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THOUGHT LEADERSHIP: INVESTMENT TOKENISATION IN REAL ASSETS – A CONCEPTUAL GUIDE

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INTRODUCTION

The first step is to will something into being. Humans are good at that. A token, whether it is a reference to digital art or an ephemeral sports achievement, has meaning because we collectively agree that it does; once it has meaning, it can have a financial value. And in this respect, human imagination can create an almost infinite spectrum of value for tokens, as long as their supply is constrained.

Real assets come from the opposite side of this spectrum: they have meaning primarily because they are finite. A developer could seek to build replica Eiffel Towers all around the world, a programmer could create virtual versions of it, but there is only one original, in a specific location. Thus, it seems strange at first glance to be considering real assets such as infrastructure or property as candidates for investment tokenisation. Although various types of real estate assets have been tokenised for investors over the past several years, there has not yet been a widespread adoption of the practice yet.

This article describes in concept how investment tokenisation in other real assets could work, with a focus on infrastructure.[1] Potential benefits for a broad range of infrastructure investors range from smarter shareholder agreements, tokens with both investment and utility functions, and expanded market access for both infrastructure projects and investors. There are still a large number of areas of uncertainty that will need to be clarified before large-scale investment occurs, particularly for institutional investors. Over the long term, though, it is likely that digital tokens held on a distributed network will at least supplement traditional ways of investing in real assets.

[1] Note that while this article makes a number of practical suggestions regarding tokenisation, it is not intended to be a comprehensive exposition of the details of doing so. Rather, it is a potential conceptual framework for infrastructure that explores the implications of distributed ledger and tokenisation techniques for this asset type.

INVESTMENT TOKENISATION: HOW DID WE GET HERE?

Investment tokenisation is a theoretical advance in finance, but it didn't come out of nowhere. Many financial innovations of the past 30 years, from securitisation to peer-to-peer lending, have been led by increases in both computing power and connectivity, which have made the aggregation of asset and borrower data much easier than in previous eras.

Peer-to-peer lending allowing individual loan analysis, for example, was an advance on the pooling of loans via securitisation, in which loans were typically only disaggregated into broad cohorts. Table 1 shows the progression of financial techniques towards tokenisation.

Table 1: The Path to Investment Tokenisation

FINANCIAL TECHNIQUE	WHAT IT DOES	EFFECT ON BORROWERS/PLEDGORS	EFFECT ON LENDERS/INVESTORS	TRACK RECORD
Securitisation	Pools individual loans together	More borrowing alternatives	More investing alternatives	Works for many asset types (not all)
Peer-to-Peer Funding	Allows lenders to select individual loans from a group	More lending alternatives/funding availability	Greater ability to select individual loans	Has worked in practice, but untested through full economic cycle
Crowdfunding	Allows sellers to fractionalise assets	More funding alternatives	Lower minimum amount to invest	Largely untested. High admin costs.
Investment Tokenisation	Allows sellers and potentially buyers to fractionalise assets[2]	Increased sources of demand for assets	Ability to invest in previously difficult to access assets.	Largely untested

[2] Investor fractionalisation in this context refers to the potential ability of investors to invest in specific fractional amounts of a real asset that continues to be externally managed (e.g the top floor of an office building).

In both securitisation and peer-to-peer funding, however, there was little change in the base composition of investors: borrowers had more financing alternatives and therefore greater negotiating ability; lenders had more ability to choose investments. But in each case, the group of lenders/investors largely remained the same group of institutional investors. Investment tokenisation introduces a potential new element to this continuum of aggregation/disaggregation techniques: splitting an investment into fractional pieces, and potentially providing small and moderate sized investors with both better access to individual assets and better liquidity. In sum, the prospect of investment tokenisation as a widespread innovation in financial services has come about because of a confluence of factors:

(1) advances in computational intensity and user connectivity have made it technically possible;

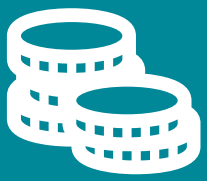
(2) the millenarian views of crypto-finance advocates have given it a cause; and

(3) a new generation of investors prefers to transact digitally, using screens and cryptography, rather than through the existing institutional intermediaries.

Chart 1: Google Search Frequency for Tokenisation Terms (2017-now)

Source: Google. Data shows smoothed weekly average of worldwide searches for each term.

For real assets, investment tokenisation in concept appears to have particular promise. Individual investors historically have been able to invest in liquid financial assets either through funds, through direct shares in a company, or through bonds or bond-like financial instruments. But they have generally not had the ability to invest directly in the equity of specific large, relatively illiquid investments like real estate or infrastructure. An investor who wishes to invest in infrastructure can invest in publicly traded infrastructure companies or funds, but as with REIT investing, may not want the uncertainty that investing in a company or fund brings. And investing directly in real asset debt – either through a fund or through CMBS – is an option primarily for institutional, rather than individual, investors. Investment tokenisation in theory could make more such direct investments available to a wider range of investors, in the process potentially turning an illiquid investment into a more liquid one.



WHAT IS INVESTMENT TOKENISATION?

Investment tokenisation is the process of representing an investment, or part of it, as data that is contained within a distributed ledger system, or 'blockchain'[3], in which all data is shared among the distributed ledger group via computing nodes, rather than from a central location. An investment token consists of identifying data that describes an investment, and that is assigned to a digital address that forms part of the distributed ledger.[4]

Which investment assets can be tokenised effectively is an evolving area. One of the key traditional advantages of financial assets is that they are meant to be liquid, but some have historically been more liquid than others. In the short term, tokenisation in areas such as digital art has been wildly successful in turning illiquid assets into more liquid ones, but whether this reflects increased liquidity or speculation is difficult to disentangle.

An initial characterization difference of tokens is whether they are considered fungible or non-fungible. Currently, fungible tokens consist of unique data (generally, a single string of digits and letters) that assigns units, or an account balance, to a specific distributed ledger address; digital currencies, for example, are fungible tokens. Non-fungible tokens consist of similar underlying data, but with other qualitative and programmed data attached so that they can be both uniquely identified and programmed to do certain things within a distributed ledger based on certain conditions.[5] Table 2 distinguishes between current token types; it is likely that new variants of token classification will emerge in the future. All token types – fungible and non-fungible – are technically transferable.

[3] This article uses the term distributed ledger as the more generic term.

[4] This article does not go through the mechanics of how investment tokens are managed by a distributed ledger. There are a multitude of references for this available publicly. 'Blockchain Networks: Token Design and Management Overview', National Institute of Standards and Technology, 2021 summarises the technical aspects. 'Understanding Cryptocurrencies', Hardle, Harvey and Reule, 2019 summarises the development of cryptography as applied to distributed ledgers. There are many other summaries.

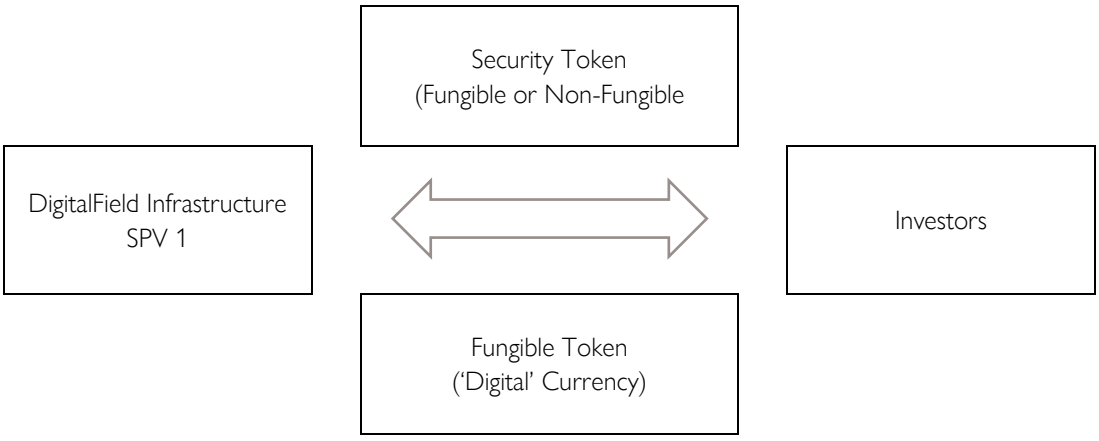
[5] This ability forms the basis for its being termed a 'smart' contract.

Table 2: Token Types and Characteristics

TOKEN TYPE	COMMON DEFINITION	CHARACTERISTICS
Fungible Token	Distributed ledger data entry in cryptographic form assigned to distributed ledger address.	Interchangeable with other fungible tokens on distributed ledgers. Digital currencies such as Bitcoin and Ethereum are fungible tokens.
Non-Fungible Token	Distributed ledger data entry in cryptographic form assigned to distributed ledger address with attached unique characteristics.	Unique on distributed ledger. Attached characteristics can include programming. Examples are digital trading cards or digital art.
Re-Fungible Token	Distributed ledger data entry that derives from one with unique characteristics (non-fungible token).	Non-fungible token subdivided into fungible tokens.

Beyond liquidity, a key goal of an investment tokenisation is to ensure that future cash flows from an asset, and/or from the asset itself in a sale, are distributed among investors, just as in a traditional securitisation. Figure 1 shows a sample version of an initial token transfer to a single investor; the tokens issued represent investment claims to a hypothetical newly constructed battery farm used to store energy (DigitalField1). Prospective equity investors in this example are assumed to have evaluated the investment themselves; the asset developer and its adviser are assumed to have agreed a purchase price with the investors. The agreed price for the asset is then fractionalised among as many investors as have committed to an investment, based on the amount committed. The consideration received for a security token in this example is meant to be a separate investment token that contains basic data representing the asset, plus qualitative data that contains the investors' rights to the asset and its future cash flows.[6]

Figure 1: Initial Transfer



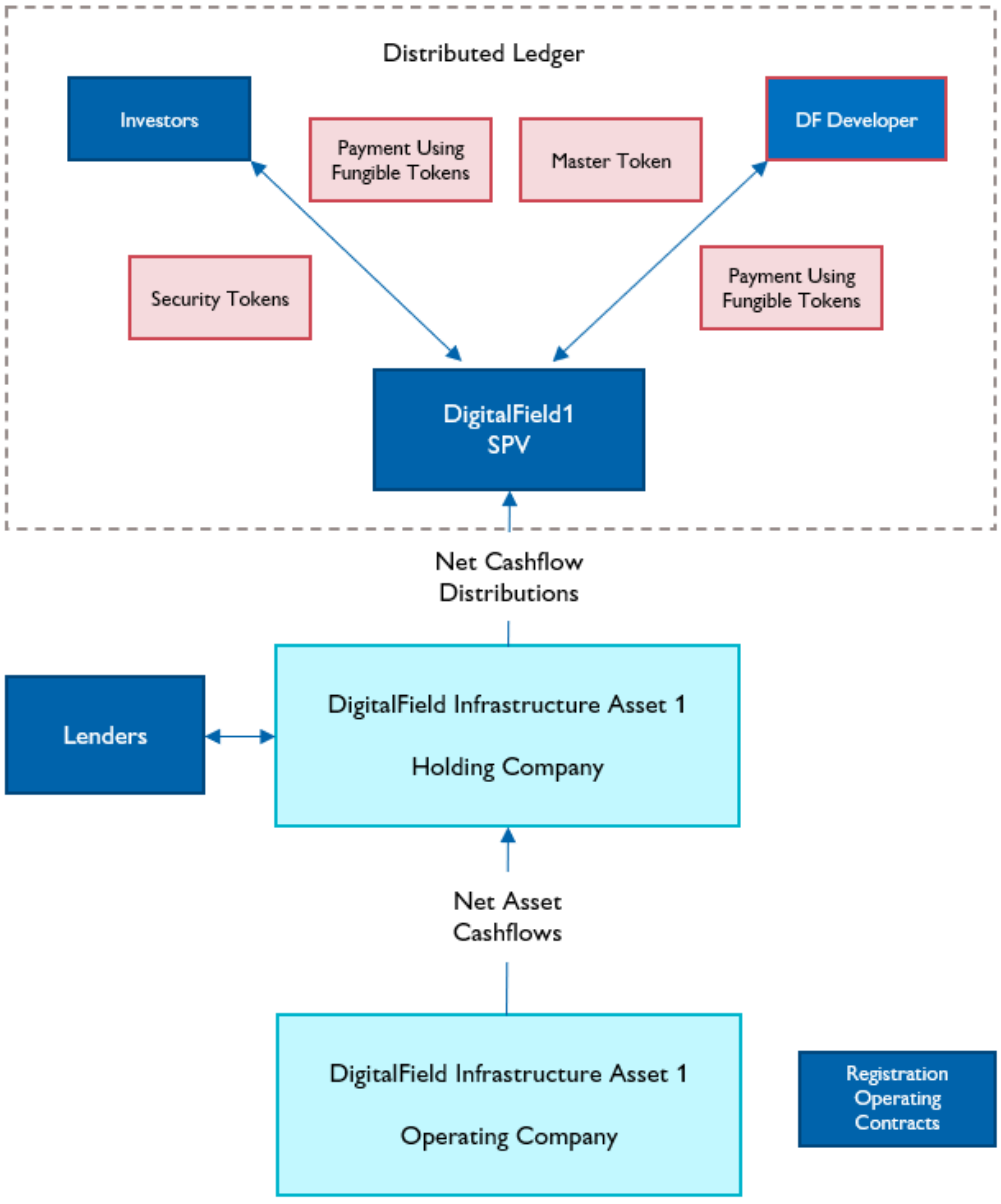
[6] Note that the contractual rights specified in an investment token have been proactively legislated in several jurisdictions.

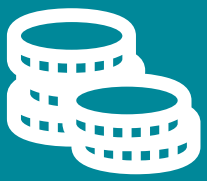
WHAT IS INVESTMENT TOKENISATION?

A Simple Infrastructure Tokenisation Model

Figure 2 shows how the sample infrastructure tokenisation could in concept be administered using a distributed ledger and investment tokens representing interests in the asset. The infrastructure asset (DigitalField1) has a value of $500 million; it requires 40% equity funding. This $200 million in equity funding is sought to be issued primarily through fractionalised interests, in the form of investment tokens, that are maintained in a distributed ledger system.

Figure 2: Sample Infrastructure Asset Financing Using Investment Tokenisation





WHAT IS INVESTMENT TOKENISATION?

In this example, the DigitalField1 asset's structure consists of an operating company, a holding company, and a special purpose vehicle created for the investment tokenisation. The operating company holds all licenses, contracts and government registrations, and the asset's $300 million debt is issued at the holding company level.[7]

Up to this point, DigitalField1 and its structure look very similar to any other infrastructure asset financing; the operating company and holding company are standard features. The only difference is how the equity would be invested and administered. In this example, the DigitalField1 asset developer creates a master non-fungible token representing the asset and transfers it to a special purpose vehicle; each small investor then pays fungible tokens to acquire a fractional interest in the asset, represented by investment tokens that are part of the distributed ledger for this asset. At initial investment funding, the fungible tokens (or fiat currency, if possible) contributed by investors are transferred to the asset's developer. If the battery farm is successful in profitably buying, storing and re-selling energy, paying its debt holders their principal and interest, and investing in maintaining or expanding the asset, it will have excess net cash flow that can be used to pay equity distributions. Under the structure above, these distributions would be made to the special purpose vehicle through the DigitalField1 master token, and from there to the digital account of each investor, in proportion to their equity interest, all on the distributed ledger with the logic attached to each investor's investment token that governs these transfers.

Model Evaluation

At first glance, this system of using security tokens on a distributed ledger does not seem to be much more than a more complicated version of the current way of accounting for investor contributions and distributions using a centralised ledger – the functions that a custodian, administrator and registrar carry out for an investment fund. But there are several potential efficiency advantages to consider: (1) the initial distribution and ongoing administration costs to investors could be lower than the current model if the tokenisation process matures, (2) the settlement process for investing could be quicker, and (3) secondary liquidity could be greater, particularly for smaller investors. Each potential benefit is reviewed below:

Administration Costs

It seems likely that ongoing administration costs for DigitalField1 investors will be lower when the tokenisation process is sufficiently mature. Investment tokenisation can be viewed as one more step towards automation of investment services; to the extent these can be programmed (correctly) into investment tokens, costs should decrease relative to an investment requiring some manual administration and oversight. In addition, if the work of any of the intermediaries (custodian, administrator, registrar) can be reduced, that should also save costs relative to the current model. Some investor costs, such as documentation (whether in programmed or

[7] This structure is for ease of reference only; debt is typically also issued at the operating company level. Also, for purposes of this example debt investors are assumed to be off any distributed ledger system.

traditional contract form), investment analysis and due diligence, will of course still be necessary, and may be even higher at first as new documentation templates are created, potentially within software programs. Investment tokens themselves would need to be coded, and the code itself audited, before they could be released to investors.

Settlement

Settlement for sample tokenised real asset investment transactions has been reportedly faster than traditional settlement, although at small sample sizes to date. Secondary market settlement also appears to have promise, since once on a distributed ledger and using tokens, in theory most or all of the multiple intermediaries now required to settle a secondary market trade (registry and custodian, broker, and potentially exchange) would seem to be unnecessary in a token exchange. For now, however, there seems to be no streamlined way of either getting on or off a distributed ledger system or purchasing investment tokens with fiat currency, other than by seeking to develop a robust process to do so in a fast-changing environment, or by working with one or more of the new fungible token intermediaries that have sprung up as facilitators. It may be that settlement is ultimately more efficient, but it will take some time to reach a level where it is more convenient.

Liquidity

Distributed ledgers in concept distribute decision-making power among token holders rather than a central authority; that is the promise of decentralised finance. And the more token holders there are for a given asset, the greater its potential liquidity, as with any fractionalised asset. If effective, a reduction of settlement intermediaries could also significantly reduce transacting costs, particularly for moderate sized investors; this could also improve liquidity. On the other hand, assets traded on a centralised exchange have traditionally had better liquidity overall. Early initiatives in creating exchanges specifically for digital financial instruments have recognised this; there are also likely to be initiatives to re-purpose existing exchanges for trading of investment tokens.

Adapting the Model for Infrastructure Assets

Smart Shareholder Agreements

Beyond these generic potential efficiencies from investment tokenisation, there are also several that could be particularly applicable to infrastructure. Some routine infrastructure investment shareholder interactions, such as shareholder agreement tag-along and drag-along rights, could be coded into each investment token, and for practical purposes would probably have to be. For infrastructure investment offerings to smaller investors, it seems possible for such potential token investors to cooperate in determining a fair price range to bid for investment tokens via a distributed network, much as large institutional investors often work together to propose a price for an infrastructure investment. There are likely to be initial inefficiencies, or at worst inaccuracies, in having computer software code resolve complex multi-party issues, but it is conceivable that these negotiations could at least take place on such a system, and provide greater efficiency in management relative to current multi-party negotiation processes among large investors. But all this remains to be seen.

Multi-Use Infrastructure Tokens (Investment and Offtake)

Many infrastructure assets are energy producing ones, and thus provide both an asset that has an operating value (usable energy which is sold to generate revenue) as well as value in the asset's equity through cash flow distributions net of operating and investing costs. It's therefore conceivable that an energy infrastructure token could have both investment and utility functions, with the utility function providing access to an asset's output to the token holder (energy produced and/or transmitted). For example, the tokens provided could provide both rights not only to receive asset cash flows, but also to purchase or sell the energy generated or transmitted by the

infrastructure asset. Investors interested in energy-saving initiatives are potential markets for this kind of multi-purpose token.

Market Access in a Digital Age

Perhaps the simplest potential benefit from investment tokenisation is that it potentially provides an expanded market for real assets. Family offices and high net worth investors are initially most likely to be interested in investment tokenisation, once it has been demonstrated to work at scale. These investors have the motivation, and in some cases the professional management teams necessary to research potential real asset investments, make the initial arrangements to access distributed ledger networks, and maintain the digital keys for their investments. If a critical mass of this type of investor develops, infrastructure projects that are smaller or more difficult to finance, such as new developments or technological applications, could become easier to complete.

Investment tokenisation could eventually make real assets, including infrastructure, available to a wider range of investors relative to its traditional institutional investor base, and the success of fractionalisation could also – again, eventually - make even small investor diversification among various direct real asset holdings also a reality.

WHAT COULD GO WRONG?

Financial innovations are generally accompanied by a mixture of uncertainty and hype, as the innovation is tested across different market environments and applications. Investment tokenisation is no different. While it may be relatively simple to create a non-fungible token, developing a working solution for real assets involving investment tokens distributed to a large number of investors will be much more challenging. A number of potential risks will need to be addressed; a summary is shown in Table 3. Because investment tokenisation is a rapidly evolving area, mitigants to some of these risks, such as specific regulation, are in the process of being developed; others will likely take longer to resolve.

Table 3: Potential Investor Risks

RISK	DESCRIPTION
Security	Certainty that an investment token provides the same legal protections as those provided to holders of traditional asset-backed or corporate equity and debt.
Regulation	Certainty that a particular tokenisation form does not contravene current regulations.
Governance	Lack of third-party intermediaries that can administer the asset for investors if required.
Information Asymmetry	Large investor could take advantage of information unknown to smaller investors.
Token Duplication (Actual)	Issuance of a competing investment token representing the same asset on a different distributed ledger.
Fraud	Transfer of security token to another person without consent
Token Duplication (Virtual)	Issuance of a token for a virtual version of a real asset.

CONCLUSION

This article has explored how distributed ledger systems involving fungible and non-fungible tokens could be applied to the tokenisation of real assets such as infrastructure. Like real estate, infrastructure assets are potentially good candidates for tokenisation, which can provide more investment opportunities to a wider range of investors, potentially lower administration costs, reduced settlement time and potentially better liquidity for investors, particularly those that have not had direct access to infrastructure previously.

Asset owners and investment managers, particularly of real assets that have been historically difficult to fractionalise, should also see benefits from tokenisation based on the potential for an expanded investor base. Potentially lower asset management and administration costs could benefit both groups. Energy infrastructure, in particular, could be an interesting test case for tokenisation, since a token could in theory provide the flexibility to benefit directly from both energy distribution, investment cash flow, or both.

There are a number of issues that will need to be considered and resolved before real asset tokenisation occurs in scale, however. Some of the benefits of investment tokenisation are not apparent now, and sceptics may see little difference between current forms of investment, which appear to work fairly well now for most institutional investors, and what tokenisation promises to offer. But despite the initial complexities involved in establishing a real asset on a distributed ledger system, being prepared for further development in this area is probably prudent. If nothing else, the next generation of investors has already shown itself to have little tolerance for traditional forms of investment management and administration, particularly those involving financial intermediaries. Investment advisors will be wise to look to this future behaviour in adapting to a more digital financial world.

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