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BLOCKCHAIN AND CRYPTOCURRENCY TECHNOLOGIES

TOKENIZATION

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Contents

1. INTRODUCTION

Blockchain is not simply a repository and a trading platform for cryptocurrencies. Since 2016, there has been a lot of interest in figuring out how to move physical assets onto the blockchain so they can profit from Bitcoin while keeping their unique aspects. Asset tokenization makes this possible. As blockchain technology becomes more and more popular, tokenization is widely used to ensure the ownership of assets, preserve data, and engage in cryptocurrency investing.

As a result of recent developments in the blockchain ecosystem, several new characteristics have appeared. The global economic and technology landscapes have undergone substantial changes since the tokenization blockchain was introduced. One of the most well-known themes to come out of the blockchain tokenization space in recent years is the tokenization of non-fungible assets. By using tokenization blockchain technology, a new method for securitizing valuables called "possession tokenization" has evolved. Asset tokenization is widely accepted, as seen by the steadily growing demand for high-quality asset tokenization platforms.

Tokens have been an essential part of the blockchain space for many years. However, advancements in the blockchain industry are accelerating at a tremendous pace. Accordingly, the use cases for tokenizing assets and data are becoming increasingly innovative and diverse. The ability to tokenize real-world assets, sensitive data, and financial instruments on the blockchain open the door to an array of complex investment tools. Also, tokenization offers issuers several benefits that could disrupt the traditional financial sector.

2. TOKEN

2.1. What is Token?

In general, a token is a dataset that stands in for another dataset containing very valuable data. Tokens don't really have any intrinsic worth on their own. Tokens, on the other hand, can be just as valuable as the original asset when they stand in for real-world goods, commodities, and data (Ivan Liljeqvist 2022).

In the real world, a poker game serves as an illustration of this. Poker chips are tokens that stand in for banknote stacks. Tokens are significantly easier to transfer around a table than large amounts of cash. The advantage is that if the chips are stolen or lost, no one loses money. Tokens can serve as stand-ins that can be redeemed for the value they represent(Ivan Liljeqvist 2022). In addition, anyone can swap out useful information from their environment for a token on the blockchain.

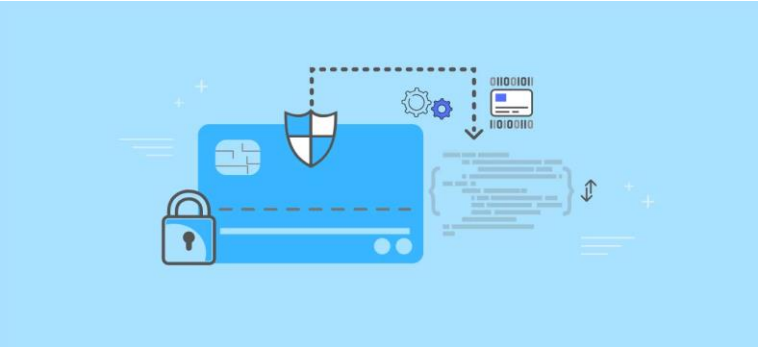

Figure 2.1: A token

2.2. Token Standards

The different token standards that are accessible should be taken into account prior to tokenizing an asset on the blockchain. There is a unique set of token specifications for each blockchain. However, a lot of these are comparable to the criteria for common tokens developed by the Ethereum development community (Ivan Liljeqvist 2022).

Anyone can develop a cryptocurrency with a standardized set of guidelines and restrictions thanks to token standards. For instance, the ERC-20 token standard stipulates a particular set of events and methods that must be present in a token. The

total number of tokens that are available on the network and each account's token balance must be accessible to everyone. An ERC-20 token can therefore be sent by anyone to almost any Ethereum wallet (Ivan Liljeqvist 2022).

Figure 2.2: Token standards

The two NFT standards with the highest usage rates are ERC-721 and ERC-1155. The ERC-721 standard enables the generation of a wide range of unique assets from a single transaction address. The ERC-1155 standard also makes it simple to bundle and sell numerous rare or distinctive assets. This is extremely useful for NFT art and crypto games. Token standards also enable the combination and integration of assets and applications with other apps (Ivan Liljeqvist 2022).

Figure 2.3: Various token standards

Ethereum continues introducing different ERC token standards to make the ecosystem more accessible and support various use cases. From ERC-20 to ERC-721 to ERC-1155, the Ethereum community has succeeded in making this blockchain a mainstream

protocol that can never be obsolete(Takyar Akash 2022). In figure 2.4 depicted how Ethereum token standards have evolved so far and what different ERC token standards are relevant today.

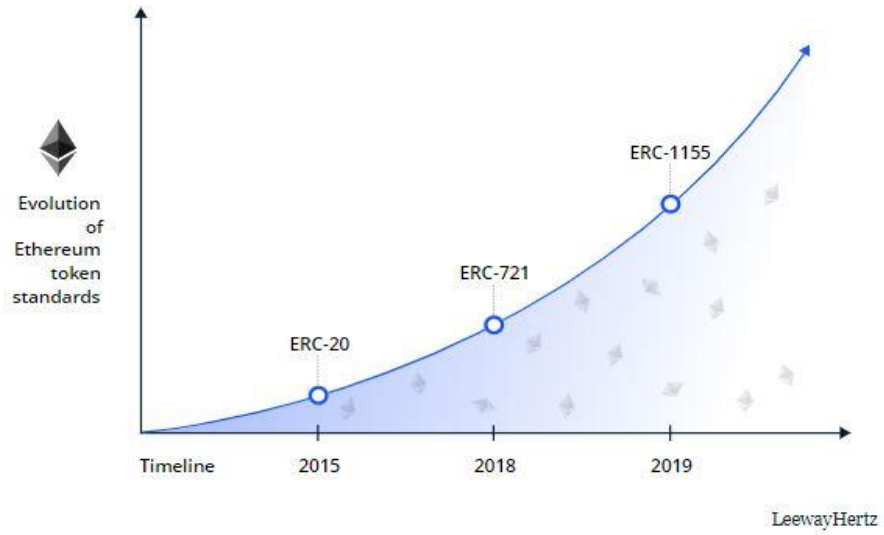

Figure 2.4: Evolution of token standards

2.3. A Token Technology

A token in distributed ledger technology is a record that has been assigned to a user through the use of public-key cryptography. Tokens differ from cryptocurrencies in this regard. It is typically based on cryptocurrencies(Konashevych 2020). The user must spend ("burn") certain coins and run technology-dependent scripts in order to create the token. Additionally, cryptocurrency is used to conduct additional token transactions(Freni, Ferro, and Moncada 2022). For instance, with Ethereum, Ether currencies are need to purchase "gas" in order to execute a smart contract operation. Tokens therefore do not arise in such platforms without cryptocurrency(Freni, Ferro, and Moncada 2020).

Users could discover alternative token articulations in business and theory. Tokens are another name for cryptocurrency(Li et al. 2019). There is currently only one DLT, called EOS, that does not originally contain native cryptocurrency and allows tokens to be generated without using actual money(Benedetti and Rodríguez-garnica 2014). It is crucial to specify key characteristics that are common and might be important for ownership rights in this diversity of technologies.

- Creation: Even though the user's private key serves as the ownership mechanism for both tokens and cryptocurrencies, their creative processes are different.
- Value: Tokens and cryptocurrencies both have distinct economic structures that influence their market values.

2.3.1 Types of Token Technologies

From the standpoint of the technology, there are at least three categories of tokens that are defined:

- **Colored Coins**: which are the original methods of using Bitcoin and related systems. Users must use some standard protocol capabilities to create tokens, such as "burning" some currencies and publishing a transaction by using a number of built-in protocol scripts(Konashevych 2020). The user enters data that establishes a new instance of marked and distinct cryptocurrency coins in the transaction. Due to the embedded data's immutability, blockchain transactions and the ownership mechanism can be used to build some economic logic around it. Due to the blockchain protocol's early lack of specialized token technology components, such tokens constitute an overlay technology(Morrow and Zarrebini 2019). Software that can insert and understand data is created as an additional component of a core wallet.
- **Name-Value Storage**: It is another type of layered technology, designed by Namecoin (2014) (Loibl 2014) and updated by Emercoin (2015), which allows for the structured insertion of data into the blockchain as a key-value record. This entry becomes a container where the user can add any data made up of two parts: a "key," which is a short text that must be unique within the database; and a "value," which is the user's data (message), which is connected to such a key. The technology offers the CRUD capabilities of a typical database(Token Technology 2017). Of course, once data has been inserted into the blockchain, it cannot be changed. To update a record, a user must publish the same key using the same cryptocurrency address, but with an updated "value," or issue a command to remove or move the record to a different address (owner)(Della Croce R 2014).
- **Smart contracts tokens**：This innovation gave rise to the blockchain protocol, which includes a built-in system for developing so-called "smart contracts." Using a cryptocurrency transaction, the user adds a smart contract, which is an executable

piece of software code, to the blockchain(Token Technology 2017). A smart contract deployment produces tokens. Due to the immutability of the ledger, the number of tokens, terms, and features described in the smart contract cannot be changed arbitrarily while it is in operation(Freni, Ferro, and Moncada 2022). Tokens based on smart contracts share the same ownership structure as public-key cryptography and can therefore be the subject of business transactions.

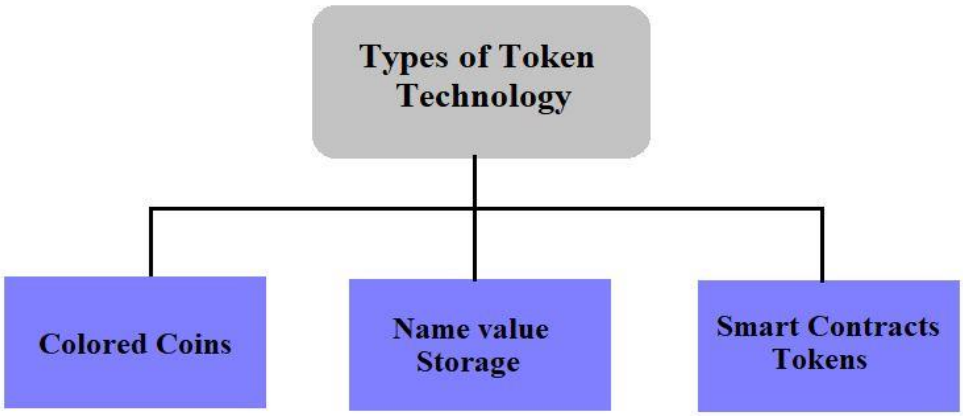

Figure 2.5: Types of token technology

2.3.2. Technology Behind Blockchain Token

Using blockchain-based smart contracts, commonly referred to as token contracts, we implement tokens. These contracts are computer programs that assist in the verification of the contractual terms and in the transfer of funds from one user's wallet to another(Abrol Ayushi 2022).There are two basic ways to transfer values using a smart contract.

- The UTXO model comes first. Many cryptocurrencies now employ this concept after they implemented the bitcoin technology to introduce it. After a successful bitcoin transaction, the quantity of digital currency that is still in a user's account is calculated using UTXO.
- The Account-based model is the next one, and it's what Ethereum and Hyperledger Fabric employ. The nodes that serve as the network's validators debit the money from the sender's account and credit the receiver's account when an order is placed.

2.4. Properties of Token

A token is a thing that belongs to someone and carries information about their property rights. Tokens are created, updated, deleted, and transferred by users within the blockchain using the public-key cryptography system(Token Technology 2017). Tokens altered (transferred, updated, deleted, etc.) via blockchain transactions are associated with a user's address, which is a representation of the user's public key. Only the relevant private key can be used to sign a transaction. Cryptocurrencies are different from tokens. The latter serves as "gas" for smart contracts and transaction fees(Konashevych 2020). Figure 2.6 illustrate the properties of token.

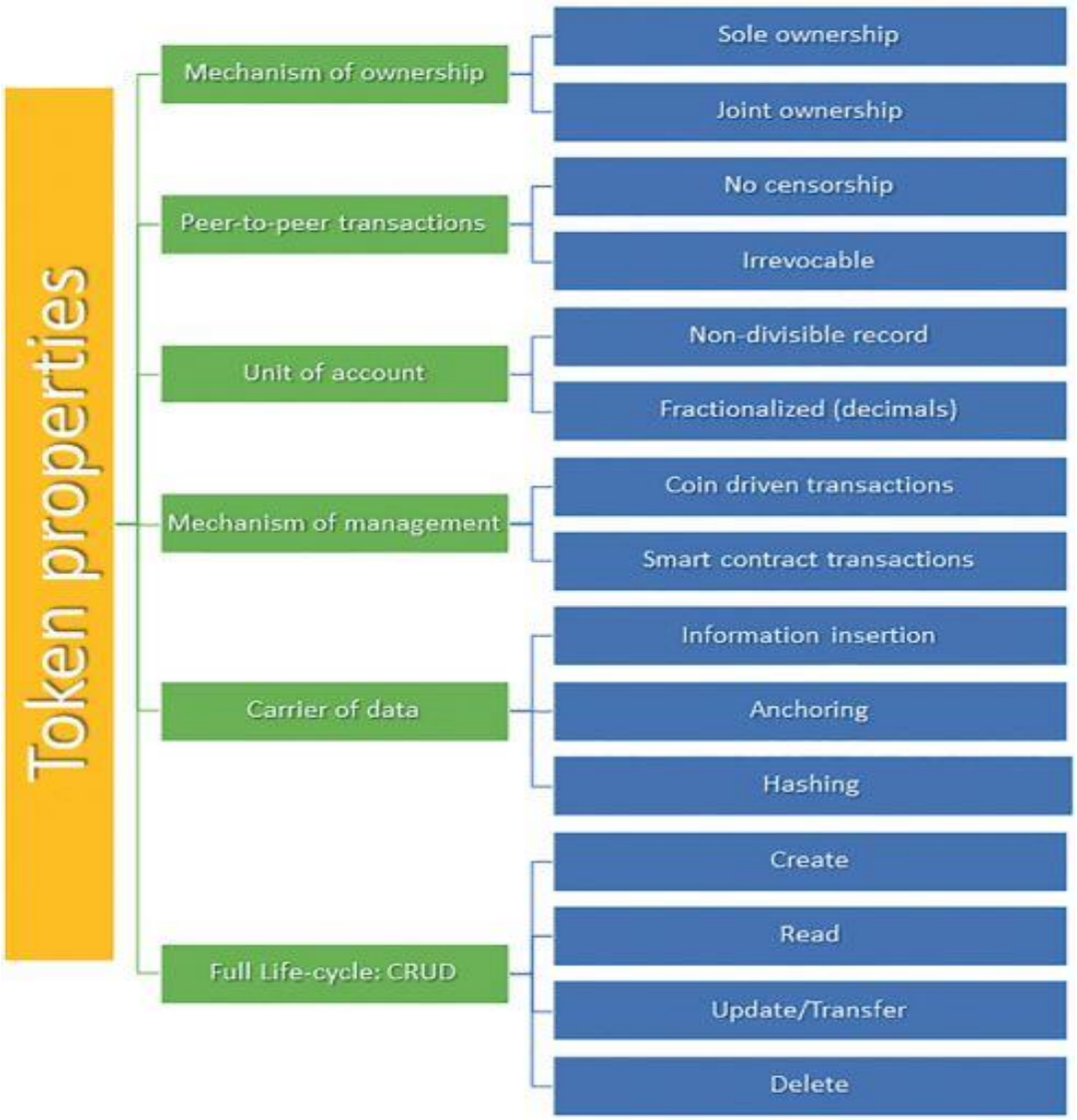

Figure 4.6: Token Properties

2.5. Token Update and Transfer

Updates or transfers of the token may be done by the user or a reliable third party. A new value is specified by the user in the event of an update. The user specifies in a token transfer scenario. A digital identification token that has been transferred becomes invalid since the address and the certifying token do not match. Consequently, the transfer of identity is not possible, in contrast to the transfer of title tokens (Konashevych 2020).

3. TOKENIZATION

3.1. What is Tokenization?

The process of converting ownerships and rights of certain assets into a digital form is known as tokenization. You can convert indivisible assets into token forms through tokenization (Abrol Ayushi 2022).

For instance, let's say you wish to sell the iconic Mona Lisa artwork. You would need to track down a vendor willing to sell it to you for millions of dollars. This obviously decreases the number of people with sufficient liquid funds to make a purchase worthwhile. However, if we tokenize the artwork. The ownership of the painting can then be divided among a number of parties. Particularly, fractional ownership is possible. Assume a person is a 1/25 owner of a painting or asset. It is best achieved through tokenization, which provides a sufficient alternative to traditional solutions. Therefore, most cryptocurrency specialists will bet on its utilization and future potentialities. This is why most experts advocate upskilling in cryptocurrency(DeJessus Taylor 2022).

Tokenization in blockchain creates a number of new opportunities for organizations and individuals. IDC, the worldwide market intelligence company, puts the tokenized asset market on the blockchain at around $500 billion. The wide variety is mind-blowing, but the concept of tokenization is not new and has been around for some decades. Before the introduction of blockchain generation, we've used tokenization, mainly in economic institutions from the Sixties, to protect our credit score card information and transaction statements. Even hospitals use them to keep touchy affected

person facts, and governments use them to keep tune of voter registration (Abrol Ayushi 2022).

Tokenization is the technique of converting an asset or the ownership rights of an asset into a unique unit called a token. Tokens are commonly brought up when discussing blockchain technology since they are utilized to signify ownership of priceless items (DeJessus Taylor 2022).

Tokens can represent ownership of tangible assets like works of art as well as intangible assets like stock or corporate voting rights. Tokenization is possible for anything deemed valuable. After that, tokens can be used to make payments, change who owns an asset, and perform other financial transactions. A good example of tokenization is bitcoin(Ayre Calvin 2021). The widely used cryptocurrency uses tokens to represent a user's cryptocurrency reserves. Tokenization started out as a method of data protection for corporations that substituted distinctive, non-sensitive data for sensitive information. While tokens typically share the same characters or layout, the original data is absent from them (DeJessus Taylor 2022).

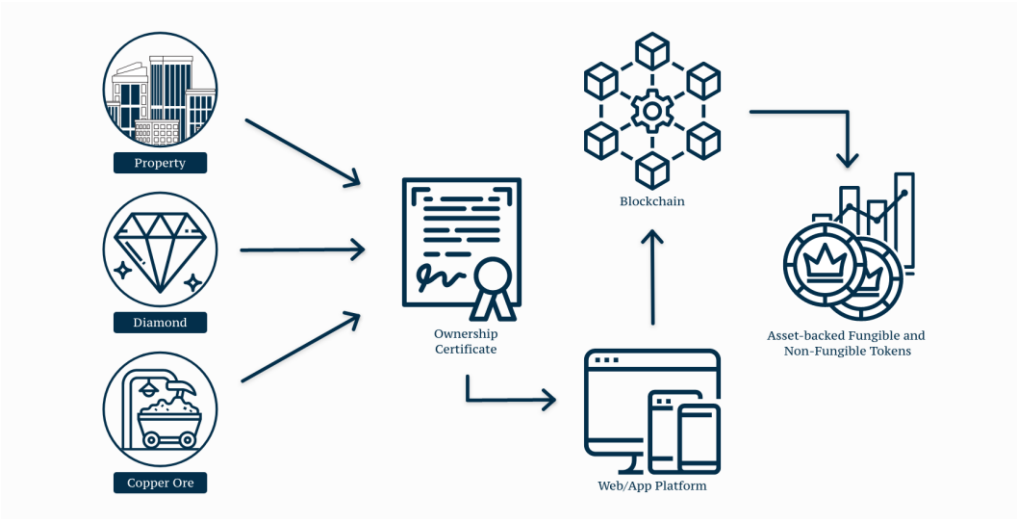

Figure 3.1: Tokenization

3.2. Concept of Tokenization

Tokenization is one of the applications of blockchain technology that allows users to digitize tangible and intangible assets, where each blockchain token represents a certain share of the asset ownership (Tian et al. 2020). Information, value, and

associated rights of an asset can be transferred onto the blockchain through tokenization (Tokenization explained: Part 1 2018).

The procedure of "tokenization" refers to representing any actual-global asset on-chain with crypto assets. Additionally, tokenization allows the transfer, storage, and verification of data transparently and securely (Ivan Liljeqvist 2022).

Tokenization has been a vital part of the crypto enterprise for numerous years. The capability to mint software tokens, governance tokens, and non-fungible tokens (NFTs) allows crypto tasks to harness the safety of a longstanding blockchain without developing a completely new chain. Furthermore, token requirements and the ERC-20 standard allow a wide range of tokens to comply with the same set of regulations while differing significantly in their application. Tokens play a crucial role in crypto derivatives, on-chain governance, staking, and extra.

That said, just about any real-world asset may be tokenized and tracked on the blockchain. But the idea of tokenization is evolving to satisfy actual global use cases. Examples of this consist of tokenizing information, proof of possession, securities, and monetary units. As a result, the era responsible for tokenization is rapidly evolving to meet the demands of a shifting paradigm. Furthermore, the tokenization of complicated economic gadgets and belongings allows issuers to program particular characteristics of assets in a format that is available around the clock. Similarly, those tokens can dramatically enhance efficiency and transparency in traditional markets (Ivan Liljeqvist 2022).

The concept of tokenization isn't exclusive to blockchain technology. Early iterations existed in the 1970s within the economic region to protect customers' personal information. Companies regularly convert information, along with credit card information and social security numbers, into strings of alphanumeric characters through the use of diverse cryptographic functions (Ayre Calvin 2021). This has consequences for the creation of precise tokens that constitute character portions of client information. However, in blockchain terms, tokenization gives a good deal broader application to an extensive variety of programs in numerous industries (Ivan Liljeqvist 2022).

3.3. How Does Tokenization work?

Tokens act as substitutes for actual information or assets. Apart from relaxed records, they have no inherent use or value. Tokens can be created in more than one way using techniques like reversible cryptographic features, nonreversible features, or randomly-generated numbers(DeJessus Taylor 2022). Tokens are related to transaction information that is saved on a decentralized ledger known as the blockchain. This ensures asset ownership because transactions can be confirmed using blockchain information.

When tokenization is used to protect charge data, the vendor will use a changing gateway that typically automates the token creation method and stores the authentic data somewhere else. The token is sent to a payment processor, where it may be linked and returned to the unique records within the vendor's token vault(Ayre Calvin 2021).

Tokenization allows efficient and easy ownership, verification, and transfer modes, powered by the Bitcoin SV blockchain. several classes of virtual tokens exist protection, application, identification, and extra. belongings can be tangible or intangible and whatever you deem valuable can be tokenized.

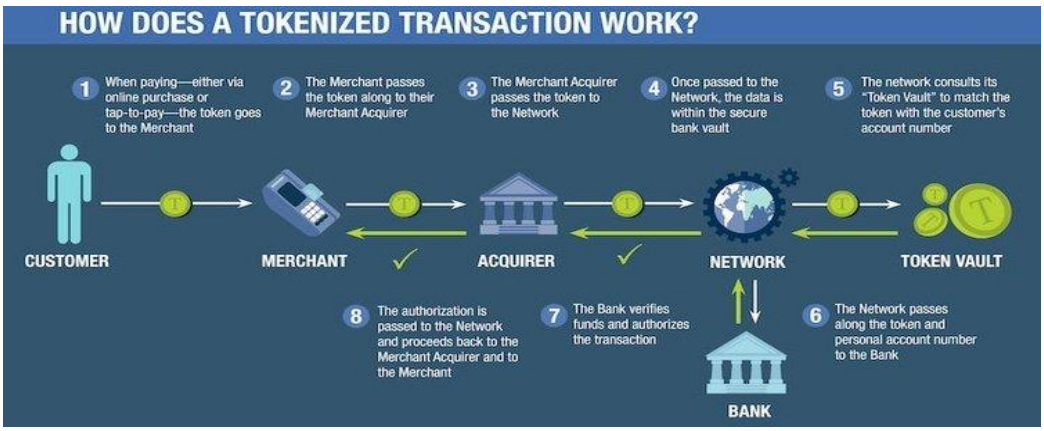

Figure 3.2: How tokenization work

Tokenizing belongings opens up the capacity investor base to a broader market, increases liquidity as compared to conventional securities, and reduces the time required to alternate. Transmission, record-keeping, control, and storage through the Bitcoin (BSV) Blockchain's protocols, trade the manner we manage conventional asset transfers. Bitcoin (BSV) Blockchain assures the token's transaction history is irrefutable (Pal Nupur 2022).

3.4. Types of Tokenization

Tokens are assets in the blockchain ecosystem that make it possible to securely and effectively transfer, store, and verify information and value. These crypto tokens can be designed with distinctive attributes that broaden their use cases and can take on a variety of shapes. In terms of raising liquidity, promoting transaction efficiency, and enhancing transparency and provability of assets, security tokens, utility tokens, and cryptocurrencies have enormous ramifications for a wide range of sectors. Both blockchain and non-blockchain tokenization come in a variety of forms(Abrol Ayushi 2022).

Considering the fact that tokenization is slowly gaining popularity throughout various industries, it's essential to reflect on the distinct varieties of tokenization. Then again, it's also vital to discover the variants of tokenization in the context of fee processing and NLP use cases. When you are using tokenization for payment processing, you have the options of vault tokenization and vaultless tokenization.

In addition, in the case of NLP, you can find specific variants of tokenization tailored to wonderful necessities, along with phrase tokenization, byte pair encoding (BPE), or sentence tokenization. At the same time, you could additionally find distinct editions of tokenization in the area of blockchain packages. Some of them consist of utility tokens, NFTs, and others(Zadikoff Adam 2021).

3.4.1. Blockchain Tokenization

Types of blockchain tokenization include:

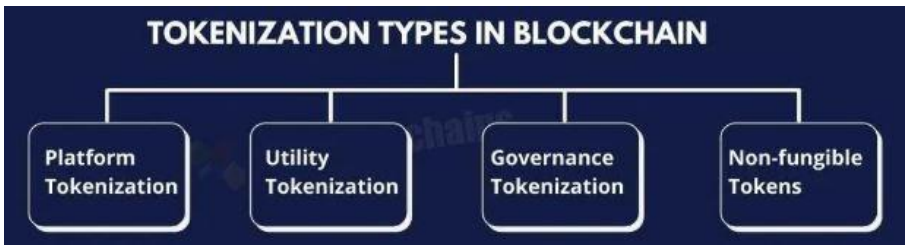

Figure 3.3: various types of blockchain tokenization

- **Fungible tokenization**: Those are trendy blockchain tokens. Because they have the same values, they can easily update each other—imagine exchanging one dollar for any other dollar. Fungible tokens mean they may be replicated or

changed. They may not be specific. Converting fungible belongings into tokens is easier as you can divide them into fractional devices(Geroni Diego 2021). The most common type of fungible token is gold. Fungible token converters include an abstraction layer that allows them to facilitate interoperability while remaining platform independent.

- **Non-fungible tokenization (NFT):** Those are less commonplace blockchain tokens that do not have a fixed value. As an alternative, they constitute possession of an asset, including digital artwork or real estate, that determines the fee of the token. Non-fungible tokens are specific, and we can tune the history of ownership on the blockchain. This ensures that the token cannot be reflected(Lu Marcus 2022). Furthermore, a non-fungible asset is converted right into a token. They start the process by providing an immutable virtual signature. It will help determine the distinctiveness of the underlying asset.

  If you have been looking at blockchain and crypto-associated information, you may have heard how NFTs are today's fashion, with some of them selling for millions of dollars. The prospect of NFT opens up a plethora of real-world applications for tokenization. Even Fortune 500 companies are racing to have NFT in their products(Geroni Diego 2021).

Figure 4.4: Fungible vs non-fungible tokenization

- **Governance tokenization:** These tokens constitute voting rights and can be used to vote and collaborate on a blockchain system. Many DeFi protocols use a native token to attract customers in diverse ways. One popular form of DeFi token is the governance token. When a DeFi protocol makes use of an on-chain balloting mechanism for protocol updates, a governance token often performs a

vital role in casting votes(Zadikoff Adam 2021). Further, many DeFi lending protocols use a local token as rewards for liquidity mining and yield farming.

- **Utility tokenization:** These tokens are used to provide admission to positive services and products on a selected blockchain, so that they can be used to complete moves like paying transaction prices or running a decentralized marketplace machine. Application tokens are the maximum simple token in a blockchain community. They may be used to get right of entry to the offerings, electricity for the consensus application, pay transaction prices, or even vote for new blockchain developments. Yes; additionally, they work as governance tokens and are utilized in the choice-making technique of DAOs(Ayre Calvin 2021).

  Assume you need to examine DAO and installation methods more closely in order to alleviate the pain of managing your enterprise. Then check out our cryptocurrency route, wherein we explain cryptocurrency in an easy and fun way.
- **Security tokens** They're tokens that help validate the possession of a particular asset or right. They are the digital illustration of an underlying asset. Together with that, they have all the benefits of conventional securities. Furthermore, we will program security tokens with the assistance of a cryptocurrency developer to have precise characteristics and capabilities that shape our desires.

  For example, you could exchange real estate tokens and pay the cryptocurrency usage fees in that chain.Then there are some tokens whose value is determined via the underlying asset, consisting of those with off-chain assets like actual property, invoices—the more treasured the asset, the dearer the token.
- **Platform tokens:** Platform tokens are used inside the blockchain to help deliver decentralized programs. For example, you could interact with Daaps built on the Ethereum network using the token Dai. In addition, as a platform token, because it is widely used in the Ethereum network.

3.4.2. Non-blockchain Tokenization

Types of non-blockchain tokenization include:

- **Vault tokenization:** This is the standard form of tokenization to protect payment records, in which the token is used to process bills without supplying card numbers or other data. In traditional fee processing programs, vault

tokenization involves the protection of a cozy database. The cozy database is referred to as the "tokenization vault database," which stores sensitive records. At the same time, the tokenization vault database also stores the corresponding non-sensitive data for the sensitive data. Customers should have no problems decrypting the newly tokenized records with the help of sensitive and non-sensitive statistics tables (Geroni Diego 2021). The most notable setback in vault tokenization is the prolonged processing time for detokenization because of the expansion of the database.

- **Vaultless tokenization**: this is a kind of tokenization used for price processing that doesn't require a token vault. As a substitute, it makes use of cryptographic gadgets and algorithms to transform statistics into a token. Instead of storing a database, vaultless tokenization focuses on the use of simple cryptographic devices(DeJessus Taylor 2022). The secure cryptographic devices leverage algorithms based on standards for the conversion of sensitive information to non-sensitive statistics. To acquire original facts without a tokenization vault database, the tokens generated by vaultless tokenization will be decrypted.
- **Natural language processing tokenization:** This type of tokenization breaks records down into simpler phrases to make them extra easily understood by computer systems. It includes the separation of a piece of textual content into smaller devices called tokens to enable machines to apprehend natural text. You can divide a bit of textual content into phrases, characters, or just subwords, in line with your requirements(Geroni Diego 2021). Consequentially, the styles of tokenization in NLP are extensively categorized into three categories. let us analyze extra approximately the tokenization editions within the case of NLP. It consists of word, subword, and character tokenization.

3.5. Key Features of Tokenized Protocol

There are so many features in tokenization protocol. Such as,

- support for a diverse array of asset types: commonplace shares (SHC), Loyalty & reward points, Coupons, Currencies, Admission Tickets, and Memberships (with many greater asset sorts to be introduced soon)
- Multi-asset atomic swaps

- On-chain messaging for orchestrating the signing of multi-signature, threshold signature, token change transactions, and greater identification smart agreement aid Oracles make sure issuers can observe KYC, AML, and CTF laws, even in secondary trading, all while retaining individual privacy.

The Tokenized platform will take customers through four easy steps to make sure the token issuance is secure and fits their desires. The assets stay theirs to sell or boost capital with in whatever way the holder chooses(Ayre Calvin 2021). Users create a personalized clever agreement with the terms and situations they choose. more data at the Tokenized protocol determined on their homepage.

3.6. Tokenization Process

The first step in issuing blockchain tokens for infrastructure is to discover the underlying infrastructure asset, which must be evaluated and audited in compliance with the existing legal guidelines and security guidelines. The facility investment's risk and return expectations, as well as its potential revenue streams and cash flow uncertainties, should be thoroughly understood. Tokenization is appropriate for challenge finance or PPPs with concession agreements between the general public asset proprietor and the non-public region operator. SPV is fashioned after the preliminary identification method so that the tokenization to take location (Della Croce R 2014). In this case of us, regulation D and S filings are required to problem security tokens to permitted U.S.A(Ziyen 2019) and non-USA buyers, respectively.

The choice on whether or not a permissioned or permissionless blockchain transaction gadget could be required for an asset must also be made based on the extent of considering the various investor members and the ability to scale investment. The issuer of security token issuance offerings recognizes your purchaser/anti-cash laundering (KYC/AML) seller, the custody provider company, and primary and secondary marketplaces are determined and confirmed after the criminal and deal systems for asset tokenization are set up (Lootsma Y 2017). Shrewd contracts are generated to address necessities and policies. Fees for protection tokens are set by the SPV's management. potential traders want to skip KYC/ AML exams to invest in safety tokens.

After completing those procedures, newly minted security tokens can be transferred to the wallets of accredited investors or be indexed on token exchanges.

“Wallets” discuss virtual garage facilities in which blockchain tokens are deposited. accredited traders can switch their tokens to different approved traders or exchange those tokens on secondary markets. The future dividends and interest payouts generated from tokenized property are sent out to the wallets of token proprietors in the form of cryptocurrencies or equivalent fiat currency(Tian et al. 2020). Figure 4.5 illustrates the infrastructure tokenization procedure. Step by step process of tokenization outlined in below:

1. Origination: The origination section include- due diligence, design deal structure, determine the terms and conditions of the digital token backed by infrastructure assets, code legal and regulatory requirements into smart contracts, and file documents.
2. Digitization: The role of digitization section is- appraise infrastructure assets, establish SPV, select technology platform, program smart contracts, and transfer transactional information onto the blockchain.
3. Distribution: This step formulate- evaluate investor's KYC/AML, price tokens, distribute tokens to primary investors in exchange for investment capital, and store transactional information automatically onto the blockchain) without the participation of intermediaries.
4. Exchange: This step include- manage whitelist, trade on secondary markets (token exchange or traditional capital markets), and peer-to-peer transfer.
5. Post- tokenization management: The last step regulate- distribute dividends, enable shareholder voting, reporting, taxing ,and accounting

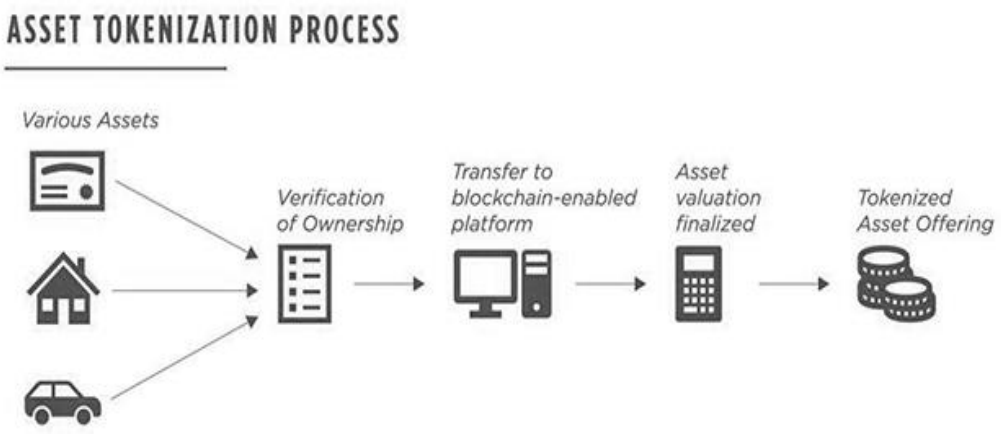

Figure 4.5: infrastructure tokenization process

3.7. Benefits of Tokenization

Tokenization enables markets to attract additional liquidity to their markets. PAX Gold (PAXG), for example, is an ERC-20 token that is backed by one fine troy ounce (t oz) of a 400 oz. London-appropriate transport gold bar. Not only does PAX Global now charge a gold fee, but token holders also have the benefit of physical possession of gold. additionally, this gold is held securely in a vault, which means that token holders benefit from the highest safety even as fending off some of the risks related to physical gold ownership(DeJessus Taylor 2022).

Moreover, tokenization benefits traders and token issuers with the aid of facilitating compliance automation and standardized administration approaches. this will be particularly useful for things like securities. moreover, tokenized securities facilitate the frictionless, compliant transfer of ownership in a manner that could now not be possible without using blockchain. Plus, record tokenization is one of the coziest ways to defend non-public statistics(Ivan Liljeqvist 2022).

Figure 3.6: A benefits of tokenization

Crypto tokens provide several user benefits that can be generalized into the following categories:

- **Increased liquidity:** One of the giant blessings of tokenization within the blockchain is that it opens up the underlying assets to a wide target audience. The divisibility of property allows for its reaping. We can now take part in investments that have a high investment threshold(Lu Marcus 2022). As a result, the liquid premium of difficult-to-promote assets such as high actual property and artistic endeavors is removed.

Furthermore, they must devote significant effort to determining the reasons for conducting business together and utilizing lawyers and other service providers to draft a contract for the transaction's execution. but, with the use of asset tokenization systems, this procedure becomes smoother and more automatic. It offers a tokenization blockchain and tokenized actual estate tokenization platform in which tokens represent personal firm stocks and are supplied to participants who have been pre-vetted in areas together with permitted traders with sufficient cash to endure the danger(Takyar Akash 2022). Thereby, those investors can clearly and quickly quit the community via selling their tokens on a secondary marketplace.

Tokenization additionally presents a broader geographic reach as blockchain is inherently international in nature. anybody with a computer web browser can interact and keep track of the asset from any a part of the world.

- **Better accessibility:** Another significant benefit of asset tokenization platforms on the tokenization blockchain is accessibility. Platforms for asset tokenization on the tokenization blockchain allow assets to be fragmented into the fewest number of tokens feasible and encourage investors to possess a tiny percentage of shares(Zadikoff Adam 2021). In addition to lowering the minimal initial outlay and duration, this creates chances for stockholders.
- **Assets divisibility:** Asset divisibility also comes with the benefit of shared possession. you may have a holiday home with 15 other human beings and agree on who will use the house all through a selected time. that is simply one instance(Pal Nupur 2022). There can be many more use instances.
- **Faster and cheaper transactions:** The elimination of middlemen that are typical in conventional asset management is another advantage of tokenization for investors. Investors can thereby avoid paying pointless fees and expenses. Additionally, as opposed to during the regular business hours of stock markets, token trading and administration frequently take place in real time.

  Bypassing market intermediaries as well as other middlemen that are generally involved in the conventional process of asset management is possible for investors using crypto tokens. This enables a more streamlined, affordable manner of transferring value by significantly lowering transaction costs and processing times for each trade(Abrol Ayushi 2022). Crypto tokens can also be

bought and sold around the world at any time because they are decentralized and live on the blockchain.

- **Increased transparency**: Transparency is a benefit of tokenization as well. When non-fungible assets are tokenized, the contracts that establish token attributes include a thorough record of ownership as well as the rights and obligations of the token holder(Freni, Ferro, and Moncada 2020). This gives you a clue as to who you're dealing with, their level of strength, and how they obtained this token. Additionally, this promotes transparency throughout the entire process.

  Transparent ownership of goods, cryptographically verifiable provenance, and transaction traceability are all made possible through the use of public blockchains. A distributed ledger that cannot be altered automatically records all distributed consensus transactions(DeJessus Taylor 2022). As a result, compared to a variety of digital content, cryptographic tokens can provide more stability.
- **Unchangeability**: Data stored on a blockchain cannot be changed, deleted, or updated. Anyone interested in buying or selling tokens can therefore be sure that the asset information and transaction records are accurate. because once they are recorded on the tokenization blockchain, they are valid and cannot be changed. With the advent of Smart Contracts and other related technologies, tokenization has also reduced the number of mediators required in a transaction.

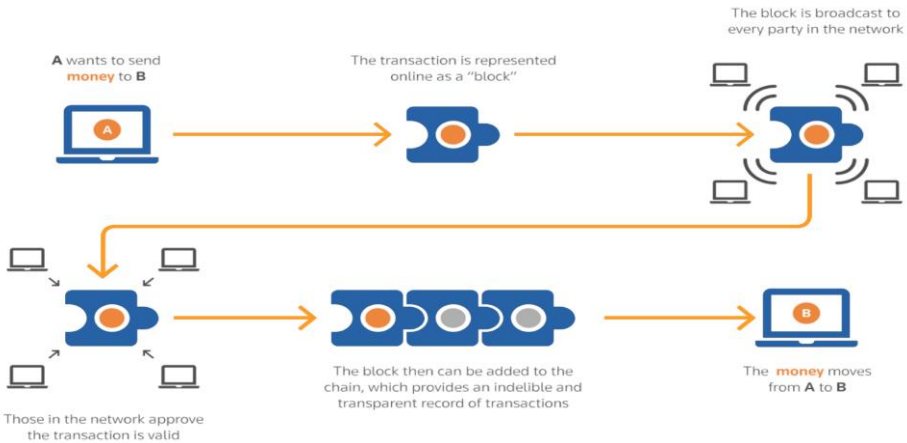

Figure 3.7: Key benefits of asset tokenization

Tokenization can improve liquidity, make financial transactions more convenient, and help relax ownership rights. Considering that tokens aren't traded on a traditional

investment marketplace, users can stay away from a variety of systems that are concerned with investing in traditional securities or shopping for large property. Purchasing a token that represents real estate ownership, for example, is a much faster method than purchasing non-tokenized assets(Loibl 2014).

The ability to cut out elements of the method can help reduce the overall cost of investing in those items and save time. Similarly, tokens are available to a far larger target market, consisting of individuals who may not have access to steeply priced investments. Consequentially, the market can turn out to be more liquid, and users will have greater funding possibilities(Benedetti and Rodríguez-garnica 2014).

The blockchain technology is used to keep transaction statistics and additionally enables the tracking of the history of a token. For example, if a person wanted to dispute ownership of a token, the blockchain would have a record of all transactions involving the token and would be able to confirm ownership. Non-blockchain tokenization also has its benefits for agencies and organizations that want to guard purchaser or member records(Morrow and Zarrebini 2019). Clients will feel more comfortable knowing that their identification is protected, and tokenization facilitates businesses meeting policies set by the PCI SSC.

3.8. Challenges to Tokenization

Blockchain tasks that use crypto tokens can stumble upon regulatory hurdles as governments around the sector scramble to react to the remarkable nature of this new generation. These tokens frequently include characteristics found in monetary securities, but they are no longer issued under the same rules as traditional securities. This affords a challenge to both government and blockchain initiatives seeking to balance innovation and compliance(DeJessus Taylor 2022).

While more countries are implementing cryptographic regulations to encourage growth, others are taking a more stringent approach in order to avoid future problems. As an instance, within the U.S., the Securities and Exchange Commission is considering officially classifying sure tokens as securities, which would subject the projects to a heightened level of external scrutiny(Abrol Ayushi 2022).

Another valuable challenge for regulators is how safety tokens will continue to be tethered to their underlying properties. If thousands of nameless buyers collectively own a tokenized lodge, how will they decide who's accountable for the lodge’s

protection and operations? Or what occurs if the gold reserves underpinning an asset-subsidized token go missing? In other words, while tokenizing virtual belongings permits decentralized, trustless fee transfers, physical asset tokenization will likely nevertheless require a degree of centralization and third-party involvement.

Projects using blockchain technology, like tokenization, will need more restrictions as society gradually adjusts to them. The tokenization of assets, however, works in a manner akin to financial securities. But such regulations might not apply to tokenized assets. While the majority of nations are putting regulations in place to promote the expansion of blockchain-based projects. However, other nations, for instance, are retaliating harshly against them. In the USA, certain tokens may be categorized as securities by the Securities and Exchange Commission (SEC). It will undoubtedly bring a great deal of outside scrutiny(Zadikoff Adam 2021).

How assets backed by security tokens will be managed is a significant additional problem. For example, a blockchain-based digital hotel may be owned collectively by thousands of foreign investors. Who will run the hotel is still a major concern. Once again if the underlying assets for a token disappear. comparable to gold-backed tokens.

As a result, a more mature regulatory environment will almost certainly be required in order to achieve widespread adoption of crypto tokens across a broader range of industries; courts will require described rules to arbitrate instances where the blockchain environment and traditional world overlap(Pal Nupur 2022). Many investors want distinct protections and the ability to seek recourse in conditions that cannot yet be completely codified in clever contracts.

4. TOKENIZATION PLATFORM

By using tokenization blockchain technology, a new method for securitizing valuables called "possession tokenization" has evolved. Asset tokenization is widely accepted, as seen by the rising demand for high-quality asset tokenization platforms.

4.1. What Are Asset Tokenization Platforms?

The platform for asset tokenization effectively serves as a channel for converting tangible assets into virtual currency. The technical name for these systems is Tokenization as a Service (TaaS) platforms. Furthermore, the best asset tokenization

platform allows for the tokenization of virtually any real-world asset(Pal Nupur 2022). Commercial financiers and investor organizations also employ investment-grade tokenization platforms to handle and monitor their investments directly, cutting out the middlemen.

Clear answers can be found by comprehending how asset smart contracts platform solutions work. In 2022, the best platform for asset tokenization will have an investment management interface for investors or issuers. The dashboard also offers capabilities for anti-money laundering, investor voting rights, fundraising, KYC, and investor verification (AML)(Lu Marcus 2022). The dashboard also offers capabilities for anti-money laundering, investor voting rights, fundraising, KYC, and investor verification (AML).

In order for consumers to purchase the token offering, the leading asset tokenization platform will launch Tokenized Asset Opportunities, or TAOs, in 2022.

4.2. Embraced Industries With Asset Tokenization

Additionally, the study covered which industries have adopted asset-backed tokenization to their effect.

- Finance: Margin borrowing, product structuring, investing, and payments are just a few of the ways that tokenization, one of the fintech industry's blockchain uses, is changing the landscape(Ivan Liljeqvist 2022).

  The idea gives financial institutions the ability to turn all non-fungible assets into easily transferable digital currency. Additionally, it enables merchants to avoid storing credit card information in POS hardware and other systems. This improves market liquidity overall and decreases data security breaches.
- Real Estate : The development of a platform for blockchain-enabled real estate is another economic sector that gains from tokenized assets. A real estate tokenization platform's concept streamlines the investment procedure. Additionally, it gets rid of middlemen, making it simpler and less expensive for buyers and sellers to interact. Additionally, it enables everyone to invest any amount, strengthening the market for all participants(Li et al. 2019).

  This tactic also lessens the likelihood of fraud. As a result, a historic auction involving 66 million buildings will soon be tokenized on the Ethereum blockchain. Several platforms offer excellent services when it comes to

blockchain-based digital real estate tokenization. Some examples include Meridio, Slice, and Harbor(Pal Nupur 2022).

- Healthcare : Tokenization is also being considered for application in the healthcare industry to address a number of significant recent challenges. Valuable patient records, including as PANs, NPPI, and ePHI, are replaced with distinct and non-sensitive values by tokenization. As a result, it also reduces the frequency of data breaches. Additionally, it transfers management of sensitive data from intermediaries, such insurance providers, to patients and medical organizations. By tokenizing medical procedures and data in this way, people may assess the veracity of their data and reduce the amount they pay to these third parties.
- Sports : Another industry that has experienced significant positive changes as a result of the emergence of asset tokenization platforms is the sports industry. Decentralizing the whole market using asset-backed tokenization on tokenization blockchain platforms. As a result, it makes it easier for traders and fans to share in and exchange the benefits obtained by their preferred sports teams and athletes(Ayre Calvin 2021).
- Enterprise : Enterprises embrace the possibility of tokenizing physical assets as part of their extensive migration to blockchain technology. They want to leverage this idea to broaden their market reach, assess employee performance, ensure proper resource allocation, put stronger incentive systems in place, and promote transparency across all internal activities.

  Enterprises also employ unique tokens for various assignment kinds to offer a more individualized experience(Pal Nupur 2022). They set a reward for a certain quantity of tokens, which helps to concretely illustrate their importance. Something that goes beyond the 'high-priority' and 'urgent' categories that product managers previously employed.
- Art industries: Blockchain technology has the potential to increase access to art for both art enthusiasts and creators. mainly because they can now sell their works globally without middlemen by tokenizing them. One recent example that made headlines was the first multi-million dollar work of art that was successfully tokenized.

  The idea of managing tokenized asset platforms will spread to a lot more corporate areas. According to forecasts, the global tokenization industry will

grow from $1.9 billion in 2020 to $4.8 billion in 2025, at a CAGR of 19.5%, suggesting that implementing this idea within your industry division is not a bad idea(Ayre Calvin 2021).

4.3. Top Asset Tokenization Platforms in 2022

A. **tZERO:** tZERO leads the way with $330 million in funding. tZERO, similarly to their bitcoin wallet, offers a marketplace for trading non-public virtual property. They were among the first to enter the game and are backed by Overstock, a publicly traded company(d'Aligny, Benoist, and Grothoff 2022). Furthermore, they offer issuers a bespoke method for getting their safety tokenized and into the tZERO ATS (opportunity trading machine).
B. **ConsenSys Codefi**: ConsenSys Codefi is a comprehensive suite of blockchain apps geared toward company clients. Codefi Belongings is their software designed exclusively for the Pinnacle asset tokenization platform in 2022 and digital asset management. Furthermore, ConsenSys claims to have spent more than $1 billion on tokenization tasks, launches, digital property, and currencies using Ethereum(Pal Nupur 2022).
C. **Securitize:** It is an give up-to-end fundraising platform, which means that they cope with the entirety from number one issuance via secondary market trading. furthermore, businesses can achieve money through a variety of methods, consisting of a "Mini-IPO," "Reg. D," as well as "Reg. D + Reg. S." Following the difficulty, businesses can be indexed on Securitize Markets, which offers a chief market in addition to secondary buying and selling(Pal Nupur 2022).
D. **Polymath:** It specializes in the advent, issuance, as well as control of digital tokens on the blockchain. They invented the ERC-1400 token widespread, additionally known as the "safety token trendy." It changed into advanced to standardize the advent, trading, as well as control of security tokens. moreover, their solution generates over 2 hundred tokens(Pal Nupur 2022).
E. **Bitbond:** It was installed in Germany and operating in the field due to the fact that 2013, more often than not provides era for tokenized bonds. customers variety from banks to issuers and investment managers. Banks, as an example, rent Bitbond's white-label option to ease the bond issuing process, according to the agency(Pal Nupur 2022).

F. **Tokeny Solutions:** The T-REX platform from Tokeny Solutions enables users to generate, manage, and transfer security tokens. The platform is made to facilitate communication between investors and issuers. The T-REX platform also provides a wide range of functionalities, including systems for token recovery, investor onboarding, compliance enforcement, and reporting.

Table 4.1: Comparision of top asset tokenization platforms in 2022

Name	tZERO	ConsenSys Codefi	Securitize	Polymath	Bitbond	Tokeny Solutions
Headquarters	USA-New York	USA-New York	USA-San Francisco	Canada-Toronto	Germany-Berlin	Luxembourg
Established Year	2014	2014	2017	2017	2013	2017
Funding	$3330.M	$82.5M	$73M	$58.7M	$7.6M	$5.6M
Team size	84	5	90	44	19	27
Tokenized Volume	–	–	$500M+	$2.2B+	210M+	8.5B+
Number of tokenized assets platforms	4	–	115	225	5	45
Used Blockchain	Ethereum, Tezos, as well as Algorand	Ethereum, as well as Quorum	Ethereum, Algorand, as well as Avalanche	Polymesh, as well as Ethereum	Stellar	Ethereum, as well as Polygon
Token	TZROP	–	–	POLYX	BB1	–
Token Standard	ERC-20	Universal Token	DS Token Protocol	Ploymesh ERC-1400	Stellar assets	ERC-3643
Open Source	Yes	Yes	Yes	Yes	Yes	Yes

G. **Tokensoft:** Blockchain technology is offered by Tokensoft for the issuance of digital assets. Additionally, they serve a wide range of clients, including investment banks, startups, funds, and businesses. Additionally, Tokensoft provides companies with a tokenization platform that enables them to specify compliance standards for both digital assets and digital securities.

H. **Securrency:** For issuers, brokers, and alternative trading system (ATS) providers, Securrency is a blockchain-based tool provider. They can also build,

manage, and trade tokenized securities using Securrency's capabilities. Securrency also developed two token standards known as CAT-20 and CAT-721 that can communicate with a variety of blockchains, including Ethereum, Ripple, and Stella.

4.4. Future of Crypto Tokenization

The way we engage with valuable assets is fundamentally changed by tokenization, which ranges from asset tokenization to real estate tokenization. Any item or service may be represented and kept on a blockchain thanks to blockchain technology, which democratizes access to assets and offers an unheard-of degree of online privacy and accessibility(Zadikoff Adam 2021).

To create the international, borderless value transfer systems that crypto tokens may one day enable, however, will require a significant, multilateral effort given the continued regional variation in the laws governing the purchase, distribution, and maintenance of crypto tokens. The tokenized future is rapidly becoming a reality as more and more people and governments come to terms with the extraordinary power and utility of blockchain(Pal Nupur 2022).

5. CONCLUDING REMARK

Over time, tokenization has aided in the security of company data, and it is currently expanding the ability to transfer ownership of assets globally. Tokenization's potential as a method of investing, however, is still being limited by several issues. It is challenging to develop seamless transactions because each country has its own technology and investment laws. Governments are starting to change legislation, and people are becoming more knowledgeable about using tokens, which is assisting technology's development and gaining recognition as a potent financial tool.

Finding new investment options that employ tokenization to digitize the value of assets may be possible for those who are interested in investing but run into obstacles in the traditional market. As we discussed above, tokenization may be quite beneficial for both individuals and businesses. Blockchain-based tokens have the potential to transform modern enterprises by enhancing security, transparency, and efficiency.

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