Real world asset tokenzation - a literature review

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(Dated: October 3, 2023)

"Tokenization could be the next trillion dollar industry"[1]. The web3 universe is rife with claims of this magnitude. We present a comprehensive review of the field of real world asset tokenization, hoping to analytically evaluate claims like the above and more from a variety of modern and traditional sources.

I. INTRODUCTION

In 1997, musician David Bowie introduced a new investment vehicle called the "Bowie Bond". Backed by expected revenue from his music, the 10 year bond offered a greater return than US treasury bonds[2]. Just as Bowie securitized his music royalties, blockchain technology offers a platform to tokenize a wide range of real-world assets, from real estate [3][4][5] to the global supply chain[6][7][8], to art[9][10][11]and back round to intellectual propery, such as music[12]!

The OECD[13] reports that the allure of tokenization lies in its potential to democratize access to a broader range of investment opportunities, allowing individuals to invest in fractional ownership of assets. Moreover, by leveraging the decentralized nature of blockchain technology[14], tokenization can reduce intermediaries, streamline transactions, and enhance transparency[15], thereby potentially reducing costs and increasing efficiency[16].

Despite its promising potential, the field of real-world asset tokenization is still in its infancy. We find that the mean age of medium articles and academic publications is one and two years, respectively.

Through a comprehensive analysis of academic papers and more modern sources such as medium articles we aim to provide a understanding of the current state of real world asset tokenization. We gather and discuss the main benefits, industrial use cases and methodologies highlighted by key players in the field. Furthermore through our quantitative analysis we identify areas in the literature which appear to be severely lacking.

II. METHODOLOGY

The web3 industry's pace often outstrips the conventional publishing cycle, leading experts to disseminate their findings through alternative mediums. In this review, we aim to perform a highly quantitative analysis across the spectrum of related academic work, alongside a review of content from more modern sources such as medium articles, technical documentation, GitHub repositories and other forums.

A. Data gathering

Gathering data in the web3 world is no simple task. We build a scraper to scan Google Scholar (an *almost* complete library of academic works) for a given set of keywords and return all relevant articles. 981 articles are returned for 'blockchain tokenization of real world assets'. A preliminary fast manual scan removes any articles not related to the topic. They are then sorted by a (*very* rough) measure of relevance, citations per year, and the top 100 returned for analysis. The works are read, and for each one the following questions are answered:

a. Does the article provide a **detailed** technical description of how tokenization will be performed?

b. Which key industries will this technology be useful for?

c. What are the main hinderences to adoption?

The same process is then performed for medium articles. There are only 21 of these, so we evaluate all of them.

III. LITERATURE EVALUATION

Here, we have gathered, organized, and analyzed a significant, representative portion of the available literature in this field. Our approach begins with a quantitative review, addressing the trio of questions posited in our methodology.

A recurring observation across the literature was the depth at which the impacts of tokenization were discussed. While the implications of tokenization are often detailed, there is an absence of in-depth description on the mechanics of real-world asset tokenization, and how it could be implemented in a decentralised manor. As depicted in Figure 1, only 5% of academic sources provide an intricate account of tokenization's implementation. Notable examples of these are[17] and[18]. The medium platform was slightly better, with approximately 20% of articles describing the process. It's noteworthy to mention that several articles, not accounted for in the 'Yes' category, did offer high-level overviews on tokenization methodologies. However, they were excluded from the 'Yes' category due to the absence of specifics on secure decentralized tokenization.

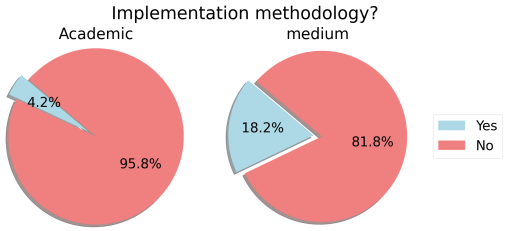

FIG. 1. Analysis of method description detail in asset tokenization literature.

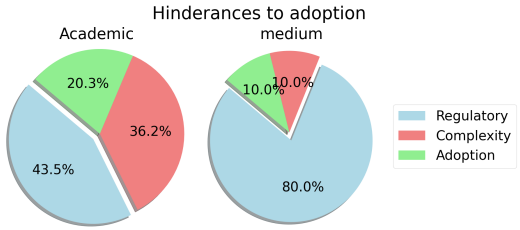

FIG. 2. Main minderances to the adoption of real world asset tokenization, according to the literature.

The lack of detailed methodologies might suggest that tokenization is a highly complex problem that remains largely unresolved. However, when exploring hindrances to adoption in Figure 2, regulatory concerns overwhelmingly dominated, accounting for 43.5% in medium articles and 80.0% in academic publications. This predominant focus on regulatory impediments might hint at a gap in the communities technical knowledge, or it might imply strategic withholding of proprietary technical details by industry leaders.

The literature ubiquitously identifies the financial sector as the prime candidate for asset tokenization. Notible examples include include Forbes[19] and others[20212]. This anticipation aligns with the prevailing trend, as a majority of web3 solutions aim to reinvent traditional financial services. The readiness of the financial world for tokenization can perhaps be attributed to its already semi-digital nature, coupled with its existing web2 presence. A 500 billion dollar asset management firm recently teamed up with Polygon Labs to advance tokenization within finance[22]. Larry Fink, BlackRock's CEO has acknowledged the promise of this innovation, declaring that "tokenization of securities will define the future of markets and securities"[23].

Real estate emerges as the subsequent contender for tokenization. There is a wealth of literature discussing the trans formative potential of real estate tokenization[24], primarily its ability to democratize access through fractional ownership[25] and bolster liquidity[26] in an illiquid market. The slow pace of real estate transactions could also witness a significant boost[27] with tokenization. However, the specifics of real estate asset tokenization are often glossed over. Noteworthy mentions include insights from[28], but even they fall short of illustrating a wholly decentralized process. It is interesting to note that a form of decentralised property deeds[29] was first discussed in 1998 by cryptographer Nick Szabo, 10 years before the famous Bitcoin whitepaper[14].

The integration of real-world asset tokenization into supply chain management aims to address longstanding challenges in the sector. By defining tangible assets, such as raw materials, products, or even intangible assets like certifications, as digital tokens on a blockchain, supply chains can increase levels of transparency and traceability[30]. Each tokenized asset, representing a unique digital counterpart of a physical item, can be tracked in real-time as it moves through various stages of the supply chain. This hopes to ensure the authenticity and provenance of products and thus mitigates risks associated with counterfeits and fraud[31]. Furthermore, the decentralized nature of blockchain ensures that all stakeholders, from manufacturers to end consumers, have access to a single source of truth, fostering trust and collaboration across the supply chain ecosystem[32]. This could be particularly useful as consumers increasingly demand ethical sourcing of products.

Collectibles are also frequently identified as real world assets which would impact from tokenization, as seen in 3. Recently, a blockchain-based platform named Freeport announced its plans to offer tokenized investments in artworks by the iconic pop artist, Andy Warhol[11]. Ownership of the pieces would be fractionalised into lots of 1000. This would make the art available to more people. It is identified in[25] that this increase in availability can increase demand in the product, bringing added liquidity and as a bonus increasing price when compared to similar non tokenized assets.

Although not as prominent in the literature, it is also worth noting that tokenized gold assets combined market capitalization recently exceeded $1 billion, as highlighted by CoinGecko's data[33]. Tokenized gold, essentially a stablecoin, is anchored to the price of gold. These blockchain tokens symbolize ownership of actual gold, overseen by the issuer, providing investors an avenue to gain exposure to the precious metal. This method bypasses the typical management fees associated with exchange-traded funds (ETFs) and eliminates the challenges of physically storing gold bullions[34]. Dominating the tokenized gold landscape are pax gold (PAXG) and tether gold (XAUT), issued by Paxos Trust Company and Tether, respectively. These two entities collectively represent a market cap nearing $1 billion[35].

IV. TECHNICAL REVIEW

We now determine the five largest players in the field according to their total locked value as determined by defillama. We do a deeper dive into each of the protocols, using whitepapers and technical documentation wherever it is available. We use TVL as a rough indicator of relevance to select the protocols to review.

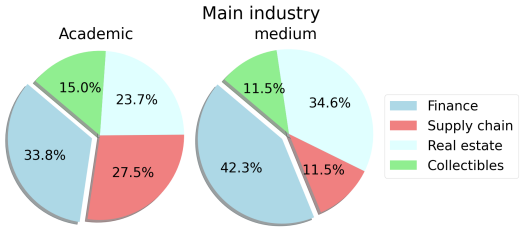

FIG. 3. Analysis of Main Industry focus in asset tokenization literature.

The protocols with highest TVL are:

1. stUSDT
2. Ondo Finance
3. MatrixDock
4. RealT Tokens
5. Tangible RWA

A. stUSDT

"staked USDT," is an offshoot of the well-known stablecoin USDT (Tether). It has by far the largest TVL of the current RWA protocolas at $1.8b. While USDT maintains a value pegged to the US dollar, stUSDT introduces staking, allowing holders to lock up their USDT to earn rewards. This staking mechanism backs stUSDT with the underlying USDT (which is in turn backed by real-world reserves like fiat currency) and also promotes liquidity and accessibility. The blockchain foundation of stUSDT ensures transaction transparency, a important feature for tokenizing tangible assets, guaranteeing clear ownership rights and asset values, while also allowing the user to interact with a real world asset - the US dollar.

B. Ondo Finance

Ondo Finance claim to be a open, decentralized investment bank. Their notable offering, the OUSG token, represents a tokenized version of BlackRock's short-term U.S. government bond exchange-traded fund (ETF) and has amassed 134 million dollars of assets under management on the Ethereum blockchain. As part of their strategic expansion, Ondo has natively issued this token on the Polygon network, diversifying their reach in the tokenized asset space.

The tokenization of traditional financial instruments, such as U.S. Treasuries, is gaining traction, with the market for such tokenized Treasuries reaching 600 million dollars. Within this market, Ondo Finance's OUSG token holds a significant share, and their associated decentralized lending marketplace, Flux Finance, enables investors to secure loans using OUSG as collateral.

C. Matrixdock

Matrix dock aims to ensure an immutable record of ownership. They provide daily Proof-of-Reserve and claim to guarantee full bankruptcy remoteness. The main offering of Matrixdock is the STBT (Short-term Treasury Bill Token). This token represents a tokenized real world asset of US T-Bills and is issued by Matrixdock itself. Designed as an ERC-1400 standard token, STBT allows accredited investors to utilize stablecoins to tap into US T-bill yields. The token's unique feature is its daily rebasing of interest on every business day. Initially, each STBT is priced at 1 USD and is backed by short-term US Treasury securities that have 6-month maturities, as well as reverse repurchase agreements.

D. RealT Tokens

RealT Tokens aim to tokenize real estate assets. The process begins by selecting a real estate property and establishing a property-specific LLC (limited liability company). This LLC is then tokenized on the Ethereum blockchain, with each token representing a share of the property. Investors can purchase these tokens, effectively buying a fraction of the property. The ownership details and rights are then embedded into the tokens using smart contracts, ensuring transparency, security, and immutability. Token holders receive rental income proportionate to their ownership, and this is typically distributed via stablecoins directly to their Ethereum wallets.

This has the potential to break down real estate, a traditionally high-barrier and illiquid asset, into smaller, tradable units, democratizing access to real estate investments. This would offer a more inclusive investment model than traditional real estate and also introduces enhanced liquidity, as these tokens can be traded on secondary markets.

While RealT's approach to tokenizing real estate is innovative and offers many advantages, it's essential to note that it isn't truly decentralized. The very nature of real-world assets, like real estate, requires legal structures and intermediaries, such as the property-specific LLCs in RealT's model. These structures introduce centralized points of control and potential regulatory oversight. Additionally, the management and maintenance of the physical properties remain centralized, as decisions related to the asset often rest with a select group or entity. Thus, while the trading and ownership aspect might be decentralized on the blockchain, the underlying asset's governance and management still retain elements of centralization.

E. Tangible RWA

Tangible also focus's on real estate. The platform has developed "Real USD," a stablecoin anchored by a diversified portfolio of tokenized, yield-generating real estate assets. This mechanism is designed to counteract the inflationary tendencies of fiat currencies by capitalizing on the consistent appreciation of real estate. To ensure stability, the value of Real USD is maintained in parity with the U.S. dollar, and up to half of its reserve is held in DAI, a well-known stablecoin. Furthermore, Tangible has introduced a feature where tangible assets are transformed into Tangible NFTs (TNFTs). These digital tokens can be traded on the platform and, crucially, can be exchanged for their corresponding physical assets. This integration signifies a strategic move to merge the tangible asset market with the burgeoning digital economy.

V. SUMMARY

Despite the decentralized promise of blockchain technology, a recurring theme across the top five players in real-world asset tokenization is the presence of centralized choke points in their methodologies. Whether it's the establishment of property-specific LLCs in RealT Token, the management structures in Tangible RWA, or the collateral USDT supposedly held (once removed) for stUSDT by a private company, there remains a significant degree of centralization in the control and governance of the tokenized assets. This centralization is evident across all five major players we reviewed, suggesting a broader industry trend rather than isolated instances.

Given this, contrary to what one might expect, the technical challenges associated with creating a private, trusted decentralized platform for asset tokenization are not the primary concern raised in the literature. Both academic and medium articles predominantly highlight regulatory concerns as the main hindrance to adoption.

If these technical challenges are overcome, or the market is happy to adopt simpler less decentralised methodologies (and lack of decentralisation does not pose a major problem), the literature is explicitly clear on the various upsides. Tokenization democratizes access to a broader range of investment opportunities, allowing individuals to partake in fractional ownership of assets, from real estate to art. This not only breaks down barriers to entry but also enhances liquidity in traditionally illiquid markets. Additionally, the decentralized nature of blockchain can potentially reduce intermediaries, streamline transactions, and bolster transparency, leading to reduced costs and increased efficiency.

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