see significant changes in value. If we want to generate liquidity for assets that do not change in value, a better approach might be pool trading interests into time-limited windows and find a single trading price for all transactions rather than run a market open all day with lots of smaller price matches. This is much more akin to how daily traded funds currently operate. Running an auction process in this time-limited window could be a different way to achieve price matching. Once a price is fixed it could become the trading level for that day. Metals markets and some bonds already trade using such price-fixing auction processes.

Additionally, matching methodologies found in CLOB markets could be adapted to prioritise maximising volume over marginal price. This means that the trading price is fixed at the level that finds the maximum matched volume, and not the highest or lowest price level from the order book. Over time this could provide a much more representative price point for marginal trades than the highest or lowest price point set in a CLOB. It should also serve to keep volatility lower than it would otherwise be.

6.3 Accounting issues

According to EY (2018), dealing with crypto-asset accounting requires a detailed understanding of both distributed ledger technology and relevant accounting concepts. However, a non-crypto token does not present any particular accounting issues beyond the valuation issues discussed above. What is the fair value of an illiquid token?

In its broadest economic sense, fair value represents the potential price, or the value assigned, to a good or service, taking into account its utility, supply and demand for it,

and the amount of competition for it. If units or tokens trade on an exchange, investor demand for the stock largely determines the bid and ask prices, and the exchange is a reliable method to determine a stock's fair value. To repeat the point: if fractionalised instruments are expected by some experts to trade very infrequently, and at a massive bid offer spread, how will the value created by the potential merger of interests be apportioned in accounts?

Chapter 7: Real estate tokenisation: the story so far

Summary: there is no ‘official’ record of successful – or unsuccessful – recent attempts at real estate tokenisation. Working with FIBREE, we have compiled an initial but not exhaustive list of successful real estate tokenisations. We find evidence of 16 successful tokenisations, of which nine were funds, six were single assets (all involving intermediate legal structures such as a REIT), and one was debt. More are in the pipeline, and there are several platforms ready to support product launches, but there have been several failures.

7.1 The first trade: 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 from 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 provided by Templum to whitelisted investors, and whitelisting is also provided by Templum.

CrowdFundInsider, 2019

7.2 FIBREE/CBRE/Oxford survey evidence

There is no ‘official’ record of successful – or unsuccessful – recent attempts at real estate tokenisation. The FIBREE Industry Report on Blockchain Real Estate, 2019 reported interviewee opinions that the most important use of blockchain in real estate is likely to be real estate investment; and that within this category by far the most popular use is asset-backed security tokens. In this report, with FIBREE’s assistance, we have attempted to list successful reported real estate tokenisations. In a November 2019 FIBREE/CBRE/Oxford survey, there were 54 respondents, of which 21 completed the full survey. 97 tokenisations were mentioned, with 16 fully reported, a total investment volume of €71,865,000, and an average volume around €4.5m in a range from €10k-20m Euros per investor. The number of token holders ranged from 1-71, and there was a 50:50 split between single-geography and cross-border transactions.

Amongst the promoters, there appears to be no one clear market leader at present. All respondents expect either steady or rapid growth in real estate tokenisation in the next five years; the main advantages were seen as speeding up transactions, reducing fees and fractionalising lumpy assets.

We combined this FIBREE/CBRE/Oxford data with our own desk research to track as many completed and proposed tokenisations as we could find. The data presented in

tables 3a, 3b and 4 should be regarded as a provisional description of a nascent market; we hope to develop a more formal survey following this report.

Table 3a: real estate tokenisations (1)

Promoter	Domicile of Promoter	Label	Type	Size (€)
Aspen Digital	United States	Aspen Coin	Single Asset	16,330,200
Blockimmo	Switzerland	Hello World	Fund	2,705,600
Blocksquare	Slovenia	Techpark	Single Asset	15,000
Bolton	United Arab Emirates	Bolton Coin	Debt	61,537,800
Brickblock	Germany	Peakside Fund	Fund	2,200,000
BrickMark	Switzerland	BrickMark	Single Asset	110,000,000
Equitybase	Hong Kong	BASE	Fund	5,290,300
Evarei Management	Cayman Islands	Evareium	Fund	1,814,500
Fraxtor	Singapore	Fraxtor	Single Assets	small
iCap Equity	Washington, US	iCap Equity	Fund	1,130,000
Max Property Group	Netherlands	Max Property Fund	Fund	6,090,000
Peakside	Germany	Peakside Fund IV	Fund	Up to 200m
Property Token SA	Luxembourg	Belval	Single Asset	small
QuantumRE	United States	Quantum REIT	Fund	20,000,000
Resolute	United States	Resolute Fund	Fund	up to 100m
Shojjin	United Kingdom	Smartlands PBSA	Single Asset	1,000,000
SocialRemit	United Kingdom	CSR	Single Asset	2,078,700

Source: FoRE/CBRE/FIBREE

Table 3b: real estate tokenisations (2)

Promoter	Investors	Date	Real estate domicile
Aspen Digital	-	October 1, 2018	United States
Blockimmo	4	March 2019	Baar, Switzerland
Blocksquare	>10	2019	Ljubljana, Slovenia
Bolton	-	March 1, 2019	United Arab Emirates
Brickblock	-	October 31, 2019	Germany
BrickMark	-	January 2020	Switzerland
Equitybase	-	February 28, 2018	U.S., UK, Hong Kong
Evarei Management	-	September 1, 2018	United Arab Emirates
Fraxtor	-	2019	Singapore
iCap Equity	3	October 2019	Washington and Oregon, United States
Max Property Group	209	2016-2019	Netherlands, Germany, and UK
Peakside	-	June 2019	Germany
Property Token SA	-	2019	Luxembourg
QuantumRE	12	Unknown	California, United States
Resolute	-	2019	United States
Shojjin	-	2019	Nottingham, UK
SocialRemit	-	May 1, 2019	UK

Source: FoRE/CBRE/FIBREE

Tables 2a and 2b report successful tokenisations of assets, funds and debt. In tables 2a and 2b we list 17 potentially successful tokenisations: nine were funds; seven were single assets, all involving intermediate legal structures such as a REIT and some intended to add more assets to create funds or REITs; one was debt. Our evidence of completed or in-progress real estate tokenisations are all in units of funds, shares in companies, SPVs or REITs, or corporate bonds. More are in the pipeline, and there are several platforms ready to support product launches, but there have been several failures.

7.3 Pipeline

In the University of Oxford and FIBREE survey, we asked FIBREE members to provide more information about their future plans. We report a selection of this responses here.

Tokeny (Luxembourg) is currently working with seven issuers of securities in the real estate industry. Some of them are marketplaces and investment banks and therefore multi-issuers, meaning they are tokenizing securities regularly. Debt, funds and equity are all types of financial instruments used by these issuers. They mostly tokenise to reach a global audience of investors and to improve the transferability of their assets. Early in 2020, Tokeny plans to release a compliant OTC exchange system for tokenised securities. It will use offchain orderbooks and onchain settlement. The compliance will be enforced in every trade using T-REX tokens and an onchainID system. The operators of these exchanges will be the issuers themselves, but also specialized operators such as traditional stock exchanges and digital asset exchanges. The orders can be shared across the network of exchanges enhancing liquidity.

iEstate (Germany) is a tech platform that has developed or is developing a system for the tokenisation of real estate, having built a complete tokenisation platform on Ethereum, based on the ERC-1400 Standard. The smart contracts have been audited by Consensys and the platform says that it is in the final stages of integrating this into their existing real-estate crowdfunding platform. They are looking to launch their first tokenised projects early next year.

UPRETS has been working hard on the tokenisation of The Oosten, an apartment property in the Williamsburg submarket of Brooklyn, N.Y. Funded by Chinese real estate firm Xinyuan Real Estate Co., UPRETS is a digital security issuance platform with a focus on transforming the global asset market. The securities in issuance are shares of the real estate fund, which will, in turn, be represented by a token (a tokenised security).

Leaseum Partners (Leaseum, 2019) has proposed a \$250 million tokenised real estate fund which uses blockchain technology to issue shares in a fund, a portfolio of New York real estate.

Having considered asset tokenisation and then mezzanine debt tokenisation, London and **Oxford Properties** is now working on developing and selling a tokenised real estate fund which owns five office buildings in Central London and Jersey. This will, the company hopes, be sold to the retail market in China.

Table 4 lists some recent propositions, including both platforms and deals which may or may not have launched. Other proposals are in the pipeline in Chile, Germany and the U.S. Some have been advertised and then withdrawn.

Table 4: proposed real estate tokenisations

Promoter	Label	Target assets	Size (€)	Status	Real estate domicile
BlockEstate	US real estate	United States	n/a	proposed	US
BTG Pactual	ReitBZ	South America	n/a	proposed	Brazil
Harbor	Convexity	United States	20m	cancelled	South Carolina, US
Fundament Group	Real Estate	Germany	280m	proposed	Germany
Konkrete	Rental housing	Australia	n/a	proposed	Australia
Leaseum	US real estate	United States	250m	proposed	New York, US
London and Oxford	Tokenhouse	London offices	300m	proposed	UK
SK Securites	Kasa Korea	South Korea	n/a	proposed	South Korea
SwissRealCoin	Swiss Real Estate	Switzerland	n/a	proposed	Switzerland
Timeless Luxury Group	Leisure assets	Western Europe	n/a	proposed	Global
UPRETS	Rental housing	New York	29.5m	proposed	Delaware, US

Source: FoRE

7.4 Failed transactions

Yahoo Finance (2019) offers a reality check.

Here's a reality check – or realty check, as it were – for tokenization evangelists. The idea of combining blockchain tokens and U.S. real estate was peaking at the start of this year, with college dorms, ski resorts and swanky Manhattan apartment blocks lined up to redefine the commercial mortgage market. Following 2017's initial coin offering (ICO) circus, a second wave of grown-up investors would raise capital and issue loans using blockchain-based tokens, and in the process disintermediate an army of middlemen and bankers. A regulated approach, offering so-called security tokens to select groups of investors, would breathe frictionless liquidity into real estate's legacy system of finance. Such high expectations (and hype) were epitomized in a joint venture between technology providers Fluidity (backed by Consensus chief Joe Lubin and Galaxy Digital's Michael Novogratz) and digital asset-focused broker-dealer Propellr.

However, the seismic disruption of the multi-trillion dollar real estate market so hotly anticipated hasn't happened. Underscoring the disappointment, the Fluidity and Propellr project was quietly shelved earlier this year. The joint venture was never officially consummated and the firms have since gone their separate ways. Neither side would discuss the specifics of the venture's cancellation. But both agree that the tokenized market wasn't ready for the real estate use case. "The market was just too young at the time," said Sam Tabar, a co-founder at Fluidity. "It didn't have sufficient institutional appetite." He described the Propellr partnering as "a contemplated joint venture" in which Fluidity was to be a minor shareholder.

As it stands, trading of private placements and structured transactions in assets like real estate is infrequent and the price is typically lower than net asset value. Tokenization was seen as a

way to remove friction around the transfer of ownership and stimulate liquidity in secondary markets. Security token offerings (STOs), which are regulated financial instruments, are a workable fit for the tokenization of real-world assets such as real estate – at least on paper. Making use of an exemption in U.S. securities law called Regulation D, STOs operate like private placements, typically allowing smaller companies to raise capital by selling equity or debt securities to select investors without going through the arduous registration process. The only thing missing from this brave new token economy was institutional capital to come piling in. “Tokenized real estate came with an embellished promise,” said Todd Lippiatt, CEO at Propellr. “It came from a place where people were actually mixing verbiage. From my personal perspective, what they were claiming as liquidity, is really market access. Institutions want to see liquidity before they will go ahead and re-engineer their entire back office.

Meanwhile, issuers have to get tokens into the market to prove their thesis, leading to a chicken-and-egg problem. Instead of institutional participation, the hype led to a kind of “adverse selection” phenomenon, said Lippiatt, attracting people who didn’t have a better option to raise funds, or who had spent a lot of money building blockchain token infrastructure and wanted to follow through with one of their own projects. “I think at one point we had \$3 billion worth of interest in tokenization,” Lippiatt said. “But once you started to sift through it all, there was a bunch of people who wanted to raise money for really bad deals.”

Fluidity and Propellr are in good company when it comes to hiccups and rethinks. Also earlier this year, a deal to tokenize \$20 million worth of student housing put together by blockchain startup Harbor and the real estate arm of Chicago-based trading firm DRW Holdings fell apart.

However, in January 2020 BrickMark claimed the largest token real estate transaction to date, announcing the purchase of a prime commercial building in Zurich from RFR Holding in an off-market deal (Medium, 2020). This was a share deal in which a significant part of the purchase price of around €120m was to be paid in BrickMark tokens.

As previously noted, a degree of inside help may be needed to launch a new product. RFR had only acquired this building in summer 2019, and will remain a 20% shareholder in the asset and will lead the redevelopment process, so these two transactions are not wholly independent. (Again, innovation sometimes requires a helping hand. According to BrickMark’s CEO Stephan Rind, “RFR’s interest in innovation in the real estate industry was certainly helpful.”)

BrickMark describes this purchase as the start of the development of a large international real estate portfolio, which is to be financed primarily with its own tokens. The BrickMark tokens will be based on the Ethereum blockchain (the ERC-20 protocol) and it is reported that it is proposed to make use of smart contracts to establish the detailed rights and entitlements of the token holders. These will include claims by the token holders for recurring payments from the rental income and participation in the value growth of the portfolio.

Dr. Alexander Koblischek, Managing Director of RFR Management GmbH is quoted as saying: “We gladly accepted the BrickMark tokens as part of the purchase price. We assume that digital financial instruments will also significantly gain in importance in the real estate sector in the future. The current transaction may have an icebreaker function for the sector in terms of its volume and institutional character”.

However, the transaction is not exactly as reported, operating as an option, meaning that the vendor is not wholly exposed to the downside risk held in the value of the tokens. According to another tokenisation platform, several deals like this have failed in the US (see above) and in these transactions there was always a non-tokenised way out that was usually unpublicized.

In this deal, it appears that Brickmark has acquired the real estate and in exchange issued a profit participation bond representing 100% of all profit coming from the asset (or portfolio, as and when more buildings are added) including any increase in value. This will likely be documented with a legal contract, but each note will additionally be evidenced by a blockchain entry (token). This would be a low risk transaction that can be reversed easily.

In a conversation with BrickMark CEO Stephan Rind, we established the following details.

- BrickMark aspires to create a fund, or, more accurately for regulatory reasons, a next generation digital REIT through the development of an operating real estate business.
- The BrickMark token provides an income based on the funds from operations (FFO) from the platform (a 97.5% distribution). Ideally more buildings will be added to back the tokenised REIT.
- RFR Holding will be paid in BrickMark tokens but only subject to a successful token generating event some time in the 12 months following the announcement.
- The tokens will give a right to 97.5% of the capital value and 97.5% of the net income structured through a bond whose coupon is formally linked to the operating company's net cash flow or FFO.
- If they become illiquid, the tokens can be retired and the asset sold, so that RFR and any other token investor has the backstop or downside protection of NAV.
- If the tokens are successful, the asset vendor has the upside of any premium for popular and liquid tokens.
- The BrickMark token and platform could be licensed for use by other tokenised operators in the future.
- The token buyers are expected to be smaller institutions and high net worth investors.
- It is likely that the domicile of any token-generating event (what many would call an STO) will be Luxembourg or Lichtenstein.

To conclude, the BrickMark transaction illustrates three key points.

1. The tokenisation of a single real estate asset is not a goal in itself but a stepping stone on the way to the development of tokenised funds or REITs.
2. This is not an asset tokenisation, but the tokenisation of the existing shares in an SPV (like AspenCoin). Barring radical change in land law, this must always be the case in most jurisdictions, as there has to be an intermediate structure and in this deal the intermediate corporate structure had already been put in place.
3. As illustrated by the first IPSX listing, Innovation sometimes requires a helping hand.

Part 3: the future and conclusions

Chapter 8: The future of real estate tokenisation

Summary: if real estate tokenisation were to become popular, several innovations become conceivable, including structured finance, hybrid real estate tokens and digital fund exchanges.

8.1 Structured transactions

Inevitably, due to the perceived size of the opportunity, the headlines regarding real estate tokenisation focus on the potential for digital fractionalisation of single assets. For a variety of reasons, this focus is likely to be misdirected. We are more confident of the prospects for the tokenisation of debt, and (especially) funds. But there may also be more creative possibilities.

According to Harbor CEO Josh Stein in an interview with TermSheet: *“With tokenization technology, you could create leveraged longs and leveraged shorts. You can go long French impressionists and short modern art. You can do the same with real estate — I tear off a 10% strip of all my Class A in Midtown and create a Midtown fund. Class A in Upper East Side, Downtown, Brooklyn, Jersey. I can go long Manhattan, I can go short Brooklyn. Yes, there will be some gambling going on, but what’s interesting is that if I’m a property developer and I just put a huge amount of capital into Manhattan, I could effectively hedge my position very cheaply and efficiently”.*

Alpesh Doshi, of digital transformation consultancy Fintricity, has a similar vision. He argues that the real estate market will change significantly over the coming years, with change being driven primarily by digital technologies, such as blockchain, AI, and the Internet of Things (IoT) that will transform the lifecycle of a real estate asset. He envisages new ways of financing real estate as an alternative to traditional investment models.

Over the past 20 years, we have seen digital technologies transform many industries. Real estate has been relatively unaffected until recently. With the ability we now have to implement digital technologies, such as IOT, Big Data and AI cheaply and in scale, Proptech has emerged as a new market imperative that will bring significant change. Any property, whether commercial or residential, can now become ‘live’ with the ability to collect data that can be used in many ways, not least to measure and track every aspect of any asset and its tradable value. The data that can be produced from an asset includes measurement of its energy footprint, the performance of lighting and heating, and (via sensors) the movement of people in a building. These and many other factors will feed into valuations, and how real estate will be used, via tokenisation. As real estate tokenisation achieves scale, decentralised structured finance and structured products encapsulated in smart contracts will become prevalent.

MIT (2019), when summarising the perceived benefits of real estate tokenisation, include structured products:

Information, payments, and requests 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.

8.2: Single asset exchanges (IPSX)

IPSX appears to be an initiative designed to achieve a conventional, non-tokenised market for shares in single assets. It has an advantage over tokenisation because there have already been considerable sunk costs in a creative yet familiar and regulated solution without the need to jump into the unknown blockchain world. However, other objections (especially a lack of evidenced demand plus pricing uncertainties) remain.

The opportunity remains to pivot this proposition into a financing tool for owner-occupiers, for example by selling income strips, and hence a means of developing structured finance products. It would also make sense to develop IPSX further into the tokenisation world – to develop tokenised securities (digital tokens representing IPSX shares in IPSX-listed single-asset property companies), subject as always to evidence of demand for fractionalised single real estate assets, or (better) portfolios of single assets and funds.

8.3 Fund exchanges

Digital Fund Exchange, a new UK platform, has been exploring the opportunity to create a scalable next generation B2B real estate investment platform with greater liquidity and transaction efficiency. According to Stephen Ashworth:

Digital Fund Exchange's objective is to make less liquid asset class funds like real estate and alternative assets more accessible to investors through lower cost structures with increased fund unit liquidity, made possible in part by using digital ledger technology as the main fund register. We are looking to enable evolution in existing industry fund structures into digital traded funds.

Our ecosystem will bring together investment managers and investors for new digital fund issuance, and developing both primary and secondary markets in a fund industry network linked by private distributed ledger technology. The application of transparent and fair price matching auction algorithms offers a new approach to fund unit liquidity leveraging existing investor networks without the need for market makers.

We envisage a wide range of opportunities for digital traded funds to hold less liquid alternative investments. In real estate digital funds could cover UK/EU/US/Asia open ended real estate funds; unlisted REITs; loans and real estate debt funds; and real estate private equity vehicles. Proposed benefits from digital traded funds for managers and investors include near real time settlement, near instant re-allocation across instruments with different risk factors, anonymity preserved, improved liquidity, a near real time audit trail of activity to approved parties, and significant operational and investor reporting cost savings.

8.4 Hybrid tokens

We have expressed our scepticism regarding the potential for the digital fractionalisation of single assets. For a variety of reasons, there is a risk that a focus on this application will result in a misallocation of resources and negative publicity for tokenisation. We are more confident of the prospects for the tokenisation of debt, and (especially) funds. But there may also be more creative possibilities.

The hybrid token, a combination of security and utility, has some promising applications. In the residential space, fractional investment has some momentum, offering semi utility, semi security tokens as the way prospective shared ownership schemes might develop. Also, community facilities – including hotels, pubs, bars, restaurants, coffee shops – have raised capital through prototype hybrid tokens. Hotel Chocolat, for example, raised capital by offering dividends paid in chocolate.

There is a growing body of opinion lining up behind the disruption effect of real estate tokenisation and the innovation opportunities that will follow. What tokenisation formats will be most popular?

Chapter 9: Conclusions

Summary: tokenisation is at an early stage of its development, and real estate applications will take time to develop and become accepted. In order to judge the likely future for real estate tokenisation, we need to balance the advantages created and the likely effective demand created with the costs incurred. The acid test lies, as ever, in economics. What advantages will in practice be delivered to market participants? Will this value outweigh the costs? There is a clear danger that innovation will be set back by years and possibly decades if attention is focussed solely on the digital fractionalisation of single assets, for which the demand is limited, the economics unconvincing and the obstacles significant.

9.1 What does tokenisation deliver?

In this report we have considered the nature of real estate as an asset class; looked at the drivers for and history of real estate fractionalisation; and examined the possibility of achieving fractionalisation through digital tokenisation. We have distinguished between utility tokens and security (or investment) tokens; and between the development of security tokens to fractionalise single assets, debt or funds. In order to judge the likely future for real estate tokenisation, we need to balance the advantages created and the likely effective demand created with the costs incurred. The acid test lies, as ever, in economics. What advantages will in practice be delivered to market participants? How highly are they likely to value these advantages? Will this value outweigh the costs? What capital investment is required to establish an efficient tokenisation platform? What will be the running and transaction costs compared to conventional fractionalisation? What demand will there be for the product, and will there be enough transactional velocity to amortise the development costs?

In Chapter 3, we suggested that in the ideal world tokenisation would perhaps avoid regulations; avoid tax (especially stamp duty land tax in the UK); reduce fees, achieve disintermediation; speed up transactions; avoid public information being made available; exploit the efficiencies of blockchain; and enable crypto currency trades. It is clear from our research that only three of these gains (speed, privacy, blockchain) have a realistic chance of being introduced via tokenisation. More pragmatic, perhaps, is the summary in Table 5.

The economic benefits of tokenisation will depend greatly on the application being developed. The key mismatch between the popular conception of real estate tokenisation and a realistic vision of the near future is the often-painted picture of a single property asset being tokenised for the retail investor, when this is (in our opinion) very unlikely to gather significant momentum. We would go further and point out the danger of investing too much into single asset tokenisation, which appears to be the largest market opportunity, but also the most challenging. It is better to invest in blockchain-supported solutions to economically advantageous innovations with a proven demand than to risk undermining the appeal of the technology by mis-applying it.

Whatever opinion we develop from the evidence presented, it is clear that the market for real estate tokenisation is in its very early days. There are many committed evangelists and several examples showing the potential of the technology. To grow faster, the market needs broader adoption and understanding of the benefits and

challenges of these new products, and the continued monitoring and reporting of new developments.

Table 5: Benefits of real estate tokenisation

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

Source: MIT (2019)

9.2 Security tokens for single assets

Security tokens for single assets are not, in our opinion, likely to be successful in sufficient scale in the near future. Barring IPSX taking off in 2020, the history of attempts to create single asset fractionalisation has been negative, with limited evidence of demand.

The real problem (with SPOTs, PINCS and SAPCos) was the lack of a market for this type of security. Only investors who understood property and its foibles were interested and, for them, direct ownership was the natural preference. Traditional equity investors taking a punt on real estate stuck to the big public property companies with their track records of good management.

Europroperty magazine, 1995, quoted in Roche (1995)

Crowdfunding equity into real estate syndications has not been a popular success, producing less than 0.25% of European transaction capital over the 2015-2017 period.

MIT (2019) summarises why this is the case, with a set of arguments for and against tokenisation of single assets for the retail investor.

Arguments for:

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 disclosures.

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).

Arguments against:

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.

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).

Source: MIT Digital Currency Initiative, 2019

We would add another couple of negatives. First, the risk of a single asset underperforming when, as is pointed out above, retail investors typically lack the skills to properly value real estate investments suggests that investors should be better served by investing in diversified REITs or funds managed by professional fund managers.

Second, the asset will either need to be tokenised in a jurisdiction which allows for many owners, and complex control and management issues will then need to be agreed and eventually standardised; or it will be necessary to set up an expensive intermediate ownership structure (a company, partnership or trust, for which control and management issues are standardised and understood).

There is a risk that this is an elegant technology solution to a very small problem; or even a solution which a majority of market participants do not wish for, as they would prefer not to see a liquid, volatile secondary market for shares in single buildings, especially when it is not clear how fractional assets will trade relative to NAV. Yet, without liquidity and the accompanying volatility, the development costs will be too

high, as the market will have no velocity of trades. There are unanswered questions to do with control and maintenance costs, and it seems clear that the conventional costs of setting up an intermediate legal structure to hold the assets cannot be avoided.

The distinction between primary and secondary markets is also important. Most of the development costs for tokenisation will be front loaded and borne by the primary market, yet many of the advantages are likely to be delivered through secondary market liquidity – unless owners can expect to see a liquidity premium baked into primary market pricing.

9.3 Utility and hybrid tokens

Utility tokens have good prospects of widespread near-term adoption. The likely effective demand for an efficient token-based system recording and charging for the use of space, the use of energy and the use of consumables such as food and drink is guaranteed to be high. This is a natural extension of pre-paid credit cards that act as intelligent building passes, and of the WeWork model for flexible space use. The cost is unlikely to be high, and the development costs incurred will be spread over a very large number of transactions.

In addition, hybrid tokens offering a combination of a utility (the use of space) and a return (income and/or capital) have a promising future. Examples include fractionalised private residential, where rent/buy hybrid structures are partially financed through hybrid tokens, and community facilities.

9.4 Debt securitisation and tranching

Debt markets are an area of great focus in the security tokenisation space, including debt markets for commercial real estate. Blockchain-based smart contracts could standardize data formats and dramatically lower the administration costs of servicing debt. This will lead to more readily accessible information being made available for real estate asset-backed securities valuations. This is an area of significant promise.

9.5 Tokenising funds

This should be an easy win for tokenisation. The intermediate legal structures have already been created and are well understood. This is already a fractionalised market, with a long record of demand for both primary issuance and secondary trading. Funds are already likely to be regulated, as any security token would have to be. The costs of traditional primary capital raising are very high, and tokenisation is a way to produce cost savings at a time when manager fees are a high proportion of investor returns.

More attention needs to be paid to this clear opportunity; if demand for this product is proven, the market for the tokenisation of large single assets might then follow.

9.6 Summary

The challenge for proponents of the tokenisation of single assets is that two radical developments have to be simultaneously accepted. First, there needs to be an expressed demand for the fractionalisation of single real estate assets. Evidence of this is at best sketchy, both through history and in the current period. Second, market

participants need to be comfortable with blockchain, the digital underpinning of tokenisation.

Connected to this is the cost of fractionalisation and the cost of tokenisation. In many land markets, fractionalisation requires an intermediate structure to be established because the direct ownership of land cannot be split into many pieces. Even where this is not the case, agreement needs to be reached regarding the control of fractionalised assets. For certainty and risk control, not to mention regulatory compliance, it makes sense to reproduce existing structures which have been proven to govern fractionalised investments. Globally, these appear to be limited companies or LLCs, partnerships, trusts or dedicated contractual systems.

We conclude that an intermediate structure is likely to be both necessary and convenient when fractionalising a single asset. This both increases the cost and reduces the extent to which a post-GFC democratisation ideal can be promoted. Given that an intermediate structure is likely to be both necessary and convenient, it seems clear that tokenisation has the greatest chance of making progress in the world of funds, where (i) that structure is already in place and (ii) there is already an expressed demand for fractionalisation.

We can see how debt contracts could also be suitable for tokenisation. The contractual structures controlling debt investments are reasonably standardised by banks and others, and CMBS and RMBS structures have evidenced an expressed demand for the fractionalisation of these assets (if only as a stepping stone to the creation of diversified pools).

It is quite possible that larger assets (The Empire State Building and others), which are already held in fund structures, will be tokenised successfully (and IPSX may provide some evidence for this type of investment); there may also be an alternative market for social impact or community assets where investment regulation and risk/return are not the main drivers of behaviour.

In conclusion, tokenisation offers exciting possibilities for the real estate investment market. It is, however, at an early stage of its development, and real estate applications will take time to develop and become accepted.

There is a clear danger that innovation will be set back by years and possibly decades if attention is focussed solely on the digital fractionalisation of single assets, for which the demand is limited, the economics unconvincing and the obstacles significant. Funds and debt offer immediate opportunities to establish the credibility of tokenised real estate applications; utility tokens for building users and hybrid tokens for residential co-ownership and community assets may well follow; and, in time, there may be some successful trophy asset tokenisations. The mass market for the fractionalisation of single commercial real estate assets, however, may be a long way down the road.

References

- Barter, S. (1989): *Real Estate Finance*, Butterworths Law
- Baum, A. and Hartzell, D (2012): *Global Property Investment – Strategies, Structures, Decisions*, Wiley Blackwell
- Baum, A and Saull, A (2019): *The Future of Real Estate Transactions*, SBS, 2019
- Blocksquare (2019): <https://blocksquare.io/pilot>
- Cambridge Centre for Alternative Finance (2018): *5th UK Alternative Finance Industry Report*, Judge Business School, University of Cambridge
- www.coindesk.com
- CrowdFundInsider (2019): <https://www.crowdfundinsider.com/2019/01/143318-aspencoin-migrates-over-to-securitize-with-18-million-security-token/>
- Deloitte (2018): <https://www2.deloitte.com/us/en/pages/financial-services/articles/blockchain-in-commercial-real-estate.html>
- EY (2018): Accounting for crypto assets
- Factornerd (2019): Factornerd.com/top-european-real-estate-crowdfunding-platforms, visited December 12th 2019
- FIBREE (2019): *FIBREE Industry Report Blockchain Real Estate 2019*
- Financial Times (2019): <https://ftalphaville.ft.com/2019/06/06/1559824318000/FSB-warns-tokenised-liquidity-could-be-illusory/>
- Financial Stability Board (2019): <https://www.fsb.org/2019/06/decentralised-financial-technologies-report-on-financial-stability-regulatory-and-governance-implications/>
- Foster, M (2019): *IPSX*, Hardman and Co
- IVSC (2017): *International Valuation Standards*, 2017
- Leaseum (2019): see <https://www.leaseumpartners.com> and <https://medium.com/leaseum-partners/introducing-leaseum-13008e6818fd>
- Medium (2019): <https://medium.com/realtplatform/introducing-realt-tokenizing-real-estate-on-ethereum-9b8a995dc3fe>.
- Medium (2020): <https://medium.com/brickmark-ag/brickmark-signs-purchase-agreement-for-the-largest-ever-real-estate-transaction-paid-in-tokens-of-13a6195cb303>
- MIT Digital Currency Initiative (2019): *Tokenised Securities and Commercial Real Estate*, MIT
- Myinvestment (2019): Myinvestment.blog, visited December 12th 2019

Novak, N (2017): *Initial Coin Offerings: When Are Tokens Securities in the EU and US? A comparative analysis on the application of US and EU securities laws to initial coin offerings*

https://www.academia.edu/38386804/Initial_Coin_Offerings_When_Are_Tokens_Securities_under_EU_and_US_Law

P2P (2019): p2pmarketdata.com/crowdfunding-europe, visited December 12th 2019

Placetech (2020): www.placetechnet.com, January 13 2020

Propmodo (2018): www.propmodo.com, May 21 2018

Roche, J (1995): *Property futures and securitisation: the way ahead*, Woodhead Publishing

PwC (2017): *Worldwide REIT regimes*, <https://www.pwc.com/gx/en/asset-management/assets/pdf/worldwide-reit-regimes-2017.pdf>

SEC (2019): Regulation Crowdfunding
<https://www.sec.gov/smallbusiness/exemptofferings/regcrowdfunding>

Snyers, A and K. Pauwels.K, (2018): ICOs in Belgium: down the rabbit hole into legal no man's land? Part 1, *International Commercial Law Review*. 2018, afl. 8, (483)484.

Savills (2018): <https://www.savills.com/impacts/market-trends/8-things-you-need-to-know-about-the-value-of-global-real-estate.html>

Shrier, David (2019): <https://www.getsmarter.com/blog/career-advice/david-shrier-the-face-of-financial-innovation/>

Term Sheet (2018): interview with Josh Stein (Harbor):
<https://fortune.com/2018/05/18/security-token-harbor-ceo/>

Untitled Inc (2019): <http://www.untitled-inc.com/wp-content/uploads/2018/01/TCF-Types-Table-only.png>

Yahoo Finance (2019): <https://finance.yahoo.com/news/tokenized-real-estate-falters-another-090000644.html?guccounter=1>, November 26