

Decentralizing Finance via Cryptocurrencies and Tokenization of Assets and Peer-to-Peer Platforms

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Abstract

The rationale behind this research is to demonstrate the tokenization effects of the blockchain on all types of assets, and how blockchain technology might improve the way we view digital exchange and use digital money. The finance industry is progressing towards innovative solutions, capable of dealing with traditional problems and of increasing efficiency, sustainability and accountability. This progression may also address market failures within the economy. In our conceptual chapter, we provide a short discussion of the decentralization of finance and where we are today. We begin with the fundamentals of money and the evolution of cryptocurrency issuance from ICOs to STOs then to stablecoins like CBDCs. We then examine the concept of tokenizing various types of assets and deliberate on a conceptualization of a tokenized capital markets trading platform. To clarify tokenization and its benefits, we provide an example on the tokenization concept for agriculture and livestock in raising capital for small farms. Finally, we conclude discussions on concerns for privacy and security which emphasizes on self-governance, self-regulation and cybersecurity measures.

Keywords: *Asset-backed Tokens, Capital-raising, Decentralization, Securitization.*

A. Introduction

There are several key drivers that are making decentralized finance work – tokenization of real-world assets, maturity of stablecoins and the improved acceptance of regulations and standardization. We are witnessing two fast-growing trends merge and complement each other: The first one is tokenization, where all illiquid assets in the world, from private equity to real estate and luxury goods, become liquid and all liquid assets can be traded more efficiently. The second is the rise of a new tokenized economy where inevitably new transactional rules will be established within the digital economy that will guide economic behaviors that are productive, efficient and just. This is a huge opportunity for Islamic economics and finance to participate to determine and implement its prescribed rules of risk-sharing and social justice in financial transactions. By unlocking the economic potential of the blockchain, these two complementary and correlated trends will complete the decentralization of finance and the way financial services of smart cities of the future will be implemented.

In this paper, the sectoral disruptions within the financial management and services industry that we discuss include cryptocurrencies, capital markets, asset and portfolio management and we provide an example on tokenizing agriculture and livestock. The identified DeFi¹ applications for financial management and services are in the tokenization of assets of

¹ DeFi is a terminology short for “decentralized finance” for a variety of financial applications in frontier technologies geared toward disrupting financial intermediaries. It removes the traditional central authority from the transactional equation and ensures direct exchange between counterparties.

value and the subsequent processes that involve client onboarding, financial prediction, management of model portfolios, payment systems, trade clearing and settlement (Mohamed, 2020a). We begin with the fundamentals of money and the evolution of cryptocurrency issuance from ICOs to STOs then to stablecoins like CBDCs. We then examine the concept of tokenizing assets and deliberate on a conceptualization of a tokenized capital markets trading platform. To further clarify tokenization and its many benefits, we provide an example on the tokenization concept for agriculture and livestock in raising capital for small farms. As in all digital transformation concepts, we include discussions on concerns for privacy and security which emphasizes on self-governance, self-regulation and cybersecurity measures.

The financial management and services industry plays a critical role in our economy such that it supports all economic activities through capital formation, preservation and distribution. However, it suffers from a trust deficit as result of persistent financial crises due to unethical and non-performance of fiduciary duties by entities that have been entrusted such duties. Technology was seen as a viable way to automate or make operationally-inherent such checks and balances that would improve the governance of financial services. The fallibility of human judgement, or the lack of it, makes digital transformation more crucial when code of ethics and corporate governance fails to live up to its noble expectations. Fraud and abuse detection mechanisms can help enforce accountability and security in financial services.

Digital transformation is also important to the financial services industry for competitiveness and stability in the markets. The sustainability of any organization relies on its ability to innovate, and embrace change and new ways of doing business to scale and substantially enhance efficiency and elevate performance within the organization. Without the reinvention and transformation of existing processes, services cannot reach to the evolving levels of financial efficiency and rising utility of the people that use such products and services.

B. Literature Review

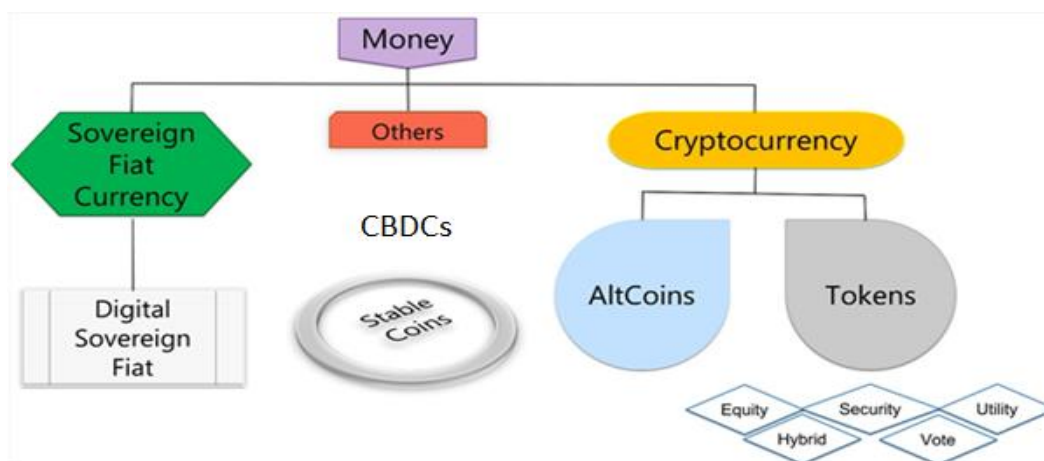
1. Money, Fiat Currency and Cryptocurrencies

The three main functions of money are unit of account, medium of exchange and store of value. Cash is a financial instrument and physical asset that combines four features: (i) it is anonymous (ii) it is universal (anyone can take possession); (iii) it is exchanged peer to peer (without knowledge of the issuer) and (iv) it does not yield any interest by itself (Mohamed, 2020b). Banks are the traditional money creators and maintain their inimitability at keeping reserves at the central banks (CBs). Peer-to-peer exchangeability allows its exchange between counterparties without intermediaries. Universality means that anybody can take possession of it, use and store it. Historically, currencies were backed by value which can be done via gold, silver, commodities, or the government. In fact, fiat money used in the current economic system is considered a currency, and this includes the emergent use of plastic and digital currencies (digital sovereign fiat). Its core function is to serve as a customary accepted form of payment by the people in exchange for goods and services.

Cryptocurrencies are a form of virtual currencies built on blockchain technology, which may be native or Bitcoin-derived, and the first cryptocurrency appeared in 2009.

“Cryptographic techniques lie at the heart of their implementation” (He et al., 2016) and “historically, the idea and concept of storing important information by using cryptography technique is considered older, as the term crypto is taken from an ancient Greek word Kryptos means ‘hidden’”. Some of the records show that “ancient Egyptians also used cryptography as it is evidenced by the usage of cipher by Julius Caesar in 100BC to 40BC” (Fry, 2018).

Figure 1: Forms of Money and the Categorization of Cryptocurrencies and Stable Coins



Cryptocurrencies bear some similarities to regular currencies. Unlike regular currencies, cryptocurrencies are purely digital assets, supported by blockchain enabled encryption techniques, using cryptography to secure transactions, control the creation of additional units and verify the transfer of assets. The critical difference between the two is that cryptocurrency can be created independently of central banks and can be used independently of typical regulated financial intermediaries (such as banks). Unlike sovereign fiat currencies, cryptocurrencies are not legal tender (i.e. guaranteed by a government).

Crypto tokens are a form of cryptocurrency that may appear as typically as equity, security or utility tokens, whose purchasing power and right of exchange is limited to a specific asset, product or service for which the token is issued. Other types of tokens, include “asset-backed token” – token that represents some physical asset like gold or real estate, “vote tokens” – tokens that confer its holder a right to involve in a project development and “hybrid tokens” – tokens that are the hybridization of two or more forms of tokens or its representation.

Cryptocurrencies are championed by its advocates due to its ability to be strictly peer-to-peer exchange without intermediaries like banks involved. Its critics are concerned with them being used in illicit transactions as the system is essentially decentralized and formally unregulated. Another problem for cryptocurrencies is its volatility. As such, the most recent phenomenon is the creation of stablecoins . Likewise, the central banks of major economies started to rethink their own sovereign fiat currencies to leverage on the benefits of tokenizing currencies in terms of a more efficient interbank settlement system (Mohamed, 2020b). Such a legal tender central bank issued digital currency are called a Central Bank Digital Currency (CBDC) whose value is pegged to its sovereign fiat currency value.

C. Research Methodology

The conceptual framework investigates and proposes various use cases for the application of AI and blockchain to support the range of financial services and the essential underlying services associated with financial institutions and its customers. Our discussion intends to demonstrate the right use of each technology to bring out its benefits when applied appropriately and to understand the relationships of technologies and how it can be used to serve the shift in consumer behavior. The paradigm shifts brought on by digital transformation is altering the customers' behaviors towards financial services and how it is being managed and deployed. Today, consumers want financial services at the tip of their fingers from anywhere, at the tap of their mobile screens, wherever they are – in offices, homes or at a park. Mobility, instant gratification and shorter attention spans are now priority considerations as financial management and services goes mobile and agile.

As such, our discussion covers a broad spectrum of areas from the onboarding of customers to financial platforms, to advisory via chat-bots, AI-driven financial predictions from historical data with respect to forward-looking market data, decentralized payment systems, digitized trade settlements, portfolio construction and asset management and on the overall framework for decentralized finance to work sustainably.

D. Result and Discussion

1. From ICOs to STOs

An Initial Coin Offering (or ICO for short) is an innovative form of raising capital or investments by issuing tokens or alternative cryptocurrencies, that does not necessarily involve any equity being acquired by the token buyers or investors. ICOs act to raise funds, where a company can raise money via tokenization of their business venture. Investors in ICOs are typically speculators who expect the tokens to skyrocket in value, and therefore only relying on the team behind the project, to improve the value of the tokens.

Unfortunately, ICOs are often likened to stocks or shares in the venture. In effect, many of the tokens issued are more like a utility to be exchanged for a product or utilized as a service. So ICOs do not grant the token-holder any right to equity or profit-sharing of the company's revenue, unlike stocks. ICOs were a duplication of the IPO (initial public offering) without having built the venture to a level of maturity that would represent some form of substantial value from revenue performance. Instead, it was meant to fast-track the venture's ability to raise capital just based on the strength of its idea and the team behind that idea. Needless to say, it raised many concerns, especially in an unregulated environment.

Figure 2: Fundamental Differences between ICOs and STOs



Then in 2018, after several mishaps and complaints, the SEC “issued a guideline (constantly being updated) mentioning that all Coin Offerings are security tokens. Many regulators followed suit shortly after, which led to the development of a new form of Coin Offerings dubbed the STOs or Security Token Offerings” (SEC, 2019). Still utilizing the tokens issued as a representation of an investment, the STO security token now signifies a “contract into an underlying investment asset, such as stocks, bonds, funds and real estate investment trusts (REIT)”. Like a typical security, it is a “fungible, negotiable financial instrument that holds some type of monetary value, or an investment product that is backed by a real-world asset such as a company or property” (SEC, 2019).

The additional requirements included that the venture must prove that they are viable through proof of data, proof-of-concept (POC) / minimal viable product (MVP) or prototype, and other elements like traction to show evidence of viability.

Table 1: Important Distinctions between IPOs, ICOs and STOs

IPO	ICO	STO
IPO gives you ownership of the company based on the number of shares acquired	ICO give rights of project, not the company equity	STO tokens represent a share of an underlying asset.
Financial data according to exchange of IPO issued	As outlined within the white paper and investor agreement.	A security offering under the qualification of an investment contract.
Subject to taxes, with investors liable to capital gains tax	ICO company may not be taxed; investor subject to capital gains tax.	Subject to taxes, with investors liable to capital gains tax
An IPO is a onetime sale with multiple intermediaries	ICOs can have multiple rounds with no intermediaries, the white paper as the blueprint.	STOs have limited intermediaries (lawyers, advisors, no bankers)
Stock exchanges and companies listed by IPO are heavily regulated	ICO exchanges are not regulated	STO are somewhat regulated

Unlike the ICO market where 2/3 of the projects failed or turned out to be scams, the STO market had higher survival and success rates. The mandatory regulatory and legally enforceable requirements imposed on STOs deterred entities with fraudulent intentions from using the DeFi movement for their dishonest purposes. Looking ahead, such steps are necessary if this channel of securitization can be an option for mainstream adoption.

Also, it is critical to distinguish between private securities and public securities. If a token is considered and handled solely as a private security, in many jurisdictions there will be the possibility of using certain regulatory exemptions. In these cases, the comprehensive IPO (Initial Public Offering) requirements will only come into force if a private token (STO) violates the restrictions related to the exemptions in question and begins to act as a public security (IPO share).

But an advantage of an STO over an IPO is that the security token can behave like a programmable share and offers a set of functionalities and attributes that a traditional public IPO share does not have. For instance, an STO can be created into an investment product that is better than traditional stocks (and bonds) by way of rewarding investors both from the forefront through risk-sharing model to share profit (and losses) and from the back through dividend payments. STO companies that can offer profits from the front and back of the business simultaneously, have the potential to become the new darlings of profit-driven investors.

2. Tokenization of Assets of Value

Tokenization is likely to become one of the most important and influential trends in the crypto space in the coming years. As mentioned earlier, tokens are a representation for 'something' on the blockchain that does not necessarily have to be a currency – like Bitcoin – but could also be a wide range of other types of tangible or intangible assets.

By tokenizing private securities, we can potentially map out and transform illiquid costly assets to highly liquid assets with higher cost-effectiveness. Given that the asset categories within the private securities market are in the trillions of dollars (where the illiquidity discount can be as high as 20-30%), the tokenization of private securities has the potential to unlock billions of dollars in value.

The basic idea of tokenization is the use of smart contracts on a blockchain to create a virtual representation of a certain asset in the form of a token. Depending on the type of asset to be tokenized, different tokens and token standards have been developed for the tokenization process, and different challenges and opportunities come with the tokenization of the asset in question. Tokenizing tangible real-world commodities differs from tokenization of intangible assets like a software license. Tokenizing fungible assets like identical types of shares differs from the tokenization of non-fungible assets like a unique work of fine art. Regardless of the type of asset to be tokenized, the basic purposes and benefits are the same: by tokenizing assets and thus equipping them with a virtual representation in the form of a token on a blockchain, it is possible to cut away costly and inefficient middlemen – decentralized trade and exchange which is faster and easier.

Figure 3: Tokenizing Different Types of Assets

		ERC-1155 Crypto Item Standard	
		Fungible (ERC-20)	Non-fungible (ERC-721)
Intangible	}	<ul style="list-style-type: none"> • Cryptocurrencies • Shares, Bonds, etc. 	<ul style="list-style-type: none"> • Certificates • Copyrights • Licenses, etc.
		<ul style="list-style-type: none"> • Hard commodities (gold, silver, etc.) • Soft commodities (corn, wheat, etc.) • Energy (Electricity, etc.) 	<ul style="list-style-type: none"> • Artwork • Collectables • Diamonds • Real Estate, etc.
Tangible	}		

Developing blockchain and smart contract-based tokenization platforms will create solutions for tokenization of all kinds of real world assets from intellectual rights to commodities to collectables to real estate with the purpose of increasing liquidity, cutting costs, enabling fractional ownership of assets and opening up the estimated US\$280 trillion market of real-world assets for investment. This makes it possible for anyone, anywhere in the world to invest and create a future global investment market far more democratized than the market of today.

3. The Tokenized Capital Markets and Debt Markets

A fully developed capital market is made up of a primary market where securities are created, and a secondary market where those securities are traded. The most common capital markets are the stock exchanges where financial products such as equities (e.g. ownership shares such as stocks), as well as the bond market where interest-bearing debt instruments are bought and sold.

With tokenized systems on the blockchain, the capital market trading platform can be streamlined (see Figure 4), “providing an automated trade lifecycle where all parties in the transaction would have access to the exact same data about a trade. This would lead to substantial infrastructural cost savings, effective data management and transparency, faster processing cycles, minimal reconciliation and the potential removal of brokers and intermediaries altogether” (see Figure 5). In the DeFi model of capital markets, the primary market where securities are created are done via securitized token offerings (STOs), and a secondary market where these securities are traded will be crypto-exchanges. The ownership of shares and securities are tokenized and recorded by smart contracts for safe-keeping or trading.

Figure 4: Conceptualization of a Tokenized Capital Markets Trading Platform

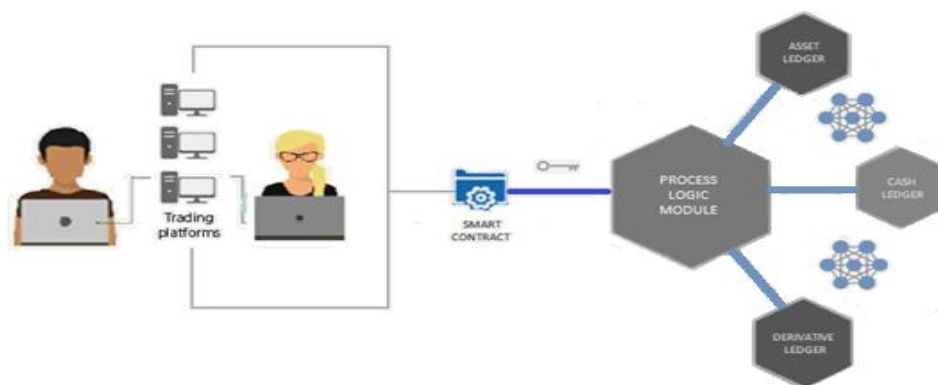
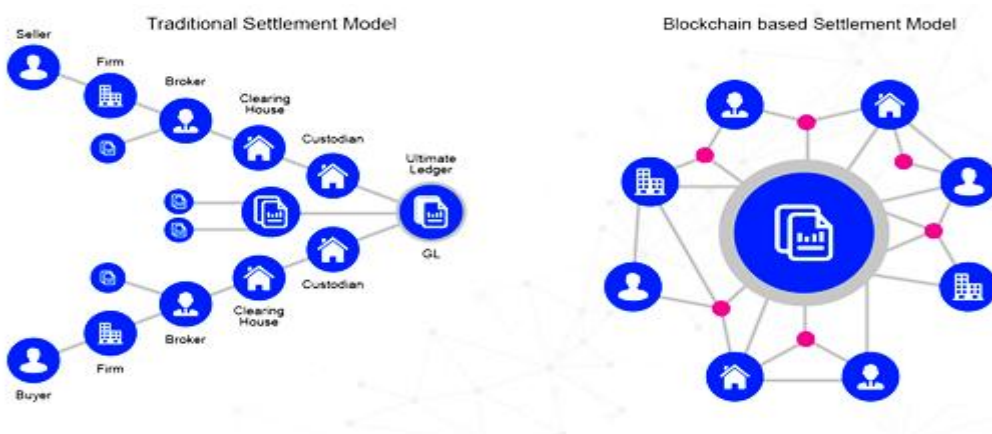


Figure 5: Comparative Settlements in Capital Markets



As for the bond market, digitalization will reduce cost of origination and issuance, allowing the quantum for digital bonds to be much lower, and hence enabling issuances which are in the range of US\$1-10 million. This opens up the debt capital market space for smaller corporations, which have lower revenues and assets and unable to issue traditional bonds for capital. They have to typically resort to high-interest corporate loans, which does not really help them to securitize any of their assets. Through tokenization, they will be able to unlock liquidity from their illiquid but valuable possessions. Such digital issuances can be further strengthened by risk-sharing asset-backed concepts like the sukuk (Mohamed, 2021, Chapter 3).

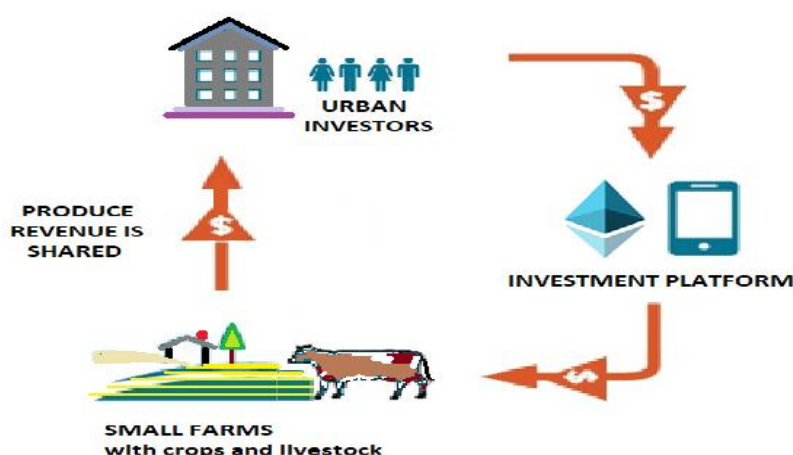
Further, a digital bond can be a structure for social impact such that the payment structure keeps “accountability a requirement for the delivery of goods and services, and that effectively spreads the risk of the underlying project amongst the investors and shareholders, instead of transferring the entire risk to the issuer without having achieved the objectives” (Mohamed, 2019).

4. Example: Unlocking Value in Agriculture and Livestock

According to the Food and Agriculture Organization of the United Nations (FAO, 2015), “about two-thirds of the developing world’s 3 billion rural people live in about 475

million small farm households, working on land plots smaller than 2 hectares” (Nagayets, 2005). A large majority are poor and in constant need for food and clean water. Access to basic markets, finance and essential services are limited. Since their options are hampered, they end up farming the land and harvest food from nature. They eventually become skillful farmers, rearing cattle and many forms of livestock and growing crops, that collectively provide for a substantial proportion of the world’s population. However, as years go by, capital and credit constrain their ability to adequately use the natural resources for maximum production. Their lack of credit, and subsequent scoring information, inhibits their access to capital in many ways, and severely impacts the availability of rural agricultural financing.

Figure 6: Tokenizing Agriculture and Livestock for Capital Investment



An innovative investment platform can be built to provide access to capital for these farming households from urban white-collar workers who are looking for better investment platform. Livestock can be viewed as valuable assets that can be tokenized to unlock capital to fund production, land, labor and other critical resources required to ensure effective farming output. However, livestock presents an unconventional way of collaterals for financing. As such, special provisions need to be in place before investors may want to risk their investments. One of those provisions are the health tracking and ability to insure these mortal and roaming assets (livestock and farm animals) to ensure the successful production cycle for both the farmers and urban investors. With the auditability and traceability of the tokenized (blockchained) system involving mobile phone apps, embedded wireless sensors on the livestock and an online platform that monitors the progress of each batch cycle, value can be distributed directly to investors who wish to support the production of meat, poultry and other forms of agriculture for small farms. Such traceability to monitor and audit allows for insurance to cover for these unique assets which will greatly help in mitigating risks in the unfortunate event that affects the livestock, to circumvent the loss of income for the farmers.

5. Benefits of Tokenization on Securities Management and Traceability

One of the most obvious benefits of tokenization is that it will enable liquidity to illiquid assets. The short-lived run of mortgage-backed securities (MBS) was an example of illiquid asset securitization, but its deceptive ambiguity was unraveled when we understood how they were packaged. The consequences of the deceptively securitized MBS resulted from components of the financial product that were not investment-grade (mixed with investment-grade assets) that began to deteriorate and consequently impacting the overall portfolio. The main issue was that although securitization of mortgage-backed securities brought liquidity, its underlying exposure in the repackaged products could not be traced. Traceability of tokens fixes this problem, as the connection to all the underlying assets with a repackaged product is clear and tamper-proof. Thus, the exposure of all assets can be determined even if the product is erroneously or fraudulently rated as a AAA investment-grade product. If rating agencies fail to carry out their duties, the innovative repackaging of financial products to create more liquidity remains possible via tokens as the underlying exposure is transparent and can be diversified accordingly, without being misdirected by asymmetric or false rating information.

Tokenization will also unleash new business opportunities in the area of custody, the safekeeping of real assets, wealth and investment advisory. In particular, the impact on the asset management industry is projected to be quite significant, especially in terms of portfolio construction. Assets under the investible universe would traverse beyond traditional equities or bonds. Asset managers of this new asset class will not only have a new opportunity set for portfolio construction, but will need to hone their skills in fundamental research, price discovery and investment-related views to determine what price to pay versus the value the investor gets in return. Ultimately, the core task of active management, and its importance will be in demand in this new space. Part of this new capabilities that asset managers need to recruit or acquire are direct real estate expertise, valuation of works of art expertise, patent and technology expertise among others in order to accurately determine the value of the underlying asset, assess its market price and eventually inform an investment decision.

6. Self-Governance, Self-Regulation and CyberSecurity

Blockchain-based platforms can be used to address the administration and coordination of identity, privacy and security across regions and platforms by decentralizing and distributing organization. These decentralized platforms give integrated systems an identity, make and “receive payments, enter into complex agreements and transact without an intermediary” (Mohamed and Ali, 2019).

One way to help ease compliance burdens is to build and deploy financial and investment management solutions using blockchain. The ability of the blockchain to authenticate and verify information through a consensus mechanism allows a trusted way to identify persons or parties that makes the entire transaction become reliable and trustworthy. Hence, a financial and investment management system based on cryptography can be developed using AML, CTF, and KYC requirements according to the regulations set

in each region or country. The entire solution is built on the distributed ledger where an enterprise is a node in the blockchain network and the platforms developed by asset management companies is driven by an AI-engine that checks on AML, CTF, and KYC compliance and builds a database of records. Computerized audits, programmed reporting, and process streamlining are other benefits offered by such AI and blockchain platforms to address regulatory compliance, where technology is assisting financial service providers with regulatory requirements and compliance management.

At the same time, the “high and extensive use of internet has created concerns of personal data loss, information leakages or loss of money through cyberattacks” (Mohamed & Ali, 2021). The pattern of cyberattacks now are sophisticatedly planned and executed in order to achieve their criminal goals. In order to preserve value and safety for usage at scale, all companies must take the extensive steps to get protection from cyberattacks, particularly in the storage and safekeeping of tokens and other critical information. Cloud security is probably one of the most important avenues to prevent cybersecurity attacks. Typically, fintech companies use cloud-based services to scale their products and services with lower running costs.

“Upholding integrity of markets is very important for increasing tokenization possibilities, hence detecting criminal cyber activities will help to overcome the issue of data breaches involving service firms among others apart from developing the legal national framework to enable the local law-enforcement agencies to cooperate with law-enforcement agencies abroad” (Mohamed & Ali, 2021). For any financial scheme or monetary system to be viable or sustainable, it must be protected by a framework of laws and enforcement mechanisms to protect the rights of individuals and ensures the stability of the market system. Enforcement of laws involve the detection of legal violation and the subsequent appropriate penalty to deter anyone from violating the rules, beyond relying on trust alone.

Unfortunately, defending against hackers is similar to defending against an invisible enemy or a deadly virus. All stakeholders need to make sure that it is not only the responsibility of IT departments or selected individuals, rather the responsibility of all employees, corporations, institutions and government. It only takes a single weak link to start the breach of token attacks or unwanted spread of private information.

E. Conclusion

By allowing to fractionalize assets and to own and perform actions over only a portion of an asset, DLT / Blockchain enables a greater liquidity. By cutting down barriers to investment, a wider range of people can buy / invest in assets. In traditionally rather illiquid markets (e.g. real estate, fine art) this technology can help sellers to find more easily a counterpart to perform a transaction. It also supports inclusive finance by opening up the investment market to a wider range of investors. As no intermediary function is required any more, investors have now access to investing opportunities whose participation used to be limited due to geographical and infrastructural reasons or due to high minimum investment thresholds. Now, the access to financial markets and a variety of new kinds of assets has been

enabled regardless of the location of an investor and with much lower minimum capital requirements.

Fractioning assets also introduces the notion of shared ownership where multiple people can buy together an asset and use it. In decentralizing finance, money as a means of exchange can be viewed as exchanging fragments of information of value. There is no doubt that cryptographic breakthroughs that will revolutionize financial transactions are being developed as we write and read about them. The technology and innovation advancements will pave the way for a revolution in every transaction, beyond financial transactions only. Among the important developments that need to take place is understanding how the price discovery of different cryptocurrencies translate to returns, and its attendant volatilities. Also, the impact of volatilities from other assets (including other cryptocurrencies, tokenized assets, stocks, commodities, and bonds, among others). Such in-depth understanding will be crucial to develop hedging and diversification strategies for financial management in investment portfolios or treasury operations.

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