



association of the
luxembourg fund industry

TOKENISATION AND DIGITAL CUSTODY IN THE WORLD OF THE INVESTMENT FUND

A COLLABORATIVE BOOK

A Collaborative Book

ALFI Digital/FinTech Forum Blockchain & Crypto-Assets

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I Foreword

With EUR 4.7 billion of assets under management in December 2019¹, Luxembourg is the second-largest fund centre in the world behind the US, and the first in Europe.

Luxembourg has 62% of market share in global cross-border fund distribution. Luxembourg funds are distributed in over 70 countries around the world and 3,785 funds are domiciled locally. The centre is well recognised for its expertise and for being at the forefront of innovation.

Over the past years, blockchain – especially tokenisation – has been gaining traction and

popularity fast. It is considered as a true game changer. Luxembourg has been active in this field with more than 50 initiatives and companies involved in the technology.

The ALFI Digital/FinTech Forum Blockchain & Crypto-Assets in collaboration with the Luxembourg House of Financial Technology (LHoFT) have recently produced the [Luxembourg Blockchain Map](#). This map shows how active the ecosystem is, covering all the aspects from the research, the infrastructure to the business use-case itself:



Compiled with the support of ALFI and the Luxembourg Blockchain Lab

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¹ ALFI: <https://www.alfi.lu/en-GB/Pages/Industry-statistics/Luxembourg>

II Objectives

The purpose of this collaborative book is to demystify the concept of tokenisation and digital custody and to provide insight into its relevance for the fast-growing fund sector.

It is based on thorough research by the ALFI Digital/FinTech Forum Blockchain & Crypto-Assets.

It aims to

- Inform of the ongoing digital initiatives in the blockchain ecosystem in Luxembourg
- Define and explain the main concepts of the blockchain, and more broadly the tokenisation and digital custody in the world of the investment fund. What is tokenisation? What is digital custody? What are the main challenges and opportunities?
- Define where the concept of tokenisation make sense in the financial industry. What are the main use-cases?
- Define the road to cross for a full adoption. What is the current legal environment? How does moving from an electronic to a digital world impact security issues and the ecosystem?

III List of abbreviations

AIF	Alternative Investment Fund
AFM	French Financial Markets Regulator (<i>Autorité des marchés financiers</i>)
AML/KYC checks	Anti-money laundering and know-your-client checks
AML/CTF	Anti-money laundering and countering terrorist financing
CBDC	Central Bank Digital Currencies
CSSF	The Luxembourg financial sector supervisory authority, the <i>Commission de Surveillance du Secteur Financier</i>
DAO	Decentralised autonomous organisation
DApp	Decentralised application
DLT	Distributed ledger technology
EBS	Electronic Broking System
ECB	European Central Bank
ESMA	European Securities and Markets Authority
FinTech	Financial technology
GDP	Gross domestic product
GP	General partner
ICO	Initial coin offering
IMF	International Monetary Fund
IRR	Internal rate of return
KPI	Key performance indicator
LP	Limited partner
OECD	Organisation for Economic Co-operation and Development
PDF	Portable document format
PFS	Professional of the financial sector
PoC	Proof of concept
RegTech	Regulation technology
SMEs	Small and medium-sized enterprises
SPV	Special purpose vehicle
UCITS	Undertaking for Collective Investment in Transferable Securities

1 Background and definitions

1.1 What is tokenisation?

In the epicentre of the blockchain ecosystem, the words “token” and “tokenisation” have become very popular. Unit of account, digital asset, programmable currency, new asset classes – there is a high potential that sums up the promises of tokenisation.

Will it change the way we do business and store values? According to the World Economic Forum, 10% of the worldwide GDP will be stored in the blockchain in 2025. Will we move to a tokenisation economy? What does it mean for our financial industry?

1.1.1 Back to the concept

The story started on 1 February 2009 with the first block, the “genesis block”, of the bitcoin, and then the blockchain technology. The first years were mainly focused on the understanding of the technology and its potential, creating a strong interest in the technology community.

In the meantime, new blockchains have been created like *Ethereum* in 2014 with the smart contract as innovation. The interest raised at this stage in the financial industry, prototyping the technology through consortia and private initiatives around selective use cases like trade finance, post trade or the fund distribution, where Luxembourg is pioneer.

In 2017-2018, the market focused on projects funded by ICOs that have brought a lot of speculation and disillusion in the market.

In the aftermath, the financial industry and the whole industry have understood the potential of tokenisation, which can bring efficiency to the market.

1.1.2 What is asset tokenisation?

In general, we consider two types of tokens:

- Utility tokens: digital assets that give their owners access to products or services produced by a company. They are not designed to be an investment.
- Securities tokens: digital assets that derive their value from an external asset that can be traded. They are made to be an investment.

The digital asset might be stored on a blockchain network (public or private). Network choice will depend on factors such as privacy, distribution channel, clients, and more globally by following the objectives. The blockchain with its benefits of transparency, immutability, cost efficiency and security could radically change the securities market landscape.

We understand the potential that it can offer to the financial industry where all the assets are today stored in electronic form with a complex and costly infrastructure. Today we value the whole securities market for more than USD 70 billion.

In this collaborative book, we will partly describe some initiatives and cover the different aspects where tokenisation makes sense. From traditional securities, debt, funds, real estate funds, tokenisation has been experimented and has already shown its potential. We already know the main limit, the cash part. The different regulators have proactively taken a positive and constructive approach.

Let's take an example with the real estate. One of your properties has a value of USD 1 million and you create a digital representation in token with 1 token = USD 1,000. You issue 1,000 tokens materialised in the blockchain and traded later, after the audit and the preparation phase. In this use case, tokenisation opens up the market to new pools of investors, by enabling fractional ownership.

A new ecosystem of players will emerge with the crypto-exchanges and the wallets that need to be secured.

1.1.3 What is digital custody? What could be the role of the bank in this new world?

A custodian is defined as a financial institution that holds customers' securities for safekeeping in order to minimise the risk of their theft or loss. A custodian holds securities and other assets in electronic or physical form. Since they are responsible for the safety of assets and securities that may be worth hundreds of millions or even billions of dollars, custodians generally tend to be large and reputable firms.

In this new era, digital securities will be stored on the blockchain.

How should cryptocurrency assets be held? What will be the role of the digital custody bank?

In a tokenised economy, the custodian will see its functions evolving. Keys management (private vs public) and their storage (hold/cold storage) is indeed one of the main characteristics of the security within the blockchain. Cold storage, also known as a cold storage wallet, is the opposite of a hot wallet where your crypto-assets are kept online. Keeping them online increases your risk or attack surface. By keeping them in cold storage, your attack surface is significantly reduced. A number of solutions have been developed in this space and this is what the digital custody bank will have to deal with. It is essential to warrant the protection of the assets, which is part of the depositary mission. With sophisticated tools and methods, depositary banks with the support of the security can allow the asset manager to be more efficient in its allocation of crypto-assets and be able to offer services.

Crypto-custody demand has grown in recent years mostly to keep cryptocurrencies on behalf of crypto-funds. The financial industry has been quite reluctant to offer this service until today and we have seen the emergence of new actors

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like *Coinbase* that are able to offer crypto-custody solutions.

As a conclusion, the world of the digital assets

is open up for the financial Institutions. A lot of technological progress has been made and the regulatory framework has shown to be open for change.

1.2 What is custody of digital assets?

Custody of digital assets is much more complex than safekeeping traditional assets, so how should asset servicers approach this?

For anyone working in the digital assets space – be it cryptocurrencies or asset tokenisation – the question of how the custody industry can evolve to support digital assets is still unresolved. The starting point perhaps should be: what do we actually mean by digital custody?

In its advice on crypto-assets published in January, ESMA stated that “having control of private keys on behalf of clients could be the equivalent to custody/safekeeping services, and the existing [regulatory] requirements should apply to the providers of those services”. The implementation of the 4th EU Anti-Money Laundering Directive in Germany for example brought custody of crypto-assets into the banking act and defines the activity as “custody (Verwahrung), administration (Verwaltung) and safeguarding (Sicherung) of crypto assets or of private cryptographic keys used to hold, store or transfer crypto-assets as service for others”.

What is common to these definitions is that when it comes to digital assets, custody services no longer concerns the simple safekeeping of “assets” but rather the storage of cryptographic keys that control those assets.

But does digital custody really equate to just storing private keys? It’s unlikely to be that simple, for a number of reasons. However, let’s recap where this argument comes from:

- Permissionless blockchain networks typically assume that digital assets are a form of bearer instrument, i.e. the private key controls the ability to spend the assets (“unspent output”). Consequently, a loss of those private keys would imply the loss of the asset itself.
- There is no concept of a nominee wallet, i.e. blockchains in the crypto-world do not support the concept of an intermediary (every private key is assumed to belong to a beneficiary).
- Crypto-exchanges offering digital wallet solutions tend to be based on centralised databases that create a relationship between

the investor and the digital wallet provider whereby the investor gives up the use of the private keys to the provider, subject to an agreement between the parties. Put simply, under this approach, beneficiary information is kept outside the blockchain.

One could therefore think that the storage of the private key equals digital custody. However, there are a number of considerations that would make me think otherwise:

- Key storage without a robust procedure to utilise the key is meaningless. Also, there are different approaches on how to structure protocols for the use of keys (e.g. the so-called “signing ceremony,” which can be used to reduce the reliance on a single party).
- Depending on the design choice of the blockchain, DLT or wallet, there may be more than one key per token, or a single key simply may not exist (i.e. different parties hold a portion of the key and need to enter into a signing ceremony to transfer an asset, via a multi-signature arrangement).
- Institutional blockchain platforms (typically permissioned) have certain hierarchical structures or a multi-signature agreement to reverse and/or rebook a transaction, with a governing node empowered to correct an erroneous entry into the database.

So in my mind, the way forward for digital assets is as follows:

Clearly, a digital custody solution necessitates private key storage capability whether for bitcoin, blockchain or DLT. As a result, the question around how those private keys are controlled is a critical one for defining the role of custody of crypto-assets.

However, differences in technology between crypto and institutional platforms, as well as the applicable and still evolving regulatory framework, requires a more holistic view of custody that goes beyond the storage of keys. Put simply, the emerging definition of what is digital custody will be more than a question of who holds the private key.

1.3 Challenges and opportunities of the custodian in a tokenised world

1.3.1 What are we actually talking about? What are the challenges?

In the previous introductions, we were able to see what tokenisation represents and what

could be considered as digital custodian. While it is true that most stakeholders, officials, and standard setters often see custodians as storage solutions for private keys, the reality is more complex.

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The digital custodians warrant protection to the tokenised assets. Nevertheless, since the definition of crypto-assets is broad, talking about custodians in a tokenised world can be just as broad. It may involve depositing funds (fiat or crypto) and/or maintaining controls on tokenised assets such as listed assets, private equity assets or simply any physical tokenised asset (such as a tokenised car). The definition of the type of asset impacts the regulation and the type of custody to be run. For instance, while tokenisation is an opportunity for SMEs, listed securities tokens have their challenges. Most of the time when it relates to financial instruments a central depository will be required and compliance with the regulations will be part of the landscape.

In order to identify challenges and opportunities and develop such activities, one needs to go back to the basis and identify what is the potential role intended and expected from a custodian.

Although different in some respects, the [5th EU Anti-Money Laundering Directive](#) and the global [FATF Guidance for a Risk-Based Approach to Virtual Assets and Virtual Asset Service Providers](#) share a common understanding of what the role of a digital custodian should be. It encompasses adequate protection and supervision of the virtual assets notably by identifying investors and beneficial owners, while providing an adequate compliance framework. In a nutshell, it is all about **accountability**. Here, the word is said.

What is expected from a digital custodian (whether a company specialised in crypto-assets or a more traditional financial institution) is to provide an adequate protection against the risk of loss (notably the underlying private key) and a tailored supervision of tokenised assets throughout controls and processes adjusted to the technology.

This involves monitoring registers operating as independent single registers and providing physical custody services for the private keys. This requires teams that master on one hand the technology, and on the other hand the current laws and regulations along with internal governance rules and processes, all with the grace and agility of building a bridge between these two aforementioned parts.

However, and contrary to what can sometimes be read, it is not always the traditional custodians that are perfectly suited for this, and it is not necessarily a question of adding internally a new layer or an interface such as a DApp to make their system work. It is often forgotten that current custodian banks for instance are not necessarily built and structured to be quickly adapted to a new technology. Some fundamental IT infrastructures and business pillars are stringent. And it will be often decided to include a new company that has already developed the custodian solutions or to create a new independent entity from the beginning to reduce operational costs.

The technology being at its development stage, it is certain that many questions remain to be asked. This includes assessing opportunity costs, such as launching a new product or business for which you need to change slightly or completely your infrastructure. In a financial sector that is estimated at EUR 70 billion for securities markets and EUR 4.6 trillion for funds, it is relatively logical for traditional players not to necessarily jump into the new challenges.

1.3.2 Yet – in all challenges, there are business opportunities

Being a young and flexible technology has its benefits and provides a pool of new talents and start-ups, of which Luxembourg can be proud. In this perspective, the [amendment](#) of the 2001 law on the circulation of securities was a clear a signal for the empowerment of new products and businesses launches in this area.

In particular for custodian activities and with the rise of tokenised assets, relevant exchanges worldwide and cold wallets now offer solutions compliant with the domestic regulations that enable companies to obtain adequate, swift and targeted answers.

Yet, it is not only a question of creating new models where custodians are the new disruptive models, but also promoting opportunities for traditional actors to gain effective market shares, based on economies of scale and a rapid global impact: a more direct approach with their investors.

Recently, *Santander Group*, which is known to have published a survey already in 2015 mentioning that blockchain technology could potentially save banks around USD 20 billion a year, announced that they will issue USD 20 million in bonds on the blockchain as a "faster, more efficient and easier" way thanks to the use of the *Ethereum* blockchain. One of the branches of the banking group, *Santander Securities Services*, should act as a "tokenisation agent" and should be indeed the custodian of private keys related to tokens.

Challenges foster innovation and business opportunities as they translate into collaboration with officials to remove obstacles. For instance, large financial institutions in Germany are currently working with authorities to remove hurdles preventing them from providing digital assets services to their customers. This preliminary work regarding the implementation of anti-money laundering rules would remove certain requirements around the use of third-party custodians, effectively allowing cryptocurrencies.

Consequently, there are domestic opportunities to develop tailor-made solutions and attracts new major investment, which can be developed until global harmonised practices are set.

2 Use cases and business plan: what's next?

2.1 Real estate, private equity and tokenisation

2.1.1 Real estate

The tokenisation of real estate has attracted a lot of attention over the past year. There have been many projects issued and the asset class has the potential to act as the catalyst to encourage institutions to apply DLT to the issuance, transfer and servicing of financial instruments.

In the professionally managed industry, the size of the real estate investment market reached USD 8.9 trillion in 2018, up from USD 8.5 trillion 2017². That being said, it is not an industry without problems. Commercial real estate, particularly, is an asset that is issued mostly in private markets, a sector that involves many complications in the structuring, transaction and settlement processes. There are a number of areas where DLT can bring benefits to real estate:

2.1.1.1 Automation

Financiers, brokers, agents and other middlemen use separate infrastructures in the issuance, transfer and trading of securities and act as multiple points of failure. Using individual and siloed systems result in many inefficiencies, duplications and inaccuracies in the process. By changing the infrastructure and utilising DLT, issuers can enable program-maturity and eliminate duplication and inaccuracies to drive efficiency. This, in turn, will improve processes and reduce costs in the administration of real estate assets. The most common form of tokenised real estate has been to tokenise all or a portion of shares in an SPV that owns all or part of a property. Rather than using intermediaries to perform functions, tasks like information, payments and requests for votes can all be retrieved digitally by token holders simply through their investor's on-chain identity.

2.1.1.2 Access

From the investor point of view, the distributed nature of tokenised securities allows private markets to be circulated on a global scale. Today, these markets typically operate in small circles and the opportunities for investors are usually based on proximity and personal networks. In the US, around 90% of the industry works in this manner. In the digital era of finance, these private networks will still operate, but the invention of tokenisation allows these issuances to live on a digital platform that can be distributed globally. By doing so, the barriers of entry are reduced for investors as they will have access to a range of global opportunities that are currently unavailable to them today. For issuers, it will increase the likelihood of hitting their investment targets, as the distributed nature of tokenisation allows them to reach more investors.

2.1.1.3 Liquidity

The vision but also one of the significant hurdles within the tokenisation space is the promise of improved liquidity. Real estate is infamous for its lack of liquidity. Long lock-up periods can often be years and in some cases can last up to seven years, particularly in private markets. The intermediaries involved make it a lengthy and expensive process for investors to sell and buy shares. Brokers can take up to an 8% fee every time an investor wants to trade their share. By using DLT to act as the digital infrastructure, an investor can quickly view their portfolio and choose to liquidate their stake without a broker. Today, a transaction on the *Ethereum* network generally settles in an hour, and often takes a few minutes to effectuate. This is in stark contrast to the settlement of traditional security transactions, which generally takes one to two days. The efficient infrastructure of DLT and the ability to fractionalise real estate will add more flexibility and transferability between investors.

2.1.2 Private equity and tokenisation

On the sell side, it can be very difficult for companies to raise capital through private equity and investors can often find it difficult to find the best opportunities for their portfolios. Middle market private equity firms will usually look at 1000+ deals a year, and seriously consider around 100 of those. Usually about 10 of those 100 complete and throughout this process reports are requested, emails are exchanged, and conversations take place. Tokenisation allows much of this information to be accessible on demand.

2.1.2.1 Automation

Currently within private equity, there are many functions that are performed through analogous processes. When shares are transferred from one investor to another, both parties need to manually sign stock certificates and hold them on a manually maintained register. When private equity is issued and settled on a blockchain, there is no need for the parties to manually sign documents. Today, the technology is there to carry out this process compliantly and provide investors with an online interface to begin and finish their investment, one that can be accessed from anywhere in the world. When an investor goes through this workflow, they create their on-chain identity and upload their identity documentation. AML/KYC checks are processed and based on the legal requirements the investor is approved or rejected. As with real estate, automation also brings significant value to private equity.

2.1.2.2 Transparency

Private equity also suffers from a lack of transparency and inefficiency. Today, company in-

² MSCI: <https://www.msci.com/documents/10199/1cb40f95-09c2-2-5af7-30e5-0e6388601fd1>

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formation gets distributed from managers to investors in the form of a PDF file or something similar. There can often be friction between managers of companies and their investors due to data not being immediate or transparent. Often investors are required to request for relevant company information and updates from the managers, which takes time and resources to acquire, adding unnecessary delay to critical information. By using DLT to store this data, investors can immediately log onto a digital platform and view information such as cap tables and act accordingly. This is much more secure than the way this process operates today, as the data can be encrypted so each party can only see the data they have been given permission for.

2.1.2.3 Liquidity

SMEs notoriously find it difficult to fundraise due to these businesses operating in thin and

illiquid financial markets with a low number of market participants. Like with real estate, DLT technology allows issuers to access a more global investor network and encourage higher trading volumes. New regulation is helping drive this, and in July 2018, the AMF exempted operations below EUR 8 million from the need to issue a prospectus with a visa. The simplified regulation enables SMEs to get to market more quickly and the utilisation of DLT will enable companies to reach as many investors as possible and succeed with their investment targets. For liquidity to manifest itself, it's essential there are secondary markets in place that list quality, asset-backed digital securities. This is likely to be the next wave of innovation in the industry.

2.2 Tokenisation of venture capital funds

Venture capital market is an ever-growing phenomenon. In 2018 global venture capital investment has reached an unprecedented USD 254 billion according to [KPMG Venture Pulse Q4 2018](#). Together with “dry powder” and investments of private equity funds, investing in companies at later funding stages, the total asset value of the venture market is an estimated USD 1 trillion according to the [McKinsey Global Private Markets Review](#) for 2018.

The modern venture capital investment space as we know it remains fairly unchanged since its coming to prominence roughly 40 years ago in the United States. The majority of venture capital investments are made by venture capital funds, which are usually structured as a partnership, where limited partners (LPs) provide capital contribution while general partners (GPs) invest the fund pool into multiple companies based on a defined investment strategy, thus creating the venture capital fund portfolio.

Venture capital investing has high entry barriers and limited to a selected number of investors who can write a “million-dollar check”. At the same time GPs and LPs are facing liquidity challenges. It takes up to 10 years for a venture capital fund to return capital to their investors. *Crunchbase* experts [say](#), “When it comes to investing in private companies, putting money into a venture is often the easy part. It's getting the money out – and hopefully more than at the start – that is the stickiest wicket in the whole process.”

It is becoming more obvious that the current venture capital industry model needs changes to overcome these hurdles. This fact is already recognised by some European and US venture capitalist experts.

Michael Jackson, former partner at *Mangrove Capital*, [said](#) in an interview with *Private Equity Insight*: “I see the fundraising process as inefficient for venture capital companies and for the entrepreneur who has to spend a lot of time going through a somewhat random and unstructured process. In the end, it depends a lot on whether an entrepreneur is reaching the right person at the right time and who is in the right mood to listen, and that doesn't feel right to me.” Michael was one of the first venture capitalists in the EU who handed a wake-up call to the venture capital community by presenting a report entitled “Tokenization: implication for the venture capital industry”.

Tokenisation of venture capital can transform the traditional venture capital industry model and become an instrument to provide liquidity and open the industry to a new class of investors.

Among some of the earliest security tokens were issued by venture capital funds. In late 2017 and early 2018, around the same time that the biggest bull run in the history of digital currency came to an end, a quieter evolution in digital securities took place. Venture capital firms started to tokenise funds because it allowed processes to operate more efficiently for a number of reasons, most of which have to do with increasing access to capital and streamlining the interaction with LPs.

It was also in 2017 that *VNX Exchange* was launched, a Luxembourg-based asset-backed token issuance platform and secondary trading marketplace.

Traditional venture capital funds can use tokenisation as a crowdfunding vehicle by issuing tokens backed by venture capital investment portfolio, equity shares in venture

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capital fund or future income distribution. Such tokens are termed asset-backed tokens. Tokenisation helps to fractionalise the value of traditional assets and thus make them more affordable for a larger number of institutional and regular investors.

Tokenisation can bring new benefits to the venture capital industry through the following:

1. Providing liquidity for LPs much quicker instead of waiting for years. LPs gain more freedom in liquidating their positions in the secondary market.
2. GPs can target LPs that have an enhanced risk appetite with a possibility to issue tokens linked to a particular investment.

3. Shorter feedback loops – GPs who realize a better IRR (reflected in the rise of token price) will be better positioned to attract new capital.

4. Tokenisation opens the industry to a broader investor based and with new investors comes more capital.

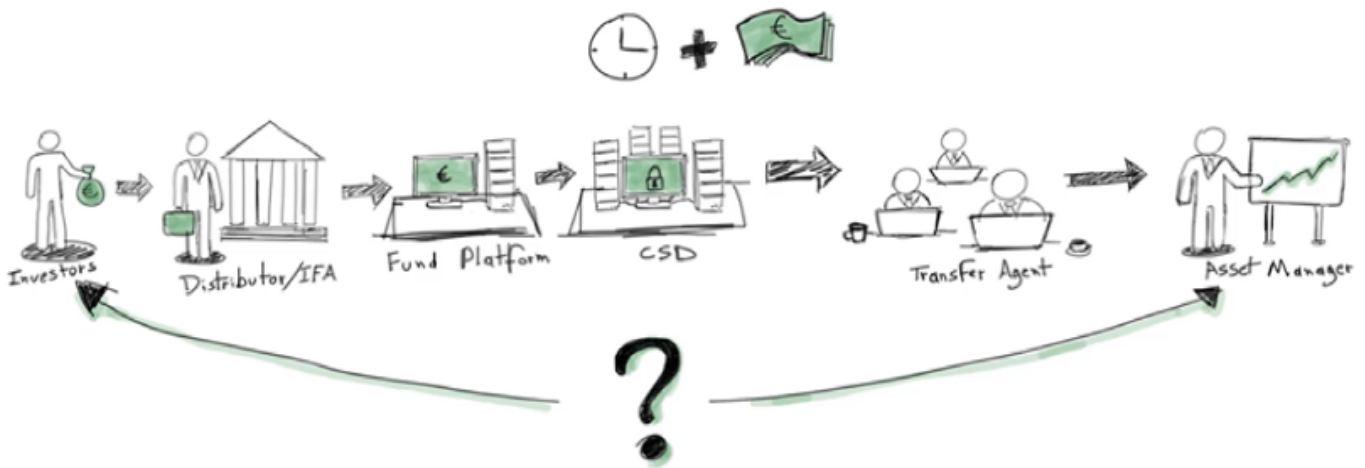
The change will also cascade down to the start-up ecosystem. Easier access to capital will result in more entrepreneurs starting their ventures, more jobs being created and more innovative products reaching the market.

2.3 Tokenisation of investment funds

2.3.1 DLT should be seen as a game-changing business model rather than a technical solution to an operational problem

As the investment fund industry begins to get the potential of DLT, it is worth taking a short step back to answer the basic question: why change? This can help us understand why fund actors have taken the steps they have, what works now and, most importantly, what DLT

will bring to future processes and products. The investment fund industry has long been selling its funds via a quite complex distribution chain comprised of many actors and siloed operational and technical environments that are labour intensive, prone to errors and involve a significant amount of duplication. It can, for example, take days to fully process a transaction in fund shares.



Improving operational efficiency and streamlining operations, particularly in the back and middle offices, while empowering the value creation of managing investors, is therefore at the core of any change. It was with this in mind that the first end-to-end fund transactions were carried using DLT in 2017.

At the same time, market, societal and regulatory forces are applying important pressures for change. Briefly, regulators are pushing for

greater transparency, investor protection and financial inclusion, while investors are seeing flatter, more efficient buyer journeys in other industries and ask why the fund industry cannot complete its digital transformation.

Additionally, there is the historical trend of lower margins as the industry shifts to more use of passive investment funds and attempts to respond effectively to the new compliance and consumer demands.

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2.3.2 Building a viable ecosystem

Replacing the multiple ledgers in use today, fund companies can, with blockchain, resolve most of their current operational issues and interoperate with their distribution networks. They will also be in a position to provide products and services better adapted to the many and diverse needs of investors and regulators. In this way, what began as a solution to an operational problem about process automation can serve the needs of the business and grow the investment fund ecosystem.

Following on from the buying and selling of fund shares the next practical applications is to include AML/KYC checks, all within a mutualised market infrastructure, resulting in faster onboarding processes. With the aim of understanding the market, data analytics can be employed by actors in the distribution chain, thus enabling fund products to be made more suitable for the fund buyer. An industry-wide DLT infrastructure can also enable nearly real-time supervision, regulatory reporting and market insight.

2.3.3 Creating value with tokenisation

One of the vital elements that are crucial for enabling DLT use in the fund industry, including smart-contract permissioning, data accessibility and privacy controls, is the notion of tokenisation, or more precisely security tokenisation.

Tokenisation is the creation of a digital representation of an asset on a blockchain. Here we are speaking of the tokenisation of investment fund shares or units, although any asset, right or even information can be tokenised.

Not to be confused with securitisation, which is a complex, costly and time-consuming process, tokenisation has none of these disadvantages with all the advantages that come from using a decentralised and immutable approach.

To take the example of private equity or venture capital funds, these are often only open to professional investors and can be illiquid. Issuing security tokens of such funds means lower barriers to entry for investors, because they can be fractionalised and thus enabling greater accessibility, and the tokens can be bought and sold more easily. The cost for the issuer of issuing, or creating, tokens is also much lower.

In general, security token offerings can improve the both the primary issuance and the secondary trading phases. Tokens can be created and distributed much more simply and faster. Additionally, throughout the lifecycle many events, such as corporate actions, can be automated. Ultimately, the issuer will be able to reach a much larger investor base.

In the case of *FundsDLT*, fund shares will be represented by security tokens within the

blockchain in which the fund register will be maintained. As a consequence the operator of such infrastructure (*FundsDLT*) will leverage on the necessary regulatory status in order to remain compliant when maintaining the fund register (such as a [Support PFS](#) and registrar) so that this tokenisation process can happen.

Tokens will enable actors in the investment fund distribution value chain to create highly responsive products, breaking down barriers to access and will be an important part of the future investment fund ecosystem.

2.3.4 Responding to regulatory and compliance requirements

The practicality of DLT in the investment fund industry has already been demonstrated. There are innovative solutions on the market. The fact that this is the way forward is certain; nevertheless, as with any major change, there are challenges.

A few legal questions remain around security tokens. Most notable of these is whether any particular security token offering is to be classified as a financial instrument in the broadest sense or as the more specific transferable security, an important, and trusted, sub-category of financial instrument under EU law. Financial supervisory authorities are often, in general, tech-agnostic, meaning they do not regulate technology but rather who is using it and how they are using it. Worldwide, regulators understand the significance of DLT and are setting up dedicated innovator units and regulatory sandboxes for companies, as well as exploring how it can enhance their own operations.

Technically, questions remain as fund actors decide on the best system for the future. Should an investment fund DLT ecosystem be based on a public or a private blockchain? Existing groups propose solutions with the latter as the way forward, while some in the fund community see a future in a public blockchain combined with protocols for zero knowledge proof. There is also the important question of interoperability between the various DLT solutions.

Still, adoption is the biggest question. Replacing legacy systems or running dual legacy and DLT systems is expensive and resource intensive. Acceptance of DLT needs to go further than a mere technical solution to a cost-cutting problem. At the moment, the industry is focused, with good reason, on internal operational systems and processes. But ultimately an industry-wide market infrastructure based on DLT means that the solutions will need to move from operations to the business side for the greatest benefits to be achieved. Tokenisation will help this move.

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3.1 A focus on Luxembourg laws and regulations regarding tokenisation and crypto-assets

Luxembourg is known for its pragmatic approach to laws and regulations. Whilst historically this focused largely on investment funds and banking, today Luxembourg has built on these traditional strengths to emerge as a hub for newer variations such as FinTech and RegTech.

As early as 2014 the CSSF showed it was open to new technologies and techniques related to virtual currencies, but the authority remains mindful to ensure they are deployed appropriately and with due respect and compliance for existing laws and regulations.

Luxembourg, being an adherent to the view that laws should be technology-agnostic, most efforts focus on supplementing guidance and interpretation of laws with respect to new technologies, rather than new or specific regimes which may quickly become outdated or include loopholes as the technologies advance and change.

Many existing Luxembourg legal and regulatory rules already apply to virtual currencies or digital tokens, with the situation in Luxembourg largely aligned to the EU analysis. As a result, where there is no specific legal regime, existing rules and regulations apply. These include, amongst others, financial sector, capital markets and investment funds laws, AML/CTF rules, and consumer protection requirements. In Luxembourg, these are largely based on EU directives, resulting in the situation in Luxembourg being largely aligned to that in other EU jurisdictions, albeit with certain country-specific particularities and interpretations.

When new situations or technologies arise, these existing rules are assessed on a case-by-case basis so evaluate how those rules will apply. As a result, although the current Luxembourg legal and regulatory framework does not *specifically* deal with questions related to crypto-assets and the legal treatment of digital tokens, as in general the existing rules already apply.

3.1.1 Technology-agnostic – yet legislating where interpretation and guidance are insufficient

Whilst the legislator and regulators have stressed that their approach is to remain *technology-agnostic* in order to ensure the rules work for multiple situations and continue to be relevant as technologies change over time – concentrating on guidance and interpretation to proactively ensure old laws adequately support new technologies and business models. Occasionally they consider this is insufficient. For example, in early 2019 a small tweak to existing wording was made to modify the law of 1 August 2001 on the circulation of securities to include DLTs. This had been considered necessary to ensure legal certainty as the original text was considered too restrictive.

3.1.2 Luxembourg as a hub for payment institutions (or so-called crypto-exchanges)

The CSSF was, however, one of the first European regulators to take a stance on the regulation of virtual currencies in February 2014. Since 2014 the CSSF has authorised several cryptocurrency exchanges as payment institutions in Luxembourg.

3.1.3 Interpretative guidance regarding the nature of tokens

Interpretative guidance regarding the nature of tokens from the Luxembourg regulator has largely remained in line with EU positions. In the context of crypto-assets and tokenisation, such analysis has focused on factors such as the features and purpose of the assets or tokens, the services provided by relevant actors, and the form of the token issuer.

3.1.4 Token qualification

From a Luxembourg (and EU) law perspective, a digital token may fall within the definition of financial instruments, electronic money or units of an investment fund under Luxembourg law.³

- Transferable securities

When does a digital token qualify as a **financial instrument** (and in particular as a **transferable security**) as defined in MiFID⁴? Here Luxembourg law is aligned with EU law and does not set out additional types of financial instruments. The criteria set-out in the EU law also apply in Luxembourg, and to the extent that a digital token fulfils these criteria, it would usually be considered as a transferable security under Luxembourg law: (i) transferability, (ii) negotiability on a capital market, (iii) no payment instrument, and (iv) comparability to equity and shares.

- Payment instruments and electronic money

Where digital platform tokens allow users to purchase and obtain digital goods and services either from the issuer itself or third-party participants, these may be regulated as electronic money as a means of exchange. Additionally, some virtual currencies may qualify as payment instruments under the law on payment services.

- Units in investment funds

Whether an investment fund may issue digital tokens depends largely on its corporate form, structure and activities.

As token issuances are often used as a way to raise funds in order to finance a current or future activity, depending on their cha-

³ As set out in several laws, including the law of 5 April 1993 on the financial sector, as amended and the law of 10 July 2005 on prospectuses for securities, as amended, or, as the case may be, the recent EU Prospectus Regulation.

⁴ [Annex II, Section B Financial Sector Law, which implements Annex I, Section C MiFID II](#)

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characteristics and rights, they may fall within the definitions of the various investment funds laws (and if so, subject to those requirements – including requirements for regulatory authorisations for the issuer and of various service providers, as well as various regulatory restrictions regarding marketing related to such offerings, vehicles or asset classes and information requirements such as prospectuses). In particular, a digital token issuance may qualify as the issuance of units of an AIF if it falls within the AIF definition⁵.

- Funds investing into virtual currencies

The interesting corollary to re-characterisation as **transferable securities** is that funds should be able to invest into tokens and/or virtual currencies – provided these fit their investment objectives and investor types.

The CSSF has stated that Luxembourg-based UCITS marketed to non-professional customers and pension funds may not invest directly or indirectly into “virtual currencies”.

AIFs (funds which do not fall within the definition of a UCITS fund) should, however, be able to invest into such digital tokens, but as for any other investment may do so only where this would fall within the remit of their investment objectives and regulatory licences, and those of their service providers, and only after ensuring their policies and procedures are appropriate.

The requirement to appoint a depositary to take custody of the fund’s assets (including the digital tokens) where a fund is over certain thresholds has been a barrier across the EU generally. Depositary solutions have

however recently started becoming available.

For further detail on this topic, please also refer to the [Guide Through the Common Features of Digital Asset Generating Events](#) and the [thinkBLOCKtank Position paper on the regulation of tokens in Europe \(version 1.0\)](#).

3.1.5 AML/CTF

Token issuers, initiators and other involved parties must, amongst other things, and to the extent they fall within the scope of the Luxembourg AML/CTF legal framework, establish appropriate AML/CFT procedures and comply with the relevant requirements, including client identification.

The [5th EU Anti-Money Laundering Directive](#) and the [FATF Guidance for a Risk-Based Approach to Virtual Assets and Virtual Asset Service Providers](#) enhance and extend these requirements.

- Information requirements

Luxembourg consumer protection laws or those related to distance contracts or services laws may apply, requiring items such as transparent and clear information.

- Taxation clarity

The Luxembourg tax administration clarified in a [circular dated 26 July 2018](#) the tax treatment of virtual currencies under Luxembourg tax law. In line with usual practice, Luxembourg taxpayers should use a principle and substance over form approach to comply with the existing Luxembourg tax rules. Given the lack of standardisation in token products a case-by-case analysis remains necessary.

3.2 Security. Can we hack the blockchain?

The fourth revolution is here with the concept of total digitalisation. Considered one of the greatest innovations since the internet, blockchain is going to celebrate its 11th birthday in February 2020 and is still at the epicentre of the revolution. Despite certain challenges, tokenisation of assets is already a reality and we see more and more signs for a massive adoption.

By definition, blockchain is an open, distributed ledger that can record transactions between two parties efficiently and in a verifiable and permanent way. Its promise of security is one that warrants further focus, however. What could be controversial is that the number of hacks has never decreased.

Security is crucial in order to allow the financial industry at large to benefit from the technology while meet its obligations in terms of investor and banking protection.

3.2.1 If a blockchain cannot be hacked, how come cryptocurrencies have been stolen?

There is often confusion between the blockchain technology and the use of the underlying the cryptocurrency/the crypto-asset. A cryptocurrency is defined as a digital currency stored in a blockchain. The biggest hack in terms of value occurred in its infancy with *Mt. Gox* in 2014 (value of approx. EUR 700 million in 2014) and

⁵ Pursuant to Article 1(39) of the AIFM Law, an AIF is an undertaking for collective investment that raises capital from multiple investors with a view to investing that capital for the benefit of those investors in accordance with a defined investment policy and does not fall within the UCITS regime.

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with *Coincheck* in Japan in January 2018 (value of approx. USD 500 million). One of the biggest and most popular of 2019 was the hack of *Binance* in May that year for USD 41 million (BTC 7,000). It was the result of a combination of malware and phishing attacks.

Every day, individuals are hacked in crypto-exchanges and with their wallets. Cryptocurrencies introduce new concepts with the public/private keys pair, and this requires special attention in terms of security. Remember that a private key is like a PIN code or password: just as you should never give your password away, you do not give away these private keys. Social engineering is prevalent in the world of crypto-exchanges, so education is crucial to prevent hacking. Dedicated solutions to store digital assets in cold storage are already on the market. The security of the crypto-exchanges is an important element in its choice to store the digital assets.

3.2.2 If a financial company moves assets to a blockchain, is there a risk to be hacked? What are the different possibilities and sophisticated techniques?

Since 2009, we have witnessed the creation of a large number of blockchains using different protocols like the “proof of work” which is the most known but also the “proof of stake” or “proof of authority”. In the case of the public blockchain, transactions are verified and validated by at least 51% of the so-called “miners” (more than 10,000 nodes in bitcoin network). The “51% attack” or “the gold finger” consists in gathering more than 50% of the computing network. A mining pool in China has already reached 42% of the bitcoin computing power. The potential impact could be to freeze the validation of transactions and to process double spending (buy a transaction and delete a transaction). This method requires huge investment and the community closely monitors such processes, even if an instance of double spending occurred in *Ethereum Classic* as recently as January 2019.

3.2.3 The potential failure of the smart contract

The smart contract is a piece of computer code running on top of the blockchain, allowing the

execution of automatic actions. When predefined rules are met, the agreement is automatically enforced. From a security perspective, a smart contract cannot be hacked. Where a failure can occur however is in the drafting of the smart contract. A [recent study](#), using an algorithm that merely checked the most common exploit possibilities, found around 3.4% of smart contracts faulty as a result. The case of *The DAO* (named after the abbreviation for decentralised autonomous organisations, DAO) became a key symbol of a fund hacked following the vulnerability of a smart contract for more than USD 50 million. The audit of smart contracts before going into production is crucial to secure the process.

3.2.4 ... and what about quantum computing?

Quantum computing has recently appeared on the tech radar with *Google's* announcement to have achieved “quantum supremacy”. It is based on the principles of quantum theory to perform computation, allowing to solve complex equations in a very short time. It is likely to ring in the era of the modern super computer. Blockchain technology is based on asymmetric cryptography. The development of quantum computing could make the blockchain more vulnerable and put it at risk from a security perspective. Quantum computing is still a nascent technology, but its impact could surpass the blockchain technology.

In our digitalised world, security is not optional. Even if we consider blockchain as sufficiently secure, nascent emerging technologies and the fast pace of change will remain challenging in the coming years.

With this in mind, the institutions need to devote absolute care to security at all levels. The role of the custodian will evolve, becoming more technology- and security-centric. The cybersecurity plan will be the crucial element that will allow tokenisation and digital custody to become mainstream.

3.3 Integration of the new world in the existing ecosystem

The tokenisation of fund parts and assets is a digital transformation that impacts operations and business models in an incremental or potentially also disruptive manner. In view to successfully integrate tokenisation, one must therefore define **why** this is being done, **how** it would be implemented and formalise the **outcomes**.

The **why** is essential as it drives tokenisation and usually sets the degree of transformation. In a nutshell, you should tokenise if it improves your operational efficiency, enhances client satisfaction, and helps make your organisation future-proof or a combination of the aforementioned. While the two first propositions

seem quite self-evident we will explain the third later.

The **how** will determine the scope, the stakeholders you need to involve, the resources required, the timing, the transformation method used as well as the KPIs. Here, the scope is essential from a technological perspective because tokenisation fundamentally entails chains of tokens, a consensus protocol and distributed ledger, but depending on the use case different building blocks would be used. Finally, the **outcome** will show the performance and importantly also the learning.

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Tokenisation holds the promise to make transaction processes faster, securer and cheaper. This is an important factor for the asset management industry, especially the Luxembourg fund administration as there are increasing pressures on pricing and quality. In this context, the scope could consist of a proprietary token within a permissioned network: distributed ledgers would be reduced to a minimum, the consensus mechanism would be light and the focus would lie on the design of tokens and smart contracts. The stakeholders would primarily be the back office, transaction management and product teams, while the front end would not see any difference, save for instance the fact that transactions have become faster. With this type of incremental operational change, it is advised to work with a parallel run to existing systems and an implementation done under a precise timeline in a scrum mode. When the aim is to evolve a whole segment of the operation, this tends to require meaningful resources. KPIs should be easy to measure and would entail elements like the cost per transaction, end-to-end time per transaction, error percentage etc.

Enhancing the client experience capitalises on the fact that tokenisation provides access to new types of investments that are highly divisible, transparent and disintermediated. Indeed, many alternative investment products like venture capital, private equity and real estate, are only accessible to selected investor groups that must invest high minimum amounts. Further, many of those alternative investments suffer from a lack of liquidity. Especially in the current low-return environment many investors are looking for yield, but do not want to sacrifice liquidity. Hence, there is a natural demand for such tokenised assets. The advantage of tokenisation is that existing investors can transact their assets in an easier manner and new investor segments can access such assets. This requires changes in the operational backbone but more importantly a new front end. Technically, a much broader set of distributed ledgers, with or without wallets, a consensus mechanism for a wider user group and very versatile, divisible and fungible tokens are required. On top of operations, a much wider group of stakeholders should be involved like for example marketing, sales, legal and compliance. In order to test and validate client buy-in, it is advisable to use design-thinking tools and to advance in agile mode. At every iteration, the approach should be validated and new features should be tested. The KPIs would include elements such as new clients acquired, client usage, client break-offs, client acquisition costs.

The future-readiness is trickier. Tokenisation will somehow impact the fund management industry but a clear use-case has not been delineated. Nevertheless, doing nothing entails the danger that in-house teams will lag behind and not be able to embrace the technology if or when it scales either by building it internally or by partnering with others. Here it is sufficient to work with full functionalities on a small scale. Usually, dedicated or virtual innovation teams are engaged in a lean and agile manner. The KPIs usually measure the effectiveness and completeness of PoCs, the successful engagement with partners, the intelligence gathered, etc.

Generally, while in projects aiming at operational efficiency it may be possible to work with internal stakeholders, most use-cases require the collaboration with external partners in view to optimise returns.

In terms of **outcomes** one should primarily prepare to measure the performance in accordance with set KPIs and other factors, but bearing in mind that much wider variances are normal for innovative projects. It may be advisable to add a variance to fixed KPI numbers or to define targets with minimum thresholds. The analysis should cover questions like: Was the expected cost reduction or increased transaction speed/throughput achieved? Were the timeline and budgetary constraints respected? Was a given number of new investors onboarded? Have investors transacted the quantity of tokens projected?

Importantly, learning should be formalised by looking at the reasons behind the variances in performance but also assessing fundamental questions like whether the use-case, the KPIs, or the KPI-range make sense or what works well and what could be improved.

In summary, the integration of tokenisation in the fund industry, requires the definition of use-cases with clear benefits. Effective execution should be founded on lean, iterative and client-centric project methodologies. The key consists in being able to test on a small scale and scale from there in an industry that is volume driven. Realistically, tokenisation is an innovative endeavour with outcomes that are being discovered, which is why it is essential to captivate value through formalised learning.

It is by smartly managing the risk of exploring as well as opportunities linked to tokenisation that the fund industry will reap the rewards.

4 Outlook by Nasir Zubairi: Inevitability

Towards the end of 2019, sitting with the LHoFT team and enjoying a glass of wine together, we began reflecting on the crazy year gone by. At one point in the reminiscing I asked the team, “Which of our member FinTech firms really excite you, which ones do you think are going to do really well?” Talking through the many incredible firms we work with across diverse fields of focus, we came to agree on four companies that excited us most, that we felt are really driving forward at Ferrari pace. All four firms are active in the blockchain field, specifically, the application of blockchain technology to the securities and asset management space. I would never have predicted that we would feel this way about a blockchain company just two years prior.

Something had changed in 2019. The slight disillusionment that I felt had come to set in around blockchain, dissipated. The raised eyebrows and dismissive hand gestures of finance executives, driven, perhaps by (1) the perceived anarchy of the core cryptocurrencies, most prominently bitcoin, (2) the questions on definitive use-cases for which blockchain was clearly the best and optimal technology, waned. It was like the clearing of an early morning mist.

The announcement of Libra, driven by *Facebook* and backed by an admirable quorum of leading firms, had made the world of finance, both institutions and notably supervisors, jolt upright from the doze they had fallen into. Suddenly, all were dusting off their research and re-focusing their teams, conducting new (ok, for some I give the credit of “renewed”) investigations, looking to understand blockchain, conducting impact assessments, risk assessments, opportunity assessments. I personally was asked to meet and discuss Libra and broader, such as implications of Central Bank Digital Currencies (CBDC), and the impact of blockchain on the securities markets, with several supervisory bodies such as the US Treasury, the US Federal Reserve, The ECB, the EC, alongside increased vigour in discussions at the IMF High Level Advisory Board on Finance and Technology. I am writing this on the TGV to Paris, where I will attend a two-day meeting at the OECD as part of their new Blockchain Expert Policy Advisory Board.

Blockchain, perhaps more specifically, DLT, is not going away. Quite the opposite; the Libra announcement was, to me, a milestone that pushed the momentum behind the technology into top gear. I am first to raise a hand to having some scepticism on the technology. Coupled with my continued learning on blockchain, I helped design a distributed ledger trading platform, the *EBS Dealing System*, that, in its heyday, matched transactions totalling USD 240 billion a day across 900 trading floors in the interbank market. So I have some hands-on experience of the pros and cons, and I would

happily debate with anyone that dared on why any blockchain solution could not be better implemented on traditional infrastructure. But I have moved beyond this discussion; it is fruitless. DLT is here to stay and will drive systematic change in the financial markets. Change that will benefit the customer. Change that will benefit industry participants only as long as they embrace it with open arms.

My learned peers as authors of this book have provided you with detailed insights on DLT, tokenisation and its potential impacts. Tokenised securities are a great way to enable liquidity for traditionally illiquid assets and also to enable access to a new class of investors. There are many different use-cases appearing for tokenisation, such as for art, real estate and private equity. Tokenisation is also driving lower costs and efficiency in traditional asset classes and services like for equity, repo, securities lending, collateral management and, in particular, for bonds, where there are a growing number of tokenised bond issues, increasing in significance.

The traditional financial sector needs to act to ensure that they can manage these digital assets for their clients through custody and administration and provide access to robust secondary markets for liquidity. The demand is there; to the extent that the customer, notably in the case of *Fidelity Investments*, is taking on self-custody of digital assets given, to some extent, the inertia of their service providers in developing the required services. There is a race between several significant sovereigns to issue a tokenised bond and I believe we will see such an issue in 2020.

There clearly must also be a focus on education and talent. Luxembourg depends on the investment industry. Fund managers, depositories, lawyers, fiduciaries, administrators, management companies – all must learn about and understand DLT and its uses, and will have to position themselves in relation to digital assets and how to manage them. Firms will have to look to develop talent internally and/or hire blockchain developers and experts. Many will turn to third-party FinTech providers. A proactive strategy related to DLT must be put in place now, not tomorrow; the time of “wait and see” is assed.

“But Goethe tells us in his greatest poem that Faust lost the liberty of his soul when he said to the passing moment: ‘Stay, thou art so fair.’ And our liberty, too, is endangered if we pause for the passing moment, if we rest on our achievements, if we resist the pace of progress. For time and the world do not stand still. Change is the law of life. And those who look only to the past or the present are certain miss the future.”

-- John F. Kennedy, Frankfurt, 25 June 1963

About ALFI



The Association of the Luxembourg Fund Industry (ALFI) represents the face and voice of the Luxembourg asset management and investment fund community. The Association is committed to the development of the Luxembourg fund industry by striving to create new business opportunities, and through the exchange of information and knowledge.

Created in 1988, the Association today represents over 1,500 Luxembourg-domiciled investment funds, asset management companies and a wide range of businesses that serve the sector. These include depository banks, fund administrators, transfer agents, distributors, legal firms, consultants, tax advisory firms, auditors and accountants, specialist IT and communication companies. Luxembourg is the largest fund domicile in Europe and a worldwide leader in cross-border distribution of funds. Luxembourg-domiciled investment funds are distributed in more than 70 countries around the world.

ALFI defines its mission as to **“lead industry efforts to make Luxembourg the most attractive international centre for investment funds”**.

Its main objectives are to:

- **Help members capitalise on industry trends**

ALFI’s many technical committees and working groups constantly review and analyse developments worldwide, as well as legal and regulatory changes in Luxembourg, the EU and beyond to identify threats and opportunities for the Luxembourg fund industry.

- **Shape regulation**

An up-to-date, innovative legal and fiscal environment is critical to defend and improve Luxembourg’s competitive position as a centre for the domiciliation, administration and distribution of investment funds. Strong

relationships with regulatory authorities, the government and the legislative body enable ALFI to make an effective contribution to decision-making through relevant input for changes to the regulatory framework, the implementation of European directives and the regulation of new products or services.

- **Foster dedication to professional standards, integrity and quality**

Investor trust is essential for success in collective investment services and ALFI thus does all it can to promote high professional standards, quality products and services, and integrity. Action in this area includes organising training at all levels, defining codes of conduct, transparency and good corporate governance and supporting initiatives to combat money laundering.

- **Promote the Luxembourg investment fund industry**

ALFI actively promotes the Luxembourg investment fund industry, its products and services. It represents the sector in financial and economic missions organised by the Luxembourg government around the world and takes an active part in meetings of the global fund industry.

ALFI is an active member of the European Fund and Asset Management Association, of the International Investment Funds Association, of Pensions Europe, of the International Association of Pension Funds Administrators and of the Global Impact Investing Network.

For further information, visit www.alfi.lu. For the latest news from ALFI and the Luxembourg fund industry, follow ALFI on [LinkedIn](#), [Twitter](#) (@ALFI-funds), [YouTube](#) and [Flickr](#).



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**TOKENISATION AND DIGITAL CUSTODY
IN THE WORLD OF THE INVESTMENT FUND**

A COLLABORATIVE BOOK