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Blockchain in Finance: An Examination of Asset Tokenization

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Abstract

English

This master thesis explores how assets can be tokenized and the transformational power of blockchain technology across different industries, particularly in regard to finance. The research will delve into the adoption, advantages, and challenges of implementing tokenization. It also focuses on how the technology is changing the world's financial landscape by providing higher liquidity, operating efficacy, and wider investment opportunities through digitizing bankable and non-bankable assets. The findings are derived from a synthesis of a literature review, case studies conducted and expert interviews that were aimed at highlighting the current state of tokenization and some of the challenges it has encountered.

Based on these outcomes it is clear that even though asset tokenization holds great promise, there are various barriers impeding its widespread acceptance. Some of these obstacles include: lack of regulations in this field; blockchain interoperability; investors' trust and industry conservatism issues. Various entities have embarked on projects to overcome such barriers showing practical benefits like faster trade execution, reduced costs and greater transparency.

In addition, the thesis examines upcoming developments like CBDCs integration with tokenized assets, the growth of nonfinancial tokenization, and an increased involvement by institutional players. The study concludes that even though it can be a significant part of mainstream financial markets in future, for this to happen regulations, technology and market issues must first be overcome. Besides, this gives policy makers, investors and institutions a guide on how to deal with asset tokenization as it evolves.

Abstract

German

Diese Masterarbeit untersucht, wie Vermögenswerte in Token umgewandelt werden können und welche transformative Kraft die Blockchain-Technologie in verschiedenen Branchen hat, insbesondere im Finanzbereich. Die Forschungsfrage befasst sich mit der Einführung, den Vorteilen und den Herausforderungen der Tokenisierung. Sie konzentriert sich auch darauf, wie die Technologie die weltweite Finanzlandschaft verändert, indem sie durch die Digitalisierung von bankfähigen und nicht-bankfähigen Vermögenswerten eine höhere Liquidität, operative Effizienz und breitere Investitionsmöglichkeiten bietet. Die Ergebnisse basieren auf einer Synthese aus einer Literaturrecherche, durchgeführten Fallstudien und Experteninterviews, die darauf abzielen, den aktuellen Stand der Tokenisierung und einige der damit verbundenen Herausforderungen aufzuzeigen.

Auf der Grundlage dieser Ergebnisse wird deutlich, dass die Tokenisierung von Vermögenswerten zwar vielversprechend ist, es jedoch verschiedene Hindernisse gibt, die einer breiten Akzeptanz im Wege stehen. Einige dieser Hindernisse sind: fehlende Vorschriften in diesem Bereich, die Interoperabilität der Blockchain, das Vertrauen der Anleger und Probleme mit dem Konservatismus der Branche. Verschiedene Unternehmen haben Projekte zur Überwindung dieser Hindernisse in Angriff genommen, die praktische Vorteile wie eine schnellere Handelsabwicklung, geringere Kosten und größere Transparenz bieten.

Darüber hinaus werden in dieser Arbeit künftige Entwicklungen wie die Integration von CBDCs mit tokenisierten Vermögenswerten, das Wachstum der Tokenisierung von Nicht-Finanzwerten und eine stärkere Beteiligung institutioneller Akteure untersucht. Die Studie kommt zu dem Schluss, dass Tokenization in Zukunft zwar ein bedeutender Teil der etablierten Finanzmärkte sein kann, dass dafür aber zunächst regulatorische, technologische und marktbezogene Probleme überwunden werden müssen. Außerdem gibt sie politischen Entscheidungsträgern, Anlegern und Institutionen einen Leitfaden für den Umgang mit der sich entwickelnden Tokenisierung von Vermögenswerten an die Hand.

List of abbreviations

- **AML:** Anti-Money Laundering
- **APAC:** Asia-Pacific
- **BAT:** Basic Attention Token
- **CBDC:** Central Bank Digital Currency
- **CVC:** Culture Voucher Certificate
- **DeFi:** Decentralized Finance
- **DLT:** Distributed Ledger Technology
- **EVM:** Ethereum Virtual Machine
- **ICOs:** Initial Coin Offerings
- **IoT:** Internet of Things
- **IP:** Intellectual Property
- **KYC:** Know Your Customer
- **NFT:** Non-Fungible Token
- **OECD:** Organisation for Economic Co-operation and Development
- **PACIS:** Pacific Asia Conference on Information Systems
- **PoS:** Proof of Stake
- **PoW:** Proof of Work
- **REIT:** Real Estate Investment Trust
- **SDN:** Software-Defined Network
- **SSRN:** Social Science Research Network
- **UBS:** Union Bank of Switzerland (United Bank of Switzerland)
- **VAKT:** VAKT Consortium (a blockchain platform for post-trade processing of commodities)

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1. Introduction

Distributed ledger technology has brought about a major change in the financial sector. Asset tokenization is one significant innovation in this field that allows physical and financial assets to be represented digitally on a blockchain. This research study aims at exploring the asset tokenization concept, its present applications, and future potential within finance.

Companies have traditionally turned their assets into cash by securitizing them with investors being given an interest in the future value of those assets. Historically, securitization has been used to monetize financial assets that provide cash flow to pay investors. When investors can sell their interests along with the payment stream, this becomes an attractive opportunity. However, these investments are usually limited by securities laws to institutional and knowledgeable investors, while other obstacles inhibit a broader participation in these value exchanges (Schwarcz, 2022).

Both industry practitioners and academia believe that blockchain and other distributed ledger technologies could revolutionize financial instruments as well as markets more generally. Instead of just stock issuance or fundraising for small firms and medium-sized corporations via blockchain technologies, it is possible for it to go beyond the existing architecture of the securities industry thereby affecting both institutions (OECD 2020).

The fintech industry has been very excited about the introduction of blockchain. The industry is always reviewing what functions can be built on a blockchain in future whether it be long or short term. Blockchain technology is poised to define this age by enabling asset tokenization among other functions (Sahdev, 2017).

Sazandrashvili states that asset tokenization is an evolution of the blockchain technology that allows for physical and financial assets to be digitally represented, and traded securely, seamlessly, and transparently (2020). It is one of the fastest growing sectors in the blockchain economy. Since the beginning of Bitcoin's time there have been many attempts at utilizing bitcoins as "tokens" for asset and commodity representation. Many people are using blockchain for issuing and trading securities with promising advantages to benefit from (Smith et al., 2019).

Today there are mechanisms for tokenizing ownership interests in real estate which are fungible on secondary markets. Tokenization broadens participation in the market so as to enable diverse portfolios with lower minimum capital requirements (Baum, 2021).

The funding of blockchain-based start-ups has been revolutionized by ICOs, which are a new way of raising money where investors receive digital currencies in return for cash to enable support or fund activities. These tokens can have different functions such as shares in future profits of the company or means of paying for goods and services when available (Gan et al., 2021).

There is another financial product on the block chain that is growing at a fast rate, which are real estate tokens. This product is considered a potential solution to many problems that have plagued property investors according to some market analysts and platforms offering real estate tokenization. The investment vehicle of real estate tokenization allows secondary market trading, lessens intercessions within transacting processes and enhances liquidity through resource fragmentation (Naumann & Kull, 2022).

1.1 Research Objectives

While it may be stated that the financial sector is being revolutionized by blockchain-backed asset tokenization, there is still a lot of ongoing research on the subject, and not sufficiently enough has been explored in relation to it. There is a lack of comprehensive studies that examine industry perspectives along with actual case studies that assess practical adoption and perception across various asset classes about tokenization. This study aims at addressing that gap by combining theoretical insights with expert interviews as well as using a case study approach to provide an overall view of asset tokenization in the finance sector.

Firstly, this thesis will critically evaluate the current state of asset tokenisation in finance. The focus will be on how certain assets are transformed into tokens and what influences their adoption. As such, this study seeks to document existing practices or variations among different types of assets including real estate, securities, art and commodities.

Secondly, asset tokenisation will be discussed in terms of benefits and challenges. This research looks into possible advantages and scrutinizes some reasons why its adoption is rather slow. Both advantages and disadvantages should be taken into consideration when examining the impact of asset tokenisation on the financial industry.

Additionally, this research looks to combine perspectives from industry experts with those of academics. In line with this objective, the thesis aims at gathering qualitative insights from key stakeholders who include industry players as well as scholars and practitioners so that they can predict how asset tokenization might evolve in future. The research leverages expert input into legislative changes, technological advancements, and market dynamics to spot patterns or trends which may drive the technology's acceptance or spread. Therefore, this thesis is based on a study by Baum (2021) which considers the potential of tokenization in real estate investment and a discussion by Baltais & Sondore (n.d.) examining the general economic implications of asset-tokenizing. A model developed by Heines et al. (2021) shows how businesses can adopt tokens and benefits that may result from doing so. Furthermore, legal matters must not be ignored when tokenizing according to Blémus & Guegan (2019) as well as the OECD (2020). Similarly, Khan (2021) and the EU Blockchain Observatory and Forum (2019) demonstrate that difficulties around stakeholderism or standardisation remain key to market penetration at large scale. Recently, it has been proved that institutional involvement plays an important role in terms of authenticating tokenization mechanisms. Moreover, Benedetti and Rodríguez-Garnica (2023) offer techniques to integrate mainstream investment portfolios with tokenized assets emphasizing cost reduction as well as transparency programs. Additionally, according to BlackRock (2024), J.P.Morgan (2023), money market funds are being used alongside other bankable assets like stocks which have been securitised by institutional investors indicating the technology's scalability potential. Naumann & Kull's research demonstrates what tokenisation does for traditionally illiquid markets like art or property. (2022). These ideas establish a basis for the thesis within the discussion of asset tokenization.

By conducting this research this, this study is not only valuable in an academic context but also provides practical suggestions for industry executives, regulatory authorities and policy makers who wish to understand how assets are tokenized as they evolve.

1.2 Practical relevance

This study's practical importance lies in exploring the shift of finances through the use of blockchain technology in tokenizing assets. By offering a theoretical framework, this research paper examines current real-life application and highlights both benefits as well as challenges associated with tokenization. The possible beneficiaries include financial analysts, investment

advisors, regulators and potential investors who are interested in tokenized investments. For finance professionals, comprehending the underlying principles and ramifications of tokenization can affect investment decisions and portfolio choices by ensuring enhanced liquidity or diversifying various assets. The study also helps regulators to understand existing obstacles to regulation as well as possible frameworks for addressing them hence providing a basis for their policies that would strike a balance between innovation and investor protectionism. Investors on the other hand, can be receive more specific information about opportunities and risks linked to getting involved more into the world of tokenized assets. Furthermore, it is possible to regard the results of the study as an educational tool that may help people comprehend what is meant by this term, thus promoting its wider usage. This research not only adds valuable information to academic literature but also provides insights that might enable future implementation and regulation in practice.

1.3 Structure of the thesis

This paper is structured into several key sections to provide a comprehensive analysis of asset tokenization in the financial sector. The Introduction outlines the significance of blockchain technology and the concept of tokenization, setting the stage for the subsequent discussion. The research objectives section defines the study's goals, focusing on the current state, benefits, challenges, and future prospects. Following this, the literature review delves into existing research and theories related to tokenization, providing a foundation for the study. The methodology section describes the research design, including the data collection and analysis methods used to gather insights from industry experts. The case studies section presents detailed examinations of specific applications of tokenization in various industries, highlighting both successes and challenges. The interview findings synthesize insights from expert interviews, identifying key themes and trends. This is followed by a discussion of challenges and benefits, which critically evaluates the practical implications. Finally, the future directions section explores potential developments and trends that may shape the development of tokenization, while the conclusion summarizes the study's findings and their implications for the financial industry. This structured approach ensures a logical and thorough exploration of the underlying topic, providing valuable insights for academics, practitioners, and policymakers.

2. Literature Review

One of the initial studies to examine the impacts that ICOs have on asset tokenization has been done by Gan et al. (2020) as they developed a model for creating “asset-backed” ICOs with insights into the most appropriate token pricing and issuance rates for equity and utility tokens, while taking into account agency problems, product attributes, and uncertain customer demand.

Sahdev (2017) has written about the entrepreneurial implications of Initial Coin Offerings arguing that democratizing access to investment opportunities through token sales will inevitably affect systemic volatility, risk preferences, and economic complexity. Fisch et al., performed two empirical studies in 2022 in order to determine if differences existing within the “offline world” are reproduced online or how far ICOs provide a neutral space where people can raise money to support their businesses. They found evidence showing enhanced funding choices for young people, ethnic minorities as well as firms located at long distances.

Heines et al. (2021) designed a qualitative framework on characteristics, factors and adoption barriers of tokens to promote understanding of how the token economy functions and presented prototypical scenarios of such. Their research shows that the financial sector is becoming more interested in tokenizing bankable and non-bankable assets. However, there has been little or no experimental knowledge on this concept, its benefits or how it can be implemented. Moreover, previous studies have not considered a holistic perspective to this phenomenon and instead focused on either technological or conceptual aspects.

Baum (2021) examined the research question, whether tokenization can be the future of real estate investment and has found, that for this to happen, there must be a stated desire for the fractionalization of individual real estate holdings, and market players must feel confident using blockchain. Smith et al. (2019) studied the use of security tokenization for properties linked with commercial real estate. Their study also revealed that tokenizing real assets may generate immense value for investors.

2.1 Foundational Theories and Historical Context

Narayanan et al. (2016) offer a thorough introduction to Bitcoin and cryptocurrency technologies by introducing the theoretical background and practical applications of the blockchain concept as it is used today. They state that decentralization ensures security and integrity of transactions through peer-to-peer networks without the need for a central authority. It is important to lay this foundation when studying about further developments in tokenization.

Tapscott and Tapscott (2016) investigate the implications of blockchain technology beyond just cryptocurrencies, arguing that this innovation can transform various industries by enabling transparent, secure and efficient transactions. Their work shows how blockchain has impacted financial systems thereby paving way for asset tokenization among others.

Yermack (2017) examines how blockchain technology might affect corporate governance from an angle that transparency and immutability could enhance accountability while reducing fraud. This perspective is particularly relevant for tokenisation because it suggests that more stringent governance structures are needed with respect to tokenized assets.

The economics surrounding blockchain according to Catalini and Gans (2016) imply that blockchain could lower transaction costs and enable new business models. Their enquiry establishes a foundation for considering whether investment opportunities can be democratized through tokenization by lowering barriers to entry while enhancing liquidity access.

Nevertheless, blockchain is a technology that is confronted with technical challenges as highlighted in the work of Zohar (2015). The stability and scale of the blockchain platforms are crucial because this underlies the fundamental idea of digital tokenization.

Lex Cryptographia is a term coined by Wright and De Filippi (2015), which is where blockchain functions as an enforcement tool for contracts using codes. This idea helps to explain how smart contracts can streamline transactions and secure them.

2.2 Overview of Blockchain Technology

Blockchain is defined as a set of protocols that regulate a synchronized, open source and permissionless version of shared history. This is the foundation for cryptocurrencies like Bitcoin and Ethereum (Ruoti et al., 2019). Blockchain has expanded beyond cryptocurrencies to form a broader cryptoeconomic ecosystem with underlying components other than digital currencies. The ecosystem contains different types of ledgers, some operating with permissioned protocols. All blockchain protocols have a similar topology consisting of a set of data blocks ordered sequentially where each block can point to at most two successors (Sultan et al., 2018).

The historical record in blockchain technology is established by a consensus mechanism. Typically, this involves a computational race referred to as mining or minting, where nodes propose versions of the blockchain. The longest sequence of blocks forms the canonical history, which is often called network security or sybil resistance and depends on the aggregate computational power in the network. This computational power helps prevent censorship since it defines how strong the chain is against unauthorized changes. (Ul Hassan et al., 2019).

The idea of blockchain was first proposed by Stuart Haber and W. Scott Stornetta, who invented a cryptographic method for timestamping digital documents to ensure their integrity (Saxena et al., 2023; Tabatabaei et al., 2022). The introduction of Bitcoin in 2008 by Satoshi Nakamoto, whose identity is unknown, converted this concept into practical blockchain technology. Nakamoto designed a distributed system using computers that would establish an authentication process automatically, through the use of “hashing,” or converting data that can be read and understood into an unrecognizable series of hexadecimal numbers which are unpredictable. This technology has been put into application mainly through the Bitcoin network that was capable of solving the double spending problem without relying on any trusted third party (Nakamoto, 2008).

In the past, transactions of traditional assets like real estate involved banks, brokers and other centralized sources. Such inefficiency caused vulnerability in the system – among them being susceptibility to cybercrime and fraud. This approach was modified by Bitcoin through blockchain technology which has no central authority. The use of such a network makes Bitcoin function as a peer-to-peer platform since it enables users to send transactions and create new

blocks without an intermediary. Hence, this decentralized method guarantees better safety and reliability via bitcoin mining, which involves participants called miners who use SHA-256 (Secure Hash Algorithm) to solve intricate cryptographic problems. The first person who correctly solves the puzzle wins new Bitcoins while the verified block is appended on the blockchain—this creates tamper-proof distributed ledgers for all times. This development introduced an innovative trust-less system based on consensus that secures transparency from any attack (Sambana 2021).

The historical introduction of Bitcoin in 2008 was the beginning of the rise of blockchain technologies globally (Tasca & Tessone, 2017). Bitcoin brought out the concept of blockchain as a decentralized digital payment system, revealing the strength and significance of distributed systems. In addition, it demonstrated how ungoverned distributed systems worked and led to a move towards decentralization. After Bitcoin various blockchains have been proposed that enhanced or extended the original work by adding new features and functionality on top of this decentralized payment system. Moreover, Ethereum has expanded on what blockchain could do with its smart contracts. This enabled programmers to code Turing-complete instructions and also make conditional payments based on actions using smart contracts within the blockchain. The EVM is a virtual machine that deploys blockchain, keeps it up to date, while in parallel executes all commands given, according to Natoli et al. (2019).

The security and independence of blockchains are crucial for managing digital currencies. Transactions on blockchain are unchangeable, open and secure, making it a viable option for several purposes like finance (Zhang et al., 2019). When compared to the traditional centralized systems, the decentralization in blockchain enhances trust and security. In centralised systems, a single point of failure can result in loss of privacy and data leakages among others. Control over this network is spread across the blockchain hence unauthorized access is prevented while data integrity is ensured (Zyskind et al., 2015).

Since it is an open distributed ledger that records transactions in a permanent verifiable way, consequently this means that it cannot be altered; therefore users can be able to trust and rely on its contents. Blockchains can either be private or public in nature. It restricts access by controlling participation making them suitable for organizational use while public blockchains

allow anyone to participate and verify transactions which ensures more transparency but could have scalability concerns (Akram & Bross, 2018).

Decentralized security and transparency in the financial system are enhanced by public blockchains, which eliminate the need for trusting a central authority. However, they have to address issues of scalability and performance as a result of its open nature of participation. The opposite is true for private blockchains that offer controlled access and effective operations best suited for organizations with high confidentiality concerns. They also hinder unauthorized entry and grant network owners the power to control behavior of participants. (Schaeffer, 2019).

This is done through various consensus mechanisms that ensure there is no one entity controlling the blockchain network. Proof-based mechanisms like Proof of Work (PoW) and Proof of Stake (PoS) are common, each offering different approaches to security and efficiency (Ngyuen et al, 2019). PoW is a mechanism used by Bitcoin as its original consensus method that requires miners to solve cryptographic puzzles validating transactions thus ensuring high security at energy-intensive costs (Yan, 2022). A more secure PoW alternative was created called PoS which utilizes miner cryptocurrency amount instead to process transactions hence it promotes energy efficiency and scalability (Asif & Hassan, 2023).

Smart contracts are coded agreements that self-execute on the blockchain, allowing for automated transactions. They underpin decentralized applications (DApps) which extend beyond financial use of the blockchain (Taherdoost, 2023). For instance, Ethereum supports smart contracts through its Turing-complete programming language called Solidity. It facilitates complex DApps creation making blockchain more powerful (Antonopoulos & Wood, 2018).

The applications of blockchain are diverse across industries ranging from finance to health care. These use cases demonstrate the potential for blockchain to transform different sectors. With respect to financial services, the technology is altering operations through heightened security, decreased charges and more transparency. Banks and other financial institutions globally have started integrating cryptocurrencies as well as blockchain-based solutions (Reddy et al., 2020).

Blockchain faces some roadblocks including scalability, regulatory issues and energy consumption which is high. These challenges need to be addressed in order to enable wider acceptance and integration into different sectors of the economy. Scalability poses a major challenge affecting transaction rates as well as network efficiency. Solutions like layer-two protocols aim at tackling these issues but are complicated in nature. Regulatory uncertainties also affect such platforms with concerns over tax evasion, AML and compliance (Morar & Propescu, 2024).

Some of the future trends in blockchain entail decentralized finance (DeFi), interoperability, and environmental sustainability. As blockchain technology advances it has the potential to revolutionize many industry sectors while addressing current limitations that exist within them. The continued advancement and application of blockchain technology across various industries indicate a bright future for this revolutionary technology (Pineda & Nieto-Bernal, 2024).

2.3 Introduction to Tokenization

Asset tokenization is the process where the ownership rights of an asset are converted into digital tokens on a blockchain. It permits expenditures and transfers to be represented with the same ease in a decentralized network as money does, which is guaranteed by the government. Through digitization, we can move from a virtual world into a multi-chain actual world, where we can create and employ different types of non-currency tokens and business models in security, asset management, banking, among others. The emergence and the clout of the new forms of investing in currency and business attest to the prospects inherent in tokenization of economic assets (Taravelli, 2023).

The introduction of blockchain and smart contracts has completely changed the operational elements of financial services, by changing the definition of money, value and security. Such change leads to reduction of costs of doing transactions, higher transaction efficiency, greater transparency and better management of accounts through the building of cryptocurrencies and token economies. Accordingly, this change has generated attention from central and commercial banks, financial and monetary authorities together with diversified financial institutions, start-ups and digital companies. Various research confirms that the

tokenization of tangible and intangible assets, instruments, or securities is an ongoing revolution, with digitization and decentralization likely to dominate the future of financial services (Paul-Emeka et al., 2024; Miah et al., 2023).

Digital asset platforms enable the orchestration and reduce the cost of transaction processing ensuring that the user experience remains unaffected with respect to what use case or token protocols are in place. The process of tokenization entails the issuance of a new token which creates a digital twin represented in a blockchain's ledger. The objective of this technique is to facilitate the emergence of a standard for the promotion of digital twin tokens made in the context of various distributed ledger technologies (DLTs) (Avrilionis & Hardjono, 2021).

The tokenization of assets holds its own best legal, technical, and organizational dimensions and greatly eliminates third parties from the financial systems. For the holders that wish to finance their assets, the process is now much easier and more transparent than before, which in turn creates more access to the economy. Tokenization improves liquidity in primary and secondary markets while attracting new categories of investors to assets that used to be difficult to sell, thereby lowering the cost of transactions. (Nassr, 2021). The industry however makes distinction between bankable assets that can be tokenized such as loan, bonds, equity from non-bankable assets such as art, cars or even real estate, (Jocham, D. 2023).

Fairfield describes tokens as digital proxies that denote the entitlement to possession of or ownership of something. It can be centralized in central government's trusted databases or decentralized in a distributed ledger and for higher safety and accessibility. Tokens can be of two types, fungible tokens that can be exchanged for something and non-fungible tokens, NFTs which are not interchangeable (Fairfield, 2022). Creating a digital version of a physical or financial asset, such as a mortgage or a loan is what constitutes the tokenization of a bankable asset. Various rights, including equity and loan, example options, and even intellectual property can be supported by these digital assets, (Tian et al, 2020).

In 2021, the OECD released a publication called "Understanding the tokenisation of assets in financial markets." The paper examines the topic of tokenisation of financial assets saying that it refers to the digital representation of physical assets on distributed ledgers or the issuance of traditional asset classes in tokenised form. This aligns with the concept of bankable

assets being tokenized and transferred within a blockchain-based space. Concerning legal compliance, the OECD report indicates that there are legal and regulatory challenges to be addressed for particular property rights and ownership issues in the area of asset tokenisation. This corroborates the argument that tokenization has to abide by legal restrictions. (Nassr, 2021).

The process of tokenization of non-fungible assets is an emerging concept in the global economy which allows asset classes that have low liquidity to be represented within distributed ledger technologies. This includes the conversion of ownership claims to assets like artwork, property, and patents into tokens easily tradable on blockchain systems. (Heibel & Steiger, 2024). The OECD reiterates that tokenization has the intrinsic capacity to improve liquidity and the tradeability of assets that have traditionally been free of a liquid market and therefore have high levels of investability barriers which are traditionally prevalent. This democratization of investment over previously unaffordable asset classes is likely to be pivotal in making the investment landscape far more inclusive. (Nassr, 2021). This form of diversification of opportunities in investment is especially useful for retail investors to gain from fractional investments. Tokenized assets are anticipated to account for as much as 10% of global GDP by 2030 according to the World Economic Forum, which constitutes approximately 24 trillion USD in market. (Heibel & Steiger, 2024). The rise of these market is anticipated due to the benefits that tokenization entails including enhanced transparency of information, lower costs of undertaking transactions, and better functionality of the markets. (Auer, 2024).

Nevertheless, lack of proper regulation poses a significant hurdle for the mass adoption of tokenizable assets. With the passage of time, it will be paramount to address these regulatory barriers together with integrative frameworks to enable the adoption of tokenized assets within the broader scope of modern financial markets (Nassr, 2021; Heibel & Steiger, 2024).

2.3.1.Types of Tokens

Tokens have evolved to be one of the key features in the blockchain environment as they perform multiple roles and depict different asset types or uses. Decoding the different types of tokens is equally important to researchers and practitioners.

Fungible tokens refer to digital currencies that are interchangeable, and are used within a blockchain environment to represent certain values or serve particular purposes. These assets are

one of three primary token classes, including utility tokens and tokenized securities. Within blockchain networks, they are commonly utilized as payment tokens or cryptocurrencies. (Schwiderovski et al., 2024; Oliveira et al., 2018)

Non-fungible tokens signify one-of-a-kind digital assets. It is impossible to exchange NFTs on a one-to-one basis. NFTs are indivisible and possess the unique ability to reflect the ownership of certain digital or physical items which makes them different from other tokens. As per Gonserkewitz et al. (2022), an NFT can be defined as “*a cryptographically unique, inseparable, irreplaceable and verifiable token that represents a specific item, either digitally or physically, on a blockchain*” (p.10).

Utility tokens are systems of digital currencies that are tradeable only for the services and products offered on a blockchain. These tokens are pivotal in platform development funding, early adoption rewards and economic interest alignment to beneficiaries. Utility tokens are not like cryptocurrencies, they allow access to services and products offered in the platform thus giving them a value. The tokenomic structure of utility tokens contains rules that govern their issue, distribution, allocation and the potential destruction of the tokens. This design is crucial to improving the value proposition of the token issuer’s ecosystem. In fact, utility tokens capture network effects whereby users gain more value as the network grows. Some examples of utility token implementations include Filecoin, Mana from Decentraland, ALEX’s dual token system, and Ether from Ethereum. These tokens show the ever-expanding scope and nature of the utility tokens within the blockchain ecosystem. (Benedetti et al., 2021)

Security tokens are blockchain-based investment contracts subject to securities law. They offer advantages such as interoperability, fractional ownership, market liquidity, and rapid settlement, making them a catalyst for finance digitization. Empirical comparisons show that Security Token Offerings (STOs) take longer and raise more funding than Initial Coin Offerings (ICOs), but have lower valuations when controlling for other factors. (Momtaz, 2021).

Governance tokens are an essential element in the functioning of DeFi projects because they allow for decisions to be made by the token holders. In the research conducted by Hu and Bai, it was noted that these tokens promote user participation and self-governance, thus changing the face of the existing corporate world. The research established that major token-driven firms,

for instance, Binance and Uniswap, change their governance arrangement in a major way. Governance tokens allow users to participate in governance from the ground up, questioning the traditional top-down governance models of corporations. This shift requiring more active models would put concern on governance paradigms which have been in place particularly in tokenized contexts. (Hu & Bai, 2024).

The purpose of stablecoins is to restrict the fluctuations in price to the value of a particular benchmark asset, which is usually a fiat currency such as the US dollar. A paper published by the Bank for International Settlements points out that stablecoins backed by fiat, commodities, or other cryptoassets have been less volatile than traditional cryptoassets, but none have managed to achieve the goal of consistently maintaining parity with their peg. Furthermore, there is no certainty that the issuers of the stablecoins would be able to redeem all the coins from the users on demand. So far, existing stablecoins do not seem to qualify for being a secure asset and a reliable means of payment in the economy. (Kosse et al., 2023).

2.4 Regulatory and Legal Landscape

In Europe, the aim of the Markets in Crypto-assets (MiCA) Regulation is to put under control unregulated crypto-assets by adopting an all-encompassing EU framework. MiCA suggests regulation over three token categories: asset-referenced tokens, e-money tokens, and other crypto-assets. The regulation sets forth provisions to crypto-asset issuers and service providers, or CASPs, which include securing national competent authority approval. After such authorization is granted, issuers and CASPs are supplied with an EU Passport, which enables them to function throughout the EU single market. MiCA intends to foster legal certitude, stimulate innovation and competition, defend consumers and investors, and maintain financial stability. However, questions have been raised about the comprehensiveness of the definitions, the risk of an unlevel playing field, insufficient supervisory requirements, and rigid provisions that could impede innovation. These issues have been acknowledged by the European Central Bank and other stakeholders who have suggested that policy clarifications and amendments be made before MiCA comes into effect. (van der Linden & Shirazi, 2023).

Nevertheless, government policies, combined with the need to comply, emphasize the importance of protecting investors. For example, Ferreira's research analyzes the legal and compliance intricacies that emerge with the development of token economies and blockchain technology. The research points to the existence of a global patchwork of regulatory structures and its resultant legal ambiguity and compliance difficulties to participants of token economies. One of the major concerns is the lack of consensus in the definitions of blockchain tokens such as security, utility, and payment tokens. What these countries do is progressive, what the rest of the world grapples with is reactionary – neutral frameworks to blockchain regulation like those adopted by Liechtenstein and Malta. Ferreira argues that these shifts lead to risks, stifled innovation, and unregulated competition between countries, and as such, international treaties that deal with regulatory concerns are needed. Regulators around the world need to find harmony – the sweet spot that enables innovation while protecting investors and keeping markets stable. Achieving this is urgent and one of the most intricate issues we are facing today, which is why it requires collaboration. (Ferreira, 2022). Blandin et al.'s comparative study of 23 jurisdictions makes this claim stronger by showcasing how nuanced things really are. It discusses the overlap in authority and the lack of uniform classification systems as major issues.

The observation by Blandin et al. suggests that there is a differentiation of traditional asset and natively digital asset, so as to assess the token characteristics from one case to another and cover all the gaps using bespoke or retrofitted regulations. There is a need to create a holistic legal guideline that is both detailed and simplified to regulate and differentiate between bankable assets and non bankable assets. Such a framework ensures the protection of consumers, bondholders, and investors with regard to institutional bankruptcy within the context of these assets creation and issuance. Regulatory frameworks should be broad enough to address the issue of both bankable and non bankable tokens as well as international interactions on these tokens. (Blandin et al., 2019).

2.5 Literature-Based Perspectives on Blockchain and Asset Tokenization

The perception and the adoption of asset tokenization and blockchain technology differ from sector to sector and are determined by their opportunities, issues, and regulatory frameworks. The tokenization of assets, as discussed by Baum (2021) and Naumann & Kull (2022), has made possible previously unattainable possibilities such as fractionalized ownership, increased liquidity, and access to formerly unavailable markets, like real estate. These advantages are in sync with the general trends of blockchain adoption, where one of the core benefits is decentralization and transparency (Narayanan et al., 2016; Tapscott & Tapscott, 2016).

Despite its remarkable features, blockchain adoption still faces major obstacles. Zohar (2015) focuses on scalability and security as the main lingering issues for resolving technological problems. The inability for blockchain frameworks to cooperate with one another to facilitate tokenization, as pointed out by Buterin (2016) and Khan (2021) as well as the EU Blockchain Observatory Forum, makes transactions between platforms difficult and reduces effectiveness. Adding additional level triggers and standard protocols are thought to be necessary for improving blockchain infrastructure and overcoming these challenges.

Another major concern is the lack of clear regulations. Blémus & Guegan (2019) as well as the OECD (2020), highlight that the difference in legal setups for different regions leads to or causes uncertainty for businesses and investors. To illustrate, the United States faces challenges due to conflicting federal and state regulations, while countries like Switzerland and Singapore have adopted clearer, more supportive frameworks, accelerating adoption in those regions.

The financial realm spearheads trade tokenization, evident in BlackRock's tokenization of its money market fund and JP Morgan's Onyx project where efficiency and cost-effectiveness are reinforced (BlackRock, 2021; JP Morgan, 2020). Investors with bankable assets easily adopt tokenization into current financial systems, which could lead to better productivity and minimize expenses (Smith et al., 2019). On the other hand, non-bankable assets such as real estate and art are slower to adopt due to the conservatism of the sector and the lack of robust secondary markets (Propy, n.d.; Maecenas, n.d.).

Investors' trust is also a contributing factor to adoption, skeptics often challenge the adoption of blockchain as it can be perceived as extremely complex as well as subject to fraud and volatility (Tapscott & Tapscott, 2016). These concerns are valid and reside in the conservative side of traditional business practices. With that being said, the likes of Propy and Maecenas serve as an example of how tokenization can be applied in the real world, providing proper transparency and vehemently addressing these concerns.

Moreover, anticipated trends such as the adoption of Central Bank Digital Currencies (CBDC) and diversification to non-financial industries such as gaming, culture, and intellectual property showcase that tokenization has broader applications and is becoming more relevant (Viola, 2024). These changes illustrate the ongoing evolution that has been driven by blockchain and tokenization technology. That being said, the existing literature confirms the view that blockchain and tokenization for instance could serve a great importance if only existential regulatory, technological and market related obstacles can be dealt with. By circumventing the aforementioned barriers, tokenization could fulfill its vision as a key pillar of contemporary financial systems and other affairs.

2.5 Identification of Research Gaps

Identifying research gaps is a crucial step in advancing the understanding of asset tokenization in finance. This study attempts to close a critical gap in the literature by looking at the contemporary state of asset tokenization, its impact, obstacles, and future opportunities. While previous literature is primarily focused on the functional details and early use cases of blockchain technology and tokenization (Gan et al., 2020; Sahdev, 2017) there is a paucity of comprehensive studies that holistically evaluate both bankable and non-bankable assets and encompass both qualitative and quantitative analyses. This involves comprehending the adoption gap across asset classes such as real estate, securities, art, and collectibles (Smith et al., 2019; Baum, 2021).

Additionally, even though the possible advantages in terms of liquidity and efficiency of the market have been identified and supported, there is little empirical research that seeks to measure these benefits, as well as the regulatory and technological issues (Heines et al., 2021; Fisch et al., 2022). With the help of industry practitioners and scholars, this study strives to fill these gaps by identifying the specifics of these other dimensions. Such contributions will be of

value in enhancing the existing policy as well as providing academic guidance in relation to asset tokenization.

The amount of available research on blockchain technology has experienced rapid growth. One of the most pressing ones is the tokenization of previously defined non-bankable assets, which poses a major research challenge as little attention has been given to what happens when tokenization becomes the primary means of capital raising and trading. Consequently, a research gap has come to light. This thesis endeavors to fill this void by offering insights that contribute to the extant literature on this subject. The findings of this thesis will aim to contribute to the existing literature on this topic.

3. Methodology

This section outlines the research objective, data collection, and data analysis methodologies used in this study. The research employs an exploratory qualitative approach grounded in **Yin's (2018)** case study methodology and supported by **Mayring's (2014)** qualitative content analysis.

3.1 Research Objective

The primary objective of this research is to investigate the benefits and challenges associated with asset tokenization in the finance industry and to understand how industry experts and academics perceive its future development. This objective is driven by the following research question:

Research Question: How are asset tokenization and blockchain technology being adopted and perceived in various sectors, and what are the key regulatory, technological, and market-related challenges and opportunities as identified through expert interviews and real-world case studies?

To explore this main question, the study addresses several sub-questions:

1. What are the perceived benefits and current trends in the adoption of asset tokenization, particularly regarding market liquidity and efficiency?
2. What are the primary regulatory challenges hindering the widespread adoption of tokenization, and how do these challenges differ across sectors?

3. How do technological advancements, particularly in blockchain interoperability and smart contracts, influence the success and adoption of tokenization platforms?
4. What market adoption barriers, such as investor trust and industry conservatism, are preventing the broader acceptance of tokenized assets?
5. What future trends in asset tokenization are emerging from both expert opinions and case studies, and how are institutions preparing for these developments?

Rather than testing predefined hypotheses, this research aims to explore these sub-questions in-depth using case studies and expert interviews.

3.2 Case Study Approach (Yin's Method)

This study follows **Yin's (2018)** exploratory case study design, which is suited for answering "how" and "why" questions about complex, contemporary phenomena where the researcher has little control over events. As asset tokenization is an evolving process, this method allows for an in-depth investigation of its benefits and challenges in the financial industry by examining real-world cases and collecting qualitative data from expert interviews.

Multiple-Case Study Design:

Yin (2018) emphasizes the importance of considering multiple cases to strengthen the robustness of findings. Accordingly, this research employs a multiple-case study design, focusing on three specific areas of tokenization: real estate, art, and securities. These cases provide different perspectives on tokenization's implementation and challenges across asset classes, enhancing the generalizability of the insights derived.

- **Case Selection:** The selected cases represent diverse asset types where tokenization is actively being explored or implemented. These cases were chosen based on their relevance to the finance industry and their potential to offer insights into the benefits and challenges of tokenization.
- **Data Collection:** The data for this study comes from two main sources:

1. **Semi-Structured Interviews:** Six experts from the finance and blockchain sectors, including C-level executives and technology experts, participated in semi-structured interviews. These interviews were designed following Yin's guidelines, with a focus on flexibility to explore participants' perspectives in detail.
2. **Literature Review:** Secondary data was collected from peer-reviewed journal articles, industry reports, and case studies from financial institutions such as Deloitte and the OECD.

Methodology Profile	Details
Methodology of the Survey	Semi-structured expert interviews
Instrument	Semi-structured interview questionnaire
Population	Austrian and Swiss enterprises
Occupation Fields of the Experts	• CEO and Founder of decentralized exchange
	• Digital asset specialist and digital asset risk manager of global bank
	• Digital innovation expert, e-foresight/Swisscom
	• CEO of Validvent, crypto tax advisory firm
	• CEO and founder of Black Manta Capital Partners, tokenization advisory firm
Time Frame	May to June 2024
Location of the Interviews	In person and online via MS Teams, Google Meet, FaceTime, WhatsApp
Length of Interviews	35 to 65 minutes
Amount of Interviews	6
Analysis of Interviews	Mayring's qualitative content analysis

In accordance with Yin's principle of **data triangulation**, both interview data and secondary sources were used to corroborate findings and ensure the validity of the research.

Maintaining a Chain of Evidence:

As suggested by Yin (2018), this research ensures transparency by maintaining a chain of evidence, documenting the entire data collection and analysis process. This approach increases the study's reliability and allows others to trace the research steps back to the original data.

3.3 Data Analysis

The collected data were analyzed using **Mayring's Qualitative Content Analysis (2014)**. This method facilitates a structured and systematic interpretation of qualitative data, focusing on identifying key themes and patterns relevant to the research questions. The approach is grounded in the development of categories, either inductively derived from the data or deductively applied from the literature.

3.4 Qualitative Content Analysis Framework

Mayring (2014) emphasizes that qualitative content analysis is an **empirical, methodologically controlled approach** that is systematically designed to extract meaning from text data. It involves assigning categories to text passages and interpreting patterns within those categories in light of the research questions.

Key steps in the process of **Mayring's Qualitative Content Analysis**:

1. **Determining the material to be analyzed:** In this study, the material includes the transcribed semi-structured interviews with six industry experts on asset tokenization, along with case study data from various financial sectors (real estate, art, and securities tokenization).
2. **Defining the units of analysis:** The smallest meaningful unit (e.g., phrases or sentences that address key topics like liquidity, regulatory challenges, or market adoption) is identified as the core unit for analysis.
3. **Formulating categories:** Categories were inductively developed based on the material. During the first cycle of coding, major themes related to asset tokenization's benefits, challenges, and expert perceptions emerged. These themes formed the basis of broader categories that were applied throughout the data.
4. **Pilot testing the category system:** Before final analysis, the category system was pilot-tested on a portion of the data to ensure clarity and consistency in coding. Adjustments were made where necessary, following the iterative process described by Mayring.

5. **Systematic coding of the material:** The full data set was coded systematically using the revised categories. Each interview transcript was reviewed, and relevant text passages were assigned to the predefined categories.
6. **Summarizing and interpreting the findings:** After coding, the material was summarized, and key findings were interpreted in light of the research questions and theoretical framework.

3.5 Inductive and Deductive Category Application

Mayring's method incorporates both **inductive category development** and **deductive category application**, depending on the nature of the data and the research design. In this study, inductive category development was primarily used, allowing themes and patterns to emerge from the interview and case study data.

- **Inductive Category Formation:** Categories such as "liquidity and market efficiency," "regulatory challenges," and "technological complexity and interoperability" were derived from the interview data, reflecting the perspectives of experts on key topics.
- **Deductive Category Application:** Certain pre-established categories, grounded in the literature review (e.g., regulatory challenges), were applied deductively to see how the expert opinions aligned with existing theories and findings.

To ensure the validity and reliability of the analysis, both **Yin's (2018)** and **Mayring's (2014)** principles for rigorous qualitative research were applied:

- **Triangulation of data sources:** The triangulation of interviews, case studies, and secondary literature ensured a robust and multi-faceted understanding of the topic.
- **Inter-coder reliability:** Although coding was primarily done by one researcher, peer debriefing was used to ensure the consistency and reliability of the coding process.
- **Transparency and Chain of Evidence:** A clear chain of evidence was maintained throughout the research, enabling others to trace the research process from data collection to analysis, as suggested by Yin (2018).

4. Case studies

4.1 Propy

Propy is a real estate platform that incorporates blockchain technology to automate key parts of property transactions, increasing security and transparency while enhancing efficiency. Propy's real estate multimedia deals can be made without the use of brokers and greatly reduced costs, due to the innovative technology that the form integrates within the industry. Some of the elements that the platform employs are smart contracts which helps in self executing agreements where the participants signing do not have to get involved, and the other parties involved don't have to manually ensure adherence to the agreement. Studies indicate, based on analysis conducted, that this approach reduced transaction times by 32.4% and costs by 27.8% (Yang, 2024).

Propy addresses challenges in traditional real estate, such as fraud, inefficiencies, and lack of transparency. By recording property ownership transfers on an immutable blockchain ledger, Propy ensures tamper-proof, verifiable transaction records, thereby mitigating fraud risks and ownership disputes (Konashevych, 2020). Its platform also supports real estate tokenization, allowing properties to be divided into digital shares. This innovation promotes fractional ownership, increases market liquidity, and simplifies cross-border transactions (Joshi & Choudhury, 2024).

Some of the most serious problems faced in real estate are fraud, inefficiencies, and even a lack of transparency. Propy has taken advantage of blockchain's optimum security features to revolutionize the industry. Rather than having ownership transfers recorded on central servers, Propys uses a blockchain ledger, making transaction records tamper-proof and verifiable. (Konashevych, 2020). Because of this innovation, the chances of fraudulent practices and ownership disputes has significantly decreased. Furthermore, with Propys platform, real estate tokenization is now possible, meaning that a single property can be divided into many digital shares, allowing seamless ownership transfer. Now individuals can have fractional ownership, making investments more feasible. (Joshi & Choudhury, 2024)

Propy has pioneered real-world applications of blockchain in real estate, notably completing the first blockchain-recorded real estate sale in 2018. This transaction demonstrated

blockchain's potential to streamline complex processes while enhancing security and efficiency (Propy, n.d.). Additionally, Propy integrates environmental and social governance (ESG) principles, as blockchain reduces paper-based processes and promotes sustainability in real estate operations.

Despite its advancements, Propy and similar platforms face challenges, including regulatory uncertainties, technical barriers, and market acceptance. Collaboration among stakeholders is needed to establish standardized protocols and frameworks for widespread adoption (Yang, 2024). Propy exemplifies the transformative potential of blockchain in real estate, addressing traditional inefficiencies while advancing accessibility and sustainability through tokenization and automation.

4.2 Maecenas

Maecenas is a blockchain-based platform that modernizes fine art investment through fractional ownership. Maecenas tokenizes the artworks through blockchain technology, which allows investors to buy digital shares of the artwork and then trade them. This way, the art market can gain much needed liquidity, allowing more than just elite collectors to participate in its value exchange. (Maecenas, n.d.).

The process works by turning authenticated pieces of art into unchangeable digital certificates or 'fractions,' which get stored securely on the Ethereum blockchain. This makes each share very safe and hard to imitate. A groundbreaking use of this model was the tokenization and auctioning of Warhol's electric chairs. This auction proved that the platform can fractionalize valuable pieces of art so that numerous investors can own a single piece. It makes the market more liquid, as more fragments of art pieces can be bought and sold as compared to the whole art piece, making the investment in art more profitable (Maecenas Blog, n.d.).

Maecenas also aligns with broader financial trends by treating artworks as financial assets that can be divided into shares, traded, and integrated into global financial markets. This concept is in contrast to the established art market dominated by auctioneers and art brokers. It facilitates a disintermediated, more open, and safer art investment environment. Tokenization makes investment in art an easier asset to deal with, while increasing the market's liquidity and transparency (Maecenas, n.d.; Maecenas Blog, n.d.). By leveraging blockchain technology,

Maecenas positions itself at the intersection of art and finance, reflecting the increasing commodification of cultural assets and offering a model for democratizing access to fine art investment.

4.3 VAKT

The VAKT platform constitutes the key development in the digitization of post trade activities in the area of energy commodities. VAKT was established in 2018 and is a joint effort of major players in the energy business, including BP, Shell, and Equinor. It uses blockchain technology to improve business processes and transparency within the entire trade cycle. The platform's capability to create an unchangeable, secure record of transactions translates to the removal of processes dependent on paper documentation and the minimization of operational inefficiencies. One of VAKT's most transformative innovations is the vSure product, which introduces legally binding digital confirmations to replace traditional paper contracts. By automating these processes, vSure reduces the likelihood of mistakes, increases compliance, and cuts down on housework. Shell and Gunvor have introduced vSure in the North-West Europe Barges market, which has marked a practical proof of concept for enhancement of post trade processes and business reliability (VAKT, n.d.).

Apart from VAKT operating efficiencies, these vultures VAKT's disabatic objectives. Digitization and changes in trading platforms like VAKT diverges from the conventional supply chain management methods which have an adverse impact on the environment. This change advances the global agenda to foster better industrial sustainable practices (Abbas & Myeong, 2024).

The platform integrates various stakeholders and market data to ensure effectiveness in data and information transmission, and as a result, VAKT assists in achieving market transparency. This increase in price visibility widens the scope for better decision making, while simultaneously decreasing reconciliation periods in the trade ecosystem (VAKT, n.d.).

VAKT is at the forefront of reimagined digital platforms for legacy industries. Through strategic investment in the combination of improved operational productivity, transparency, and even sustainability, VAKT has remarkably advanced the energy commodity markets where technological investment and productivity growth has long lagged behind other sectors.

4.4 JPMorgan Onyx

Onyx, a project from J.P. Morgan, is one of the major steps toward the integration of blockchain technology within traditional financial services. Onyx was launched in 2020 as a blockchain development platform of the firm designed to create novel payment systems and solutions with digital assets. One of the major developments is the JPM Coin System, a payment infrastructure for institutions that enables real time transactions across borders. This system increases speed and reduces the costs associated with intermediaries, resulting in much more efficient payment processing (J.P. Morgan, 2020).

In parallel to JPM Coin, Onyx has launched Onyx Digital Assets, a multi-asset tokenization platform with over \$900 billion worth of tokenized US Treasuries since its inception. The platform facilitates the settlement and transfer of tokenized assets and improves the liquidity and efficiency of operations within the financial markets (J.P. Morgan, 2020).

The vision of Onyx strategizes the use of blockchain technology in new and competitive industries such as the space economy. A case study addresses Onyx's advancement by providing the world with an Earth-to-satellite blockchain payment as the first in the world. This case reveals the versatility of blockchains expansive adaption (Khan, 2022).

Moreover, Onyx has built further on the idea of deposit tokens that are digital tokens issued on a blockchain by banks that allow for a wide range of transferability. Unlike stablecoins and central bank digital currencies (CBDCs), these tokens represent deposits with the issuer and have programmability and instant atomic settlement as their strong suite. Deposit tokens have the potential to be a master form of digital currency in the developing financial world (J.P. Morgan, 2023).

4.5 BlackRock

BlackRock is leading innovation in asset management by spearheading the tokenization of Real World Assets (RWAs). Tokenization of real world assets is the process of converting tangible assets into digital tokens on a blockchain, thus improving liquidity, accessibility, and transparency in the marketplace (Karayaneva, 2024). The BlackRock USD Digital Liquidity Fund, which was launched in March of 2024, marks a significant milestone in the firm's

commitment to integrating digital finance into traditional investment models as it was the first fund built on the Ethereum blockchain (Karayaneva, 2024).

This initiative corresponds with wider economic developments. Baltais and Sondore (2024), for instance, point out that the reduction of inefficiencies associated with trading, custody and settlement processes makes RWA tokenization a potential source of global economic savings up to \$2.4 trillion per year. Additionally, the prospect of this innovation is emphasized by the Boston Consulting Group's (2024) forecast of assets under management with tokenized funds, which will exceed \$600 billion by 2030.

In addition, tokenization is capable of lowering issuance costs, improving transparency over assets' whole lifecycle, and decreasing the number of middlemen needed (Benedetti & Rodríguez-Garnica, 2023). BlackRock's focus on democratizing investment opportunities through enabling access to traditionally illiquid markets using these advantages further add to his claim (Karayaneva, 2024; Benedetti & Rodríguez-Garnica, 2023).

This move by BlackRock gives the firm a competitive edge in financial innovation while indicating a move toward enhancing efficiency, accessibility, and inclusion within the asset management industry through blockchain technology.

5. Interview Findings

In-depth interviews with key industry figures provided invaluable insights into the practical implications and future trends of tokenization within the financial sector. The perspectives shared by these experts underscore several critical themes, including regulatory challenges, technological advancements, market liquidity, and future adoption trends.

5.1 Key Themes from Expert Interviews

Theme 1: Current State

From the viewpoint of the current state of asset tokenization at hand, there seems to be a mix of optimism, experimentation, and significant challenges. Most experts agree that tokenization is still largely in its exploratory phase, particularly when it comes to non-bankable assets such as real estate, art, and collectibles. Interviewees III, IV, and V indicate that while there used to be quite some initial excitement about the idea of the tokenization of non-bankable assets, it peaked at around five to six years ago, before subsequently tapering off into more practical implementations surrounding bankable assets such as securities, bonds, and funds. For instance, UBS is now active in the tokenization of bonds while Citigroup recently began tokenizing private market funds. These efforts demonstrate a shift towards the further integration of tokenized assets into the traditional financial infrastructures.

As previously stated, the tokenization focus has shifted from bankable to non-bankable assets such as real estate, art, and collectibles. This phase is driven by the need to democratize access to these highly illiquid markets. However, as Interviewees III, IV, and VI have noted, the initial hype has subsided, and more practical and financially viable implementations became the focus. Addx in Singapore, for instance, has been experimenting with the tokenization of private market investments and creating some liquidity into highly illiquid assets, but these cases remain niche (Interviewee III).

The movement towards bankable assets such as securities, bonds, and funds is caused by their more structured and regulated use which allows them to fit more easily within the pre-existing financial frameworks. This has been started by institutions such as UBS and Citigroup, which have begun tokenization of bonds and private market funds for improved liquidity and operational efficiencies. This change has also been made by major financial institutions building

private blockchains and novel financial instruments. The JP Morgan Onyx project illustrates these trends, as they show how traditional banks use the block chain for more efficient and less costly operations (Interviewee VI). In the interview, it appeared that the tokenization of bankable assets is, practically speaking, the easiest to achieve. Interview I observe that this corresponds to the growing need by financial institutions to show the utility of blockchain integration outside of the hype (Interviewee I).

Theme 2: Regulatory and technological challenges

The industry faces daunting challenges in lieu of the advancements made. These are significant obstacles such as regulatory uncertainties and the intricacy of technological factors that must be resolved to ensure the adoption of the assets is widespread in nature. Advanced interviews II, IV and V expressed the need for a regulatory framework alongside technological improvement in order to completely incorporate tokenized assets into standard financial markets. Overcoming these challenges alongside reaping the full advantages of tokenization requires technological interoperability, standardized protocols, and last but not least, a lucid legal framework.

Different laws create a legal void which then disrupts liquidity and adoption because businesses are reluctant to perform investment activities within tokenization projects without an appropriate legal framework, rules, and policies (Interviewees I, IV, and VI). In Interview I, the most pronounced issue of tokenized assets is the lack of clarity regarding the legal framework within which assets such as real estate can be used as collateral due to a variance in existing property laws across the globe. This ambiguity in the law frequently discourages investments and inhibits the progress of markets for tokenized assets that exists (Interview I). Concerns such as these have been confirmed by Interviewee VI, stressing that regulatory ambiguity poses great challenges to the ability of substantial financial services to undertake tokenization projects (Interviewees VI).

As was pointed out, the existence of a greater fragmentation and conflicting nature of policies in the United States poses a challenge, while Switzerland and some countries from the Asia pacific region (APAC) have adopted more favorable, definable policies that are growth friendly. The DLT pilot scheme, for example, attempts to do this by creating a ‘sandbox’ where

certain regulatory requirements and constraints are relaxed while designing new solutions to ease the investment process. Transcript IIIIV states that regulatory compliances may be lacking in ease and practice, especially in terms of securities and financial assets. The interviewees seem to doubt if such frameworks could be imposed without endangering investor safety. There is a chance that section IV of the informative document will be able to establish standards which strike a balance between investor safety and welcome innovation. It is also a step in the right direction.

Investor protection against money laundering is one of the most complex challenges. These costly and complicated regulations must be followed against the burdening anti-money laundering rules within financial organizations. There existed a strong consensus from the Interviews I, III, and IV regarding the fact that, in a number of jurisdictions, it has become difficult to form a well-defined legal relationship between digital tokens and their assets, which restricts investment opportunities and slows down the growth of a strong market for tokenized assets. To illustrate, the tokenization of real estate properties is bound by legal intricacies that include complying with the property jurisdiction laws of various regions and states.

Additionally, there is a need to deal with regulatory issues. Progressively, blockchain interoperability, digital identities, and smart contracts could provide useful legal technology to the regulatory authorities managing the risks incurred from tokenized assets. Interviewees III and VI stressed the potential spot in enlargement from the regulatory perspectives of the traditional finance to the innovation of the blockchain system. For instance, the use of ZKP and identity verification could be deployed to secure tokenized assets in a way that improves the ability of regulators to oversee the transactions that take place with the tokenized assets.

Theme 3: Market Adoption

The fusion of technological growth, economic benefits, and supportive regulatory frameworks have together caused the adoption of asset tokenization in the financial market. The value of tokenization is increasingly recognized by financial institutions. For example, it enables an economical and fast execution of trades, reduces operational costs, and automates the entire value chain. Interviewees II and VI pointed out that one of the most attractive aspects of tokenization is the astounding ease with which repo transactions are executed. Instead of taking

days, these transactions now merely take minutes, thereby drastically reducing costs while improving efficiencies.

The economic reason for adopting tokenization is commentable, if not overwhelming. For instance, trades can be executed faster, operational costs are reduced, and greater transparency is guaranteed in the financial system. The practical advantages of tokenized money market funds on Ethereum by BlackRock, for example, provides instant settlement and new investment opportunities (Interviewees II and IV). These benefits of increased efficiency and decreased costs are motivating factors for financial institutions to seek and adopt tokenization technologies.

The adoption of particular technologies in the marketplace depends on whether institutions are willing to adopt them. There is rather a challenging question in the industry as to whether supply creates demand or demand gives rise to supply. Some of those interviewed, IV and VI, were of the opinion that the large established institutions must stimulate demand by showcasing the potential benefits of tokenization to their clientele. This involves not only demonstrating economic benefits but also removing obstacles such as high ticket sizes for some products and the absence of a genuinely active secondary market for tokenized assets.

The absence of trust and education is one of the major hindrance when it comes to adoption. There is a clear indication of mistrust and thereby misunderstanding even with the advancement of particular technological domains such as blockchain and tokenization. Those interviewed II, IV, VI were highly sceptical and put a lot of emphasis on education and the effort to build trust. The potential investors must be shown that there would be significant efficiency gains to be had from the use of tokenized assets and that such assets would be reliable. Furthermore, the non-technical investors have difficulty understanding tokenized assets and their appreciation because of the underlying blockchain technology. The complex nature of blockchain further complicates the situation therefore, there is a need to educate about the assets while being fully aware of the risks involved.

The other notable challenge is divergence in various blockchain systems. The architecture of such technology is so open-endedly diversified that it builds barriers that interfere with free movement and trading of tokenized assets. From the interviews, III and VI underscored the need for aligned development of blockchains with interoperability protocols and standards which

greatly necessitate improvement and decreased complication. These cross chain solutions and set standard protocols are a necessary condition toward an integrated market of tokenized assets.

The last issue to be mentioned and one worthy of every consideration is the fact that the financial industry is too conservative for this to be widely adopted without the proper regulation support and clear legal frameworks. To ensure that these institutions partake in tokenization projects, regulatory bodies need to faithfully provide the rest required clearness and boundaries so comprehend the cubical operations without being troubled with the civil legal issues. As expressed in the notes from Interviewees IV and V, the regulatory framework is vital for the future of tokenization of assets and there is a need for interplay between regulators and the private sector to resolve this. Enabling technologies such as tokenization must be supported with broad evaluation and investment friendly, sufficiently restrictive legislation.

Theme 4: Future Trends

In the long run, the potential of asset tokenization is fantastically bright but is hinged on overcoming challenges present today. The interviews highlight several trends and focuses that will influence the development of tokenization phenomenon for the next five to ten years.

In the first place, the development and usage of blockchain systems should be able to meet requisite level of standardization and harmonization if mass adoption is to be achieved. As stakeholders notice the need for cooperation and articulation of goals at technological levels, efforts directed at standardization of smart contract and regulatory policies will take off. Interviewees IV and VI stressed the need to develop an ecosystem for tokenized assets with articulate, standard, and cohesive design features, including the cradle of interoperability protocols for diverse blockchains. Collaborative efforts and setting standards will aid in ensuring smoother integration and increasing adoption of tokenized assets.

Advancements in technology will continue to drive the further development and adoption of tokenization. Important developments include layer two technologies, EVM, and zero-knowledge proofs, which are needed for better scalability, privacy, and functionality of the public blockchains (Interviewees III and VI). Moreover, Interviewees V and VI further pointed out that developments in digital identity will also be crucial for facilitating secure transactions which are legally recognized and further enhance the use and adoption of tokenization. These

technological innovations will overcome existing constraints and enable new possibilities for the utilization of tokenized assets.

This particular technology has wide-ranging Potentials, as demonstrated by the emerging trends which include the penetration of tokenized assets into realms outside finance such as the gaming, fashion, culture with the inclusion of CBDC. Additionally, Interviewees V and VI cited an innovative tokenized use example of Vienna Culture Token which combines CO2 certificates with vouchers for cultural events. The coupling of CBDC with tokenized assets could increase liquidity and trust with an added government back promise of security and stability.

The increasing participation of leading international business actors in the tokenization sector is yet another relevant phenomenon. Companies such as BlackRock, JP Morgan, Citibank, among others, are not just researching tokenization, they're engaging in building and applying schemes that use blockchain technology to reduce inefficiency and cost. This institutional uptake is essential for market uptake and for proving the benefits of tokenization to a larger audience (Interviewees II, III and VI). Their involvement enhances the credibility of the whole process and speeds up the construction of adequate and feasible tokenization solutions.

With the maturing of regulatory frameworks and the development of more operational use cases, asset tokenization will probably become a standard feature in financial markets. Interviewees III and IV indicated that the tokenization of financial assets such as derivatives, money market funds, and structured products will cover a highly liquid market and will be important for growth. They offer substantial economic value due to the efficiencies gained in the issuing and settlement processes. The appropriate regulation that will permit innovation alongside investor protection will be critical to achieving a balanced and prosperous tokenization environment.

5.2 Benefits

The advantages and challenges associated with asset tokenization can have an impact on the finance industry in more than one way.

With tokenization, trades can be made with higher speeds, lower costs, and more transparency within the financial ecosystem. One of the major benefits of tokenization is the ability to automate various processes, which lessens the time and money spent on manual

financial operations (Interviewees II and VI). Tokenization tends to improve the efficiency and effectiveness of many financial operations by automating transactions, which results in cost benefits (Interviewee II, Interviewee VI).

Also, tokenization enables the creation of fractional and divisible assets, which can increase market liquidity for previously non-liquid assets. This allows for more investors to engage in markets that were not as accessible to them and increases the overall liquidity of the market (Interviewees IV and VI). These ownership mechanisms of real estate, art, and collectibles enable these industries to be more liquid and less restricted (Interviewee IV).

Using Blockchain technology prevents transactions from being changed and makes fraudulent activities difficult. Interviews V, IV, and II pointed out that the self sustaining system of block chain improves the trustworthiness of financial markets leading to better reporting on investment. This assurance that the trade made is genuine enables relief to the investors as all dealings made can be smoothly accounted for.

They include numerous potential use cases in almost every field like creating new services and funding products. For example, tokenized assets are used in altered finance DeFI platforms for new markets and services that were never offered before. The finance industry may continue to prosper and expand due to this innovation. It is possible to gain new income streams and create markets that have no competition (Interviewee III).

At last, tokenization promotes integration between distinct financial systems, which makes operations much less complex and more holistic. This integration is useful especially for large financial companies that operate with different classes and types of assets. The creation of cross-chain solutions and standardization of protocols will be critical in building an integrated ecosystem for tokenized assets (Interviewees III and VI). Good interoperability guarantees that tokenized assets can be moved and exchanged across different blockchain infrastructures with ease, increasing market efficiency (Interviewee III).

5.3 Challenges

One of the key obstacles inhibiting the growth of asset tokenization is regulatory uncertainty. The absence of a clear legal structure and measures fosters tentativeness among investors and financial companies alike. This suggests that much work is needed in developing

clear regulatory frameworks which pose innovation programs against investor protection (Interviewees I, IV and VI). Interviewees noted that the fractured and vague regulatory frameworks across various jurisdictions are barriers to propelling it to achieve global adoption. (Interviewee I, Interviewnee IV). Interviewee VI pointed out that innovative activities should be enabled through investor protection. As such there is a need for an elaborate regulation (Interviewee VI). According to these interviewees, this regulatory uncertainty is one of the reasons preventing many traditional financial stakeholders from adopting tokenization due to compliance issues. (Interviewee VI).

Particularly, the lack of interoperability across the different blockchain platforms serves as one of the many technological challenges. It is vital to enhance standard protocols and interoperability mechanisms to ensure there is a unified ecosystem for tokenized assets (Interviewees III and VI). The absence of interoperability greatly limits the usefulness of tokenized assets in the financial market (Interviewee III).

Many investors still feel skeptical and do not comprehend quite how blockchain or tokenization work. Trusting the market and educating it on the advantages and disadvantages that tokenization has to offer should be prioritized. These obstacles can be mitigated with targeted campaigns aimed at educating the public (Interviewees II, IV, and VI). The new technology incurs suspicion from a plethora of investors which is why a well rounded educational campaign is necessary (Interviewee II, Interviewee IV).

Alongside operational concerns, the adoption of newer technology alongside previously existing financial systems poses difficulty and can be extremely expensive. There are also legal issues that remain, especially regarding the connection between digital tokens and the assets they represent. To successfully create a viable market for tokenized assets, firm legal relationships must be established, making it easier to navigate property laws within different regions (Interviewees V and VI). There is an ample amount of legal and operational barriers to take care of and doing this requires legal investment in intellectual capital (Interviewee V).

5.4 Future Directions and Developments

The future of asset tokenization is poised for significant growth and transformation, driven by ongoing technological advancements, regulatory developments, and increasing market adoption.

Collaboration for defining technological requirements is likely to increase as the industry begins to incorporate standard smart contracts and regulatory policies for blockchain platforms. Standards are required to enhance the integration and adoption of tokenized assets. That kind of integration would greatly facilitate the development of an effective and functional infrastructure. It is expected that those parts of the new technology that are not mature will propel innovation and acceptance of tokenization. Development of digital identity will also greatly increase the scope of tokenization use cases by enabling secure and legally acceptable transactions and thus, lending credence to the adoption of tokenization (Interviewees III, V, and VI).

The integration of Central Bank Digital Currencies (CBDCs) with tokenized assets is a significant trend that might enhance trust and liquidity. The added incentive is a government-issued protective blanket. This integration will be crucial for the broader acceptance and utilization of tokenized assets (Interviewees V and VI).

Adoption is bound to be boosted by major players gradually entering the tokenization world and demonstrating major use cases. The fact that institutions including BlackRock, JP Morgan, and Citibank are currently working on and deploying tokenization projects adds credibility and accelerates the development of scalable tokenization solutions. With time, as regulation frameworks catch up and more use cases are successful, tokenization will be a given component of financial markets. The financial assets tokenization, especially in highly liquid and fungible markets such as derivatives, money market funds, and structured products, will be a big area of growth. There will need to be innovation friendly regulatory frameworks that protect the investors to enable a good and working ecosystem. (Interviewees V and VI).

6. Discussion

This section addresses the main research question: How are asset tokenization and blockchain technology being adopted and perceived in various sectors, and what are the key regulatory, technological, and market-related challenges and opportunities as identified through expert interviews and real-world case studies?

Specialists and practitioners believe that asset tokenization and blockchain technology are presently being adopted at different degrees in multiple industries because of the excitement over improvements in liquidity, operational effectiveness, and transparency. Adoption is most advanced in financial markets, especially in securities, bonds, and private market funds. Financial institutions like JP Morgan, through its Onyx project, and BlackRock, with its money market fund tokenization endeavors, illustrate the ways major market players are using blockchain to improve the speed and cost of settlements and unlock new investment avenues. These usages are examples of practical asset tokenization within existing financial systems.

Adoption has also been sluggish in non-bankable sectors like real estate, and fine art but it is getting there. For instance, Propy allows real estate transactions on the blockchain, Maecenas allows fractionalized ownership of high-value artworks. These platforms exhibit the opportunity that tokenization can offer to make access into high value, but illiquid markets more democratic. Nonetheless, these sectors are slow in adoption due to the challenges that regulatory and market readiness poses.

In all industries, tokenization is viewed as a new form of innovation that can change how assets are owned and invested in. There was a shared sentiment during the interview that tokenization increases confidence and trust, thanks to blockchain's unchangeable ledger and smart contracts. Nevertheless, there is an existing skepticism that is always present, especially in traditional sectors such as real estate and fine art. These industries are concerned with the sophistication of tech, the absence of proven secondary markets, regulatory uncertainty, and without mitigation, acceptance will be difficult.

Regulatory uncertainty serves as the key barrier for companies to be willing to accept tokenization innovation. It is most noticeable in America, where regulations differ in states, which largely does not allow active participation from institutions and yet its absence in places

like Switzerland and APAC accelerates adoption. It is vital to ensure a legal framework is in place, especially in America to encourage institutional participation, compliance concerns such as AML must be mitigated.

The lack of interoperability with blockchain and advanced smart contract are few of the many technological barriers which inhibit growth, scalability, and usability across different platforms. More advanced technologies as ZKP and other standardized protocols are urgently required to tackle these problems and allow for more effortless trading of tokenized assets.

Market-related hurdles constitute yet another barrier to adoption. First, there is investor reluctance which presents a fundamental challenge since potential investors have a view that blockchain technology in general is overly complex and comes with a wide range of risks. This view is further deepened because even the way tokenization is done is not very easy to comprehend and is therefore not trusted. Secondly, cautiousness in the industry presents yet another problem. Conventional industries tend to resist change and therefore adopt new strategies, such as blockchain based tokenization, at a snail's pace. Ingrained habits and the attendant fear of risks of new technology causes such reluctance. One more hurdle is the absence of well developed secondary markets, which retards adoption. The absence of proper developed places for the trading and exchange of the tokenized assets means that there is limited liquidity of these assets and hence their attractiveness decreases to investors. These issues must be resolved to enable greater acceptance of asset tokenization in different industries.

6.1 Findings

What are the perceived benefits and current trends in the adoption of asset tokenization, particularly regarding market liquidity and efficiency?

Asset tokenization plays a vital role in the operational effectiveness and liquidity of the market, especially for traditionally illiquid assets. Tokenization facilitates fractional ownership of assets which increases the access of the market to a wider range of investors, unlike the constraints set to only select wealthy individuals or institutions.

The present market focus outlines a development in the direction of tokenizing bankable assets, such as securities and bonds, from the existing tokens which are based on real estate and other collectibles. This development is due to the fact that tokenized assets can be integrated into

active systems and produce more financial benefits right away. The lower costs and the speed at which financial transactions can be executed drives adoption. Experts further emphasized that tokenization improves transparency and accuracy, making it easier for investors to monitor and trust their holdings.

What are the primary regulatory challenges hindering the widespread adoption of tokenization, and how do these challenges differ across sectors?

The global adoption of asset tokenization is greatly hindered by regulatory uncertainty. This is especially problematic in areas with legal fragmentation, such as the US, where regulatory standards are vastly different. The challenges in linking real estate tokenization and the accompanying property laws in different jurisdictions and regions, slows down investment and adoption of these assets as well.

However, the bond and securities market tend to be much more accommodating because of the existing governance structure. Countries such as Switzerland and other APAC nations are also taking the lead in implementing these assets because of the more comprehensive crypto regulations. The EU's DLT pilot regime provides specific encouragement for the adoption of new technologies while balancing servicing the existing legal framework to protect investors.

Compliance with AML laws and security measures remains another significant hurdle. Individual regulatory framework are often cumbersome and burdensome, as in the case study of Propy where the legal restructuring needed for transaction-specific regulations is enormous, which in effect shows the systemic division between sectors.

How do technological advancements, particularly in blockchain interoperability and smart contracts, influence the success and adoption of tokenization platforms?

Technological advancements, especially in blockchain interoperability and smart contract Innovation is important in the evolution of tokenization platforms, especially in smart contract execution and blockchain interoperability. Development of single unified blockchain systems to promote interoperability within various existing blockchains is vital for boosting liquidity and scalability and preventing these silos from forming.

While smart contracts promote enhanced data sharing among financial institutions through automation, it is important to ensure the reliability and security of these contracts, especially during complex cross border transactions. This technology coupled with blockchain greatly reduces human error as well as improves transparency.

To further alleviate these concerns, the use of zero knowledge proofs and digital identifications is a promising innovation for tokenized transactions. While still being developed, these ideas offer the potential to fill the existing void between traditional regulations and blockchain technologies.

What market adoption barriers, such as investor trust and industry conservatism, are preventing the broader acceptance of tokenized assets?

Investor skepticism and conservatism within the industry continue to serve as fundamental obstacles in the wider adoption of tokenized assets. Even as blockchain technology is transparent and immutable, a significant number of investors remain sceptical of it due to the absence of long term success, as well as the implementation of complex systems around it. It is imperative to take educational measures and Trust building initiatives to solve these problems.

Further, the appeal of tokenized assets is reduced because there is no secondary market that offers a wide variety of products for trade. The high ticket sizes needed to access certain products coupled with the fear of blockchain technology keeps wide spread adoption out of reach. As emphasized in interviews, financial institutions must lead by example, demonstrating the benefits of tokenization through successful implementations.

Industry conservatism, particularly in sectors like real estate and fine art, slows adoption. Typical stakeholders tend to shy away from investment in new technologies due to the complications regarding compliance, regulations, and operational changes. There needs to be a partnership between the regulators and the industry stakeholders to create a world with sufficient protection for investors while allowing innovations to takes place.

6.2 Contributions to Theory and Practice

This research adds to the literature on blockchain and asset tokenization by providing a detailed assessment of the advantages, disadvantages, and tendencies of this new technology. It

fills gaps in the literature by including other case studies and expert opinions which account for a perspective that encompasses both bankable assets and non-bankable assets. The study validates existing theories on the economic advantages of tokenization such as increased willingness to trade and efficiency of processes, while also revealing areas of regulatory differences and lack of technological regulations.

Additionally, the research helps in understanding how the adoption of tokenization by institutions will drive broader acceptance. The research proves that the willingness of big clients such as JP Morgan and BlackRock provides credence to adopting blockchain based solutions, thus leading to increased innovation which requires prominent institutions to take the first step. It also shows that the need for smart contracts and interoperability facilitates the adoption of tokenization.

This analysis practically assists practitioners regarding the integration of tokenization projects. Their results can assist financial institutions, regulators, and technology vendors in managing the challenges of regulatory compliance, technology integration, and investment literacy. The Propy and Maecenas case studies highlight how industry specific issues such as legal uncertainty and market conservatism could be addressed.

The recommendations of the study concerning regulations on the harmonized frameworks and the sandbox approach will boost innovation in the market, without compromising investor protection. These recommendations will also help strengthen investors' understanding of the opportunities and risks that accompany the newly emerging tokenized assets, thus encouraging trust and participation in this developing market.

6.3 Limitations and Future Research

This study sheds light on important aspects of the research topic, but it is not without its limitations. First, this research is concerned only with the assets and their value, and does not consider their use in other industries such as in supply chain or in healthcare. Notably, the use of qualitative data collected from six expert interviews may also limit the overall conclusions of the research, as a larger and more heterogeneous sample base would be able to encompass more views.

Furthermore, the research outlines a specific period in time when the regulatory and the technological environment was suitable for the tokenization, which was the point in time when the research was conducted. This temporal limitation entails that some findings may not stand as new regulations and technologies are forged. Lastly, the argument raised in this research paper – case study focused – implies that good or successful end results are always encouraged and sought after, which can easily lead to the explanation of the phenomenon whereby projects either deemed a failure or even worse never got built, are underrepresented.

There needs to be a shift in the scope of asset tokenization for example in intellectual property and healthcare for further research. Looking at various industries in comparison may unveil peculiar constraints and prospects for each industry in unique ways. There has been an emphasis on longitudinal studies which will assist in determining the dynamics and sustainability impact of tokenization over time.

The results of this research can be further substantiated with quantitative tools, such as econometrics and surveys, as they would be able to measure the benefits and challenges mentioned in this paper. The expansion of this research can also delve into standards of interoperability and examine the influence of nascent technologies, like quantum computing, on the efficiency and security of blockchains.

Finally, in order to reduce the environmental damage caused by the blockchain technologies implemented in the tokenization process, further analysis must be conducted to investigate sustainable measures and innovations that address the negative effects.

7. Conclusion

This thesis sought to find out the acceptance and perception of blockchain technology and asset tokenization. Through identifying their possible benefits, major challenges and future prospects, the research aimed at examining how asset tokenization and blockchain technologies might be used to ameliorate the financial markets as well as other sectors.

Some of the identified advantages of tokenizing assets through blockchain include market efficiency, reduced operating costs and improved liquidity (Baum 2021; Heines et al., 2021). Tokenization also allows individuals to enter traditionally illiquid markets such as real estate, art or commodities through fractional ownerships (Naumann & Kull, 2022; Maecenas, n.d., Abbas & Myeong, 2024). Nevertheless, these gains depend on overcoming obstacles like inadequate and liquid secondary markets or technological hindrances such as lack of interoperability in blockchains (Gan et al., 2022; Fisch et al., 2022), Sazandrishvili, 2020).

Smith et al. (2019) found that bankable assets such as securities and bonds are the most tokenized due to their compatibility with structured financial systems. The complexity of regulations and the conservatism of this industry have limited the acceptance of non-bankable assets such as real properties and fine arts. However, projects such Onyx by JP Morgan and BlackRock's money market tokenization demonstrate practical benefits and economic potential of this technology (Benedetti & Rodríguez-Garnica, 2023; Khan et al., 2022).

Regulatory opacity is a notable hindrance. Some jurisdictions like the US have fragmented statutory arrangements that make it difficult for adoption while others such as Switzerland or APAC may be more developed in this aspect due to exact guidelines given (Blémus & Guegan, 2019; OECD, 2020).

Moreover, investors' doubt and conservatism within the industry also hamper market uptake. Broad application relies on trust that can only be built through clear regulatory frameworks that support tokens use cases especially where they are demonstrated through doing so among other factors facilitating a better understanding for stakeholders (Heines et al., 2021; Baum, 2021). This will help to understand the advantages of using tokens in practice (Smith et al., 2019; Baum, 2021).

This study adds to the body of knowledge concerning blockchain and the tokenisation of assets. It brings together expert opinions and case studies, thereby providing a broader picture of bankable and non-bankable assets in general. The research acknowledges the economic advantages of these tokens, but notes absence of regulatory alignment and technical standardization (Baum, 2021; Gan et al., 2020; Blémus & Guegan, 2019). Thus, as practitioners, it is important to focus on implementing tokenization projects overcoming regulatory compliance issues integrating technology within existing frameworks and educating prospective investors. Also there are harmonised recommendations for regulators like sandbox regimes that promote innovation minimizing investor exposure (OECD, 2020). Finally investors are more likely to understand opportunities coupled with risks thus creating trust which promotes market participation.

However the research is limited by concentrating only on financial assets, a small sample size for expert interviews as well as a rapidly changing environment. Future studies should consider non-financial sectors where tokenisation is possible and conduct longitudinal analysis so as to validate the findings quantitatively. Again it would be interesting if they probed into regulatory effects vis-à-vis technological interoperability or how investors behave regarding environmental footprints on blockchains (Blémus & Guegan, 2019; Zohar, 2015; Tian et al., 2022).

Overcoming these barriers, and improving the adoption of tokenizing assets could change industries fundamentally and lead to efficiencies, inclusiveness as well as transparent possibilities. This thesis sets a foundation for future studies that offer essential insights for scholars, practitioners and policy makers.

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9. Appendices

9.1 Semi-Structured Interview Questionnaire

Introduction:

- Briefly explain the purpose of the interview.
- Assure the interviewee of confidentiality and explain how the information will be used.
- Obtain consent for recording the interview.

Background Questions:

1. Could you briefly describe your experience related to finance and blockchain?
2. How familiar are you with the concept of tokenization?

Main Questions:

Current State of Asset Tokenization:

3. How do you see asset tokenization being implemented across various asset classes (e.g., real estate, securities, art, collectibles)?
4. What factors do you think are influencing the adoption of asset tokenization in the financial sector?
5. Could you describe any specific examples or case studies of asset tokenization that you find particularly illustrative or impactful?

Benefits of Asset Tokenization:

6. What are the primary benefits of asset tokenization in finance, in your opinion?
7. Specifically, how do you perceive the impact of asset tokenization on market liquidity, especially for traditionally illiquid assets?
 - Can you provide examples or case studies where increased liquidity was evident?
8. Do you believe that asset tokenization can lead to a more efficient and accessible market? If so, how?
9. Are there any other benefits of asset tokenization that you find particularly noteworthy?

Challenges of Asset Tokenization:

10. What do you see as the main challenges or obstacles to the widespread adoption of asset tokenization?
11. How significant is regulatory uncertainty in hindering asset tokenization efforts?
 - Can you elaborate on specific regulatory issues or uncertainties that are problematic?
12. What technological complexities do you think present challenges to the implementation of asset tokenization?
 - Are there any particular technological hurdles or limitations you have encountered?
13. Are there other challenges, beyond regulatory and technological, that you think are relevant?

Perceptions of the Future:

14. How do you see the future of asset tokenization evolving over the next 5-10 years?
15. What role do you think regulatory bodies will play in shaping the future of asset tokenization?
16. How do you anticipate technological advancements will impact the development and adoption of asset tokenization?
17. Do you foresee any emerging trends or innovations in asset tokenization that could influence its trajectory?

Conclusion:

18. Is there anything else you would like to add about the benefits or challenges of asset tokenization?
19. Do you have any recommendations for stakeholders looking to navigate the challenges associated with asset tokenization?
20. With all things in mind, do you personally believe that there is a future for tokenization?

9.1 Transcriptions of interviews

Interview I . Robin Hojski, CEO and Founder of Cobra.io (Interviewee I)

Interviewer: Okay, this is interview number one, Robin Wojcicki, CEO of Cobra.io. Hello. So first of all, thank you very much for taking the time.

Interviewee I: Good evening.

Interviewer: Good evening. I think your expertise in this is really remarkably valuable. My first question would be, how familiar are you with the concept of tokenization?

Interviewee I: Very familiar. It started initially also in the early days of the startup when we wanted to bring out our own token, but not just as a speculative thing, but actually be one of the first ones, or the first ones at least in Europe, to successfully tokenize company shares. It was our first foray into actual real world assets tokenization, which is also currently, after other institutions have come in successfully, we'll talk about this I guess later, BlackRock and so on. Capital is pouring in. Real world assets tokenization will be a big driving factor to bring in further liquidity and maturity to the market. So we wanted to, for obvious reasons, already started that way back then, because we saw it with ICOs. That was during a time of ICOs, where it was mostly just new blockchains trying to raise money for their project in a decentralized manner. But obviously, we wanted to directly raise money for a private company, but use the new technology the blockchain offers and its benefits to a wider audience and basically make it investable for a fractional amount all across the world. And, you know, without any barriers, of course, from a legality standpoint, there were huge challenges that still exist to a degree today. They've been somewhat pushed and overcome in minor ways. And there are companies that are actively in the space and offering tokenization services, specifically for real assets, specifically for equities, currently. Most of them are focused on shares of companies and shares of real estate.

Interviewer: That would bring me to my next question, which mainly is regarding the current state of asset tokenization. Just to continue this thought, how do you see asset tokenization being implemented currently across various asset classes, meaning real estate, securities, or collectibles? Where do you see it being used? In which type of asset classes? You started saying that the biggest implementation is within the securities.

Interviewee I: This is the... so to finish off the previous question, the securities tokenization is where we started, and we're still continuing, but it evolved, especially how the web three ecosystem developed and how the smart contract enabled blockchain platforms like Ethereum progressed. They now provide options to basically program any kind of financial function. We moved beyond just tokenizing one-to-one assets, or something that is even backed. We also have a platform that provides this, for example, tokenizing debt, in the widest sense, is also security. You can see it as a security and an ease by classification. But it moves beyond just paper-based securities. I'm also thinking about derivatives, which we already do, and it's kind of in the space that derivatives got tokenized, the leverage positions behind this, and so on. There are many ways to do it. Now, to think further and to get back to your next question. Securities, as you can see, is obviously the largest market because it has many different applications. There are what we have seen now also just in the last two, three years, or branched out into tokenizing art through NFTs. We're already here at a peculiar moment in history. Time will tell how this will develop and if it will experience a rebranding, because for all experts like me in that space, when NFTs got this hype moment a couple of years back, it was already an issue for us guys in the space because NFT itself doesn't inherently link to art. NFT is an acronym for non-fungible token, meaning they're just a finite amount of pieces and can't be produced more. The funny

thing about this is that real world assets are getting tokenized, real estate or whatever, all those tokens are actually NFTs as well. There's this big hump because they're also non-fungible tokens, and you would describe them as NFTs. By definition, the tokens itself would be just, it was literally just a descriptive nomenclature of a type of instrument, if you want to bring it more into finance terms. It got hijacked by this movement to kind of be like the poster child for digital art, which it is not. Again, if we tokenize debt instruments as we do on our platform, or if you tokenize real estate and provide digital shares of it, those digital shares are literally NFT tokens. We already have an issue with branding stuff properly. This is the thing, and actually, I've already listened to... we had this discussion internally in the community. When I started, this whole term of wallet, crypto wallet, is already problematic in itself, because yes, it kind of makes more clear initially, at least to the user, what it's supposed to be and how it helps. But the technology evolved much further, and there are so many different ways possible with it. The wallet itself is actually kind of hindering and bad user experience for the user, because it's too restrictive in what it's supposed to actually exemplify. It also added terms thrown around like smart account is more appropriate now for this. Although you can suggest more abstract terminology in a wallet. But again, the wallet, you run into issues just by technically clean standpoints and user experience. But anyways, that's the whole thing.

Interviewer: Would you say that's a question of branding or rather of education?

Interviewee I: I was, like many, and a lot of people still believe this, I mean, leaders in this space, that education is an important thing. But the fact of the matter is this, and we kind of all of us go kind of a bit too deep into this. It's one thing educating people about this new technology and Bitcoin existing and what it can do. It's so much better than traditional finance. But beyond that, and I think at this point, we are successful that we kind of promoted it properly. It's now reached a far-reaching audience, and most people know or have heard about it, even if they don't know exactly how it works or what it is. This is an issue I see. Because there are also communities still that want to push this educational path. We wanted to also make this as clear as our core element is the company strategy. But what you come to realize is that it makes no sense. Why? Because you just need to look at parallels. And if you look at parallels to all the great revolutions throughout history, whether it was the Industrial Revolution, the personal transport revolution in cars, the Internet revolution, the smartphone revolution, all of those things that revolutionized society and then had an exponential adoption curve, they all thrived. People go to it not because the industry made a good effort to educate them. You didn't have factory owners back then standing around handing out pamphlets and trying to educate people on what those machines do and why they're so great. They produced and the economy itself, the people in the know that use them, the products that the factories produced, or the services and so on, it changed the way how the economy worked. By default, society had to adjust. Similar way with personal transport. Henry Ford didn't try to educate people on why the car is better. He also famously said if he would have asked his clients what they actually want, it is kind of what is also modern notions to listen, ask your clients what they want, and build it. He said, if I asked them, they would have said faster horses. And even when it came out first, it was not a fact that he first needed to try to educate the masses and show them. It was such a revolution, so much better that the players that understood it and understood its merits were adopters anyways, and drove the adoption from there. At some point, you needed to realize, even if you were kind of against it, or had even a business tied to horse carriages, that this is a much better thing. Really educating the masses or

bringing change or this revolution always follows the same trajectory, the same path, and it follows the adoption, first of first adopters, but who are those businesses or economic entities that rely on this boost or this improvement of efficiency. Through that, it automatically gets distributed and disseminated further into the people.

Interviewer: That perfectly leads into my next question, which is exactly which factors do you think are influencing the adoption or widespread adoption of asset tokenization specifically in the financial sector?

Interviewee I: So the fact that I laid it out like this, and there are clear parallels to how revolutionary technologies came to be or evolved, that's a major factor already. It's evident, as we just established, that it was through an economical path and from a business standpoint. What I think, and I'm not immune to that as well, we have the same belief, we in the crypto community and a lot of them still hold this belief, assume that the mass adoption has to do with the masses and will come through retail, through people, normal average people investing in it or realizing the merits, which is not the case. And by the way, to make the case for both of the questions, the previous one and this one, the adoption was part of it. Similar to the internet today, you can see it with the Industrial Revolution, cars, internet, phones. The hallmark of it was not just that first economical players adopted it because it was better. But through that, new innovations were formed where it was put into the average citizen's hands or everyday life without them even noticing that they were interacting with it actively. Best case for this is, for example, the internet. If you would have tried to walk around back then and try to make people understand what the internet is and what you can use it for, you would still be trying to educate the first 1 million people. What the revolution brought was companies and economic players realizing the inherent value and what you could build with it. One of the things was, for example, communication, email, we started, but then the web browser came along. Now all of a sudden, you can visit different websites, you can make blogs and forum posts and talk with people a world away. Then the advent of e-commerce happened. All of a sudden, you could even buy things online. I mean, Amazon started in the 90s, but this was only possible because of the internet. This was a clear case of where the company or an economic player adopted this new technology to provide value for the end user. Us today, as Amazon shoppers, still don't interact technically directly with the internet, we don't have to understand how it works. We don't have to deal with any complexities or technicalities with it. We simply have some kind of interface, which is the web browser or in this case, the mobile phone nowadays, and an app, and we just shop like as if we're in a shop physically, we pick our stuff, we click order, and it magically just appears at our doorstep. There's one saying where any sufficiently adopted technology at some point quickly then moves into the background and becomes invisible. This is the hallmark of any revolutionary technology. This is really what we should be looking at for adoption, not how many people, because for example, in cryptocurrency today, people look at how many people have invested in Bitcoin or cryptocurrency and how many people have a wallet or have used the wallet or have used an exchange before. Actually, none of this is relevant. We could have 4 billion people, half of the world population, who have already used an exchange or somehow invested another 10 bucks in cryptocurrency. None of this would even make a significant dent in the adoption. Why? Because what does it matter? They've tried it. It's interesting because they heard about it, but they see no inherent value because it's too technical and too difficult. The point of the end user should never be that they should be educated in a technical manner and even be burdened with dealing with it.

The hallmark is that we bring technology to this standpoint where it becomes economically damaging to any company or any economic player, even if it's a country, not using it and becoming too expensive not using it and too inefficient that they have to adopt it. Through that, new opportunities arise, and new products and services arise that basically move this technology finally into the background where people then get exposed to it in their daily lives and it doesn't matter then if it's private finance sending money all around the world, or if it's investing, buying real estate, or even some more abstract stuff. Because for example, blockchain technology is obviously very useful in voting scenarios, to verify data and make it transparent, to make sure that it's not tampered with and that it's secured. Long story short, we should move away from looking at adoption from a point of how many people have heard about it, like average people and use it. If we look at the actual adoption curve of all the revolutionary technologies, it's completely irrelevant. We should only look at how much it has been adopted by economic players or players that are relevant, and how much it has moved through this into the background. The less you hear about people using wallets and investing in Bitcoin, and the more you hear people sending money in seconds for a couple of cents across the world, that's where we are. Because this latter part, it doesn't matter if it's blockchain or any other technology, anything that enables this is the outcome we want, and people shouldn't be bothered if they are investing in Bitcoin or any other currency and then have to use this. It doesn't matter. The point is to improve the life and business of all people.

Interviewer: That's a very interesting angle. That's something nobody writes about. Thank you very much for that. We are through maybe 1/4, and we're already at half an hour. A lot of the questions that are going to be coming next, we've already referenced too, but still, just to keep your time in mind. Having talked about this, do you know of any specific cases or companies that are particularly impactful in this area and that you find interesting in terms of asset tokenization, maybe even real world asset tokenization, both bankable and non-bankable?

Interviewee I: Impactful in that regard is definitely Coinbase, one of the largest ones and currently the only publicly listed one.

Interviewer: But they're an exchange.

Interviewee I: The critical part is what I wanted to emphasize. The exchange builds, obviously, the core part of the business and how they started. And still to this day, just like Facebook, for the Facebook platform is still the core revenue generator, Google with the search machine and ads business. But all of those companies have obviously different projects, that add to the whole thing. Binance very early on started this way and has also built such an ecosystem. Coinbase is just catching up. Now, I'm just emphasizing Coinbase because Binance is its own thing and has a very shady past and present still. So it's not the best role model in that regard. But they are very much pioneers in that sense and still pioneer a lot of stuff. But Coinbase is here to praise because they recognized the benefits. What I'm talking about, the exchange is one thing to make it easy for people to invest, it's great. One of the other core businesses is actually a joint venture between Coinbase and another startup, but they basically control it, which is Circle, which issues or has a whole business issuing stable coins. This application of stable coins is an important factor, not just in the adoption of cryptocurrency for retail, but it started out as a necessity for crypto companies or economic entities dealing in the crypto space. Because if we think back just

a couple of years ago, when this was still in murky waters and there were no clear regulations, a lot of the banks kind of shut the doors and didn't want to take us as clients and kind of dealt with the whole cryptocurrency sector as criminals, not just because it was not really well regulated or understood yet but also because they were the first ones to recognize it as a threat to their own business. So they had an easy way to kind of close the doors on us. Stablecoins arrived because the whole point was how are we moving value in and out? How are we even addressing trading in value on cryptocurrency exchanges itself, but then also doing inter-payments if you don't have access to accounts or if every time we do even a small transaction, even if you have an account that gets blocked or frozen or whatever. Stablecoins came along to not just use the underlying technology that we're all talking about, but directly produce a use case and showcase what it's possible to do. They were one of the largest issuers, not the second largest, the only larger one, there was also the first one, Tether. This is an important factor. They also came out with their own blockchain and made a lot of strides in connecting a normal business cryptocurrency exchange directly to the blockchain and making it more seamless. As we discussed, putting this technology in the background, what you also still had to do even with their own blockchain, a lot of projects that came up, they supported directly, they also had built-in direct promotions and actions in the Coinbase exchange itself. But what was really a breakthrough, what they now allow, what came up recently, is that your account balance on the Coinbase exchange, which was also for normal standard users and businesses, is now automatically also your wallet balance on their own blockchain. As for you, you don't even have the complexity anymore to move value and kind of deal with the fact that you might have Bitcoin on Coinbase and just bought it like a normal app, a gift that is easy to use as Amazon. But now, if you want to interact with blockchain and different decentralized finance, how do you do this? Well, first, you need to then bridge it onto this new blockchain and so on. But already, complexities started, you don't have to do this anymore. You can just, like it's another bank account, use it freely and interact with decentralized finance on this blockchain. This is a fact where we're progressing where this technology basically moves into the background. It doesn't really matter anymore that a person even understands what's going on or the technology behind it, but just how much better it is now and how much it improves the livelihood.

Interviewer: That makes sense. I would like to ask you, if you could just briefly state to me what you think the primary, the main main main main benefits of asset tokenization in finance are, just kind of like bullet points.

Interviewee I: Security, transparency, efficiency, speed. Maybe thinking, any other words that come to mind are kind of like parts or sub-parts of information.

Interviewer: Now we can also get more into it. My next question would be, how do you perceive the impact on market liquidity, especially if we're talking about traditionally illiquid assets?

Interviewee I: An inherent part of our modern economy, or any economic development, is the thesis of efficient markets, a cornerstone of all of it. Efficient markets can only be realized if there's sufficient liquidity in those markets. So the base goal or base aim of any of us, or in any other industry, is to basically drive liquidity into the sector. This was also critical, for example, people think that gold was around forever, which it was, but it really only got a proper status as

an actual asset class a couple of decades ago, only when the first gold ETFs, that was kind of the starting point, were established, and then subsequently, just paper shares in gold. They're supposed to be backed. But, yeah, that brought in liquidity to the whole market and basically even allowed the industry to flourish or have it as an investment vehicle. Up to that point, it was also really common for companies to hold it on their balance sheet actively, but it enabled the exchange market where you'd normally trade equities. It opened the market now for commodities like gold and brought in huge amounts of liquidity. It made it efficient to a point where it was feasible for companies to use it, and all kinds of entities, even governments, to have an efficient exchange market. Liquidity is the number one objective. We've seen, that's why so many people in that space were kind of waiting for it. We saw it as a moment where the floodgates were opened, when the first Bitcoin spot ETF got confirmed and established. Most importantly, it got established not just by smaller companies or hedge funds trying to do this, but it was spearheaded by not just BlackRock, it started with BlackRock, but there are a couple of other ETFs as well by the largest other asset managers, and even banks.

Interviewer: But we're talking about specifically crypto ETFs here?

Interviewee I: Yeah, I'm saying this was more specifically the crypto ETF

Interviewer: If we're talking about the realm of tokenization, do you know of any cases where it significantly impacted market liquidity?

Interviewee I: Not yet, because it all goes together. For example, I'm good friends with one of the guys that founded a tokenization platform, Black Manta. They were focused on real world asset tokenization, primarily real estate. I think they extended also to company shares technically, but it was primarily real estate. Their hopes were high, and it was logical to us like, yeah, it's going to have a huge boom and huge amounts of liquidity will come in from small investors who were maybe before that locked out. But what happened was that there wasn't that much interest for small investors to own fractions of an apartment, for example, because what do you do with this? Okay, you get rental income maybe, but there are all other complexities around who manages it, how it is managed, how do you deal with if you sell your parts, whatever. It was a clear case of, again, the adoption not being the way it should, where the technology was put in the front, oh, look, we have tokens here, you can now invest in real estate through tokens. This part was already too complicated for most people, even if it was in an enclosed platform where you don't ever even have to send in or deal with crypto wallets separately. But it was still too complicated and unnecessary for most people, because even when they were interested, they were asking, okay, but why even the crypto element if it's also just on this platform? Because of the legality, because it's a security and needs to be registered, you could only do it on this platform and not use it as an open crypto token on your own wallet, because it would violate security laws. So you end up shoehorning in a technology and making it the hallmark when it's actually in how it's executed not needed at all. It's okay if you might have used it in the background to streamline your own operations. Cool. But then again, they used it as a promotion when nobody really cared about it. A lot of people thought that through this, by tokenizing real assets, liquidity would come into real world assets in general, especially historically illiquid ones like real estate. It hasn't happened yet, but it will happen again once we progress in this trajectory where adoption happens from an economic standpoint, and players might use it in the

background. One of the parts is also to use a more administrative approach for governments, for example, to set up databases or blockchain registries where land titles and so on are stored transparently and can easily move around even across country borders. This is a use case where it comes in handy, but obviously by this use case alone, the end user doesn't care. They would use it regardless if it's blockchain technology as long as it fulfills its promise and provides the service. It's an improvement to governance, to business, to transactions, to efficiency. It would bring investments and liquidity into the market because people would be more open to invest or buy property in Mexico because you can do it within seconds without dealing with any bureaucracy.

Interviewer: Interesting. If we just finish off this topic, because we were also talking about more efficient and accessible markets apart from making them more liquid. Do you think that tokenization can contribute to more efficient and accessible markets? If yes, then how?

Interviewee I: By making it more accessible in general to people. Most of the world is still underbanked or unbanked at all. They don't have any access and other parties are underbanked, meaning they might have some kind of financial services or even a bank account but are hugely affected by limits, accessibility, and actual features of the services of those banks. We saw a rise of Neo banks specifically to counter this problem, to address this problem, which is a good step. Tokenization will contribute to the movement of any kind of value, whether it's fiat money, securities, commodities, titles, ownerships, whatever, all digitalized. This was not possible even with the internet, but we needed this extra technology layer like blockchain, that with the internet works together to create a whole new platform or layer where new use cases are possible. I can give you a personal example. The industrialization already enabled Western Union to come up as a money transmitting service. First, it was very manual, took weeks sometimes to process because it was still paper-based. With the advent of the internet, they improved, it was also a case of the internet being adopted by companies like this because they saw the benefit and digitalized operations to make it much more efficient. It wasn't just efficient for the end user but especially increased their profit margin significantly because they could cut down the workforce in half. They still exist and have a market today. One of the largest money movements today is still remittances, people going to a different country, working, getting paychecks, and sending them back home to their families in poorer countries. The companies themselves through the internet worked more efficiently, but it's still very expensive for the end user, transactions still take at least a week, and it still eats 15-20% of the sent amount. If you use a bad service, you might lose your money. Blockchain helps in this. We have employees in Pakistan, and the big issue was how to pay them. Pakistan is a curious case, not just far away, in Asia, a third world country, one of the heavily most underbanked countries, very bad access, heavy and expensive bureaucracy. Any service there is very expensive. It was the most expensive to use. It would take forever, even if employees had bank accounts, which you had to be very lucky to have. You basically only get in if you work for other companies. You can't even open a bank account as a normal user, you need to be an employee or own a company to even officially have a bank, which is extremely prohibitive. Even if you have a bank account, most banks anywhere in the world will flag that bank account because of the country, higher risk country. When I first tried to send the first check, it took six weeks to even arrive, it was still very expensive because of all the costs involved. Since we work in cryptocurrency, we decided to play around with it. What ended up happening is we have a good setup here. I would load up money, deposit it on a

cryptocurrency exchange, exchange it to Bitcoin or stable coins, send it to his account on that same platform, and he would cash it out into his local currency. We undercut any service, it was 100 times faster and 1000 times cheaper. I pay a euro or for free to deposit money onto the cryptocurrency exchange, exchange fee is minimal, sending on the platform costs nothing, and cashing out costs minimal amounts. The result was I managed to send a full monthly salary across the world in less than five minutes for a total cost of less than five euros.

Interviewer: Let's talk about the challenges of asset tokenization adoption. What are the main obstacles?

Interviewee I: The biggest issue is regulatory challenges. Regulatory bodies like the SEC can block projects or act on personal vendettas, which hinders progress. This was evident during the cryptocurrency hype cycle of 2021-2022, where regulatory issues prevented the industry from breaking through.

Interviewer: How significant is regulatory uncertainty in hindering adoption?

Interviewee I: It is very significant. Regulatory uncertainty affects liquidity and adoption, as companies, especially conservative ones, won't invest in cryptocurrencies due to compliance concerns.

Interviewer: Can you elaborate on specific regulatory issues?

Interviewee I: It took a long time to greenlight the Bitcoin spot ETF. Regulatory uncertainty prevents companies from officially investing in cryptocurrencies. Compliance departments will shut down any attempts to experiment with tokenizing assets due to these concerns.

Interviewer: Does the Bitcoin ETF directly relate to tokenization?

Interviewee I: Yes, because if companies cannot invest officially in cryptocurrency, they won't touch tokenization projects either. Compliance departments will shut down attempts due to regulatory uncertainties.

Interviewer: How does this impact large financial entities?

Interviewee I: Despite the market cap size of cryptocurrency, large entities like sovereign wealth funds haven't invested in it due to compliance and regulatory issues. Many executives personally own cryptocurrency and see the potential, but their compliance departments prevent their companies from investing.

Interviewer: Are there technological complexities hindering tokenization?

Interviewee I: Yes, interoperability between different blockchains is a major issue. There's no unified communication layer, which splits value across different projects and blockchains. This lack of standardization is a significant technological hurdle.

Interviewer: What is the future outlook for asset tokenization over the next 5-10 years?

Interviewee I: The future depends on liquidity and whether companies see the merits of the technology to increase efficiency and reduce costs. Adoption will also hinge on regulatory support and the ability to see real-world benefits. Pragmatically, it will depend on whether asset tokenization becomes an established asset class.

Interviewer: What role will regulatory bodies play?

Interviewee I: Regulatory bodies will play a crucial role. The complexity of the topic, intersecting finance and technology, means regulation will be a significant factor. Regulatory challenges have been a major hurdle for projects like Facebook's Libra, which was shut down due to political and regulatory issues despite having significant backing.

Interviewer: Are there any technological advancements that could impact development and adoption?

Interviewee I: The technology is already here. Adoption will depend on economic players seeing the value and the technology becoming invisible to the end-user. Regulatory issues and lack of standardization are key factors holding back adoption.

Interviewer: Do you think asset tokenization has a future?

Interviewee I: Yes, it would be naive to say no. The technology offers direct benefits and will eventually be adopted. Like other technological revolutions, it takes time and patience. Even with current constraints, cryptocurrency has a higher adoption rate than previous revolutionary technologies. If regulatory issues are resolved, the potential is enormous.

Interviewer: Thank you for your insights. They will be invaluable in understanding and navigating the challenges of asset tokenization.

Interviewee I: You're welcome. It's important to be pragmatic and actively involved in shaping the regulatory landscape.

Interview II (Digital Asset Specialist, Global Bank)

Interviewer: Hello, shall we start? You're ready? Great. Before we dive into the questions, I would like to officially obtain your consent for recording you and using this information within the realm of my master thesis. I will not use your name, I will refer to you as Digital Asset Specialist. Are you okay with that?

Interviewee II: Yes.

Interviewer: Brilliant. Before we start about the actual topic, could you briefly describe your experience related to finance and specifically to blockchain?

Interviewee II: Yes, gladly. I have been working in banks and consulting for banks since 2007. I started in front office wealth management, then moved to consulting for financial service providers, and now I work at a large global bank as a business strategist for digital assets. My first touchpoint with crypto was as an asset class for investments, but I became more interested in the underlying tech. I have been playing around with crypto since 2018 and have been in the strategist position for one and a half years.

Interviewer: Can you tell me how familiar you are with the concept of tokenization?

Interviewee II: Very familiar. We are tokenizing securities as part of our strategic focus. I'm not the project manager for tokenization but work in the strategy department and we talk about this a lot.

Interviewer: How do you currently see tokenization being implemented across various asset classes, both bankable and non-bankable?

Interviewee II: For non-bankable assets, I must admit it is not a focus at the moment. Tokenization of illiquid assets like real estate or collectibles has slowed down significantly since the hype. I have seen efforts to tokenize art and land, but not with banks. Mostly, I see the tokenization of bankable assets like securities, bonds, funds, and structured products. Tokenized gold is also a topic I've seen, with examples like HSBC in Hong Kong and STX in Switzerland.

Interviewer: What factors do you think are influencing the adoption of asset tokenization in the financial sector?

Interviewee II: Regulation is the most important factor. Banks in Switzerland and APAC, namely Singapore, Japan, and Hong Kong, have a head start due to favorable regulations. The European Union has also implemented clear regulations, which is helping to catch up. Besides regulation, there's a growing understanding of the possibilities of tokenized assets. Major players like BlackRock and JP Morgan are driving adoption by committing to public chains and proprietary blockchains, respectively.

Interviewer: Would you describe it as businesses being ready and seeing the economic value?

Interviewee II: Absolutely. The economic value is obvious—you can speed up transactions, lower costs, and automate the entire value chain of an asset. For example, a repo transaction that used to take days can now be done in minutes at a lower cost.

Interviewer: Can you describe specific examples or case studies that you find particularly impactful in terms of asset tokenization?

Interviewee II: BlackRock's tokenization of a money market fund on Ethereum is a game changer. They created a token with a stable value of one US dollar that yields dividends. This

allows for instant settlement into and out of USDC, creating new opportunities for automated investment strategies.

Interviewer: What do you think are the main benefits of tokenizing assets?

Interviewee II: Faster execution of trades, lower costs, automation of the entire value chain, and interoperability if more than one bank uses the same blockchain.

Interviewer: How do you perceive the impact of tokenization on market liquidity, especially for traditionally illiquid assets?

Interviewee II: On paper, tokenization increases liquidity by allowing fractional ownership and making it easier to sell assets. However, I haven't seen this play out in real life yet.

Interviewer: Do you think tokenization can lead to a more efficient and accessible market?

Interviewee II: Yes, absolutely. It can disintermediate the entire correspondent banking system, making transactions instant and accessible globally, especially if using public blockchains.

Interviewer: What are the main challenges or barriers to the adoption of asset tokenization?

Interviewee II: Regulatory fragmentation and network fragmentation are significant barriers. The US needs to release coherent legislation. Network fragmentation is an issue because too many people are building their own blockchains, creating silos that need to be interconnected. Public chains face privacy and scalability issues, and legacy systems and processes also pose challenges.

Interviewer: Can you elaborate on specific regulatory uncertainties that are currently problematic?

Interviewee II: One major issue is whether Ether, the native currency of the Ethereum blockchain, is an asset or a currency. There's also uncertainty about how digital assets need to be secured and backed on bank balance sheets. These definitions and rulings need clarity.

Interviewer: How do you see the future of tokenization evolving over the next 5-10 years?

Interviewee II: If there is no prohibitive regulation, tokenized assets will be adopted within 3-5 years. Financial infrastructure providers are already building the necessary infrastructure. For example, Deutsche Börse's D7 platform is ready to go. They're waiting for regulatory approval.

Interviewer: What role will regulatory bodies play in shaping the future of this technology?

Interviewee II: They will continue to play a crucial role in protecting investors and ensuring market integrity. Their mission will remain the same, but they will need to adapt to the new financial landscape.

Interviewer: Are there any technological advancements that could significantly impact the development and adoption of tokenization?

Interviewee II: Yes, layer two technology, Ethereum Virtual Machine (EVM) technology, and zero-knowledge proofs are essential for public blockchains. For private chains, interoperability protocols and standards are crucial. Quantum defense will also be important in the far future.

Interviewer: Do you see any emerging trends that could influence the trajectory of tokenization?

Interviewee II: Yes, the increasing involvement of major global players, the proliferation of high-tech understanding in the financial sector, regulatory maturation, and the rise of on-chain money. Peer-to-peer transactions using digital assets are also a significant trend.

Interviewer: Do you have any recommendations for stakeholders looking to navigate the challenges associated with this technology?

Interviewee II: Educate yourself. It's crucial to have a deep understanding of the technology, financial system, and the politics behind it. This knowledge needs to be spread throughout the entire organization, not just within a small team.

Interviewer: With everything we've discussed, do you think there is a future for tokenization?

Interviewee II: Absolutely. I believe in it strongly. The world is starting to understand the possibilities this technology brings, and I think a watershed moment for widespread adoption is coming soon.

Interviewer: Thank you so much for your insights. They have been extremely valuable. I'll stop the recording here.

Interview III, Digital Innovation Expert at Swiss Firm

Interviewer: I would switch to English right now if it's okay for you. So, yeah, I'll be recording this interview. I hope I have your consent for that. Okay, so maybe because of time, let's skip the first two questions. And let's just dive right into the main questions. I would start with the current state of asset tokenization. And I'd like to ask you, how do you see asset tokenization being implemented currently across different asset classes? Meaning across art, real estate, securities, collectibles and so on?

Interviewee III: So it's a very good question because it's very different across different asset classes on the one hand, but overall, you can say it's still a niche area. So whether it be let's say, fungible assets, financial assets, bankable assets, or non-bankable assets, it's still in the exploratory phase. Definitely. What we see is currently that the big rush, the big hype around non-bankable assets, in real estate and so on, that was a big topic 2-3-5 years ago. On the other hand, where we see now major or international initiatives coming from, that's everything around financial assets, particularly high and liquid assets on the short term of the maturity spectrum, simply that when we talk about derivatives, OTC bonds, when we talk about money, markets, bonds and so on, there are major initiatives now coming from the banks in particular. I think we can delve into that a bit later on. But I think that's that's a really major evolution that we see. So as I've said across all asset classes, still early stages, but now we'll see major pushes when it comes to these let's say large scale market fungible assets, highly liquid assets, particularly short term funds and short term bonds.

Interviewer: Okay. And which factors do you think are influencing mainly the adoption of asset tokenization specifically in the financial sector?

Interviewee III: Yeah, so a lot of different factors. On the one hand, it's of course technology, which is advancing fast. So, a whole raft of different and private blockchain solutions with public blockchain solutions, which have reached maturity status clearly, and also in where we line with various new different use cases, there are also new blockchain implementations that are coming into wave also being implemented. So one is the technology piece, which is fast advancing, then we have here the whole regulatory evolution. So I mean, in the United States or European Union, obviously, to some extent also in Switzerland, if that's of interest for you. The regulatory frameworks so far are quite largely implemented. Everything around anti-money laundering and so on, has quite a high maturity state. And then also when it comes to the representation of property rights on blockchains, and so on. So major regulatory bodies are in force. So, typically, we have a pretty good set of advancements when it comes to the property rights on the blockchain. On the other hand, I mean, then we see what's actually driving the adoption in the industry. Here, I would distinguish between the industry actors themselves, like the banks, particularly, so asset managers, also the infrastructure providers. And then on the other hand, we have governments, which also are active as direct initiative pushers, so you can say. So when it comes to the industry actors themselves, it's mainly commercially driven, of course. So here we see a large potential of cost savings, particularly when it comes to the issuing process of financial assets. But there's also everything around settlements, transfer of ownership rights, and so on. That's sort of the biggest commercial case, which is manifesting itself to a secondary degree, then also the integration of tokenized assets into portfolio solutions. That's the second big use case, where the industry actually sees a lot of commercial potential. And then only in third and fourth place, fourth place a lot of studies, surveys, and so on, show that, that it's around liquidity, and also new asset classes, which are being integrated. So the commercial benefits revolve more around cost benefits when it comes to the operational side of things to settlement, issuing, and so on. And then also, as I've said, integration into different portfolio solutions. So that's sort of the main drivers. But then when you go over to the regulators, what's interesting to see is also this has a geopolitical component. So there are regions or city-states like Hong Kong, which are pushing very much tokenization cases in the industry. So they go to the banks for big asset managers and say, You need to adopt X Y, Z tokenization use case. So also, I

think governments and regulators are pushing the industry to experiment with new use cases themselves. They tell us that some of the local regulators, they push this organization institutions, which don't make sense very much, at least at surface value. So also regulators and governments are pushing the industry to experiment a bit with use cases, you could say.

Interviewer: And could you describe any specific cases or case studies of tokenization that you personally find interesting or impactful?

Interviewee III: There are a lot across different asset classes. Maybe we could start with the more exotic ones. And then I could talk a bit about the ones which are, I think, the major economic gains will come from, and also where the major industry initiatives actually are coming from. So we've seen a lot of talk about the alternative asset classes. For instance, tokenization of private assets, private market assets, for instance. But also you've mentioned already art, collectibles, and so on. That's very niche. But they are interesting. We have been, for instance, close to a bank in Liechtenstein. with tokenizing their art collection. They're also a wealth manager acting on a global scale. So that's definitely a use case worth looking at. So they are implementing tokenization solutions and offering that also to their clients, for portfolio integrations. For instance, if you look for VP bank art collection tokenization. A recent example is the Federal Bank in Germany. They have now a cooperation with a tokenizer where it's also about art integration. So the idea is not just to give access to investments as direct investments to a certain extent, but also to integrate that into discretionary mandates of their clients.

Interviewer: That's definitely interesting. Yes. I'd go then on to the next question, or did you want to add something else?

Interviewee III: I wanted to also talk about private markets, a good example as a referral case, is for example Sygnum bank. What they have been doing recently is tokenizing private debt. So that's a wholly new asset class, which has been tokenized. So also very interesting to look at. But I think the most important ones, the most interesting ones are actually the big banks, what they are doing, when it comes to not alternative assets. But as I've said, these are classic financial assets. So for instance, UBS, with tokenizing bonds in Hong Kong, or Citigroup in New York, which is tokenizing, private market funds, BlackRock, for instance, with money market funds tokenization. Very important. And also, then JP Morgan, in the derivatives market, very interesting. So, here, you've got a huge case with derivatives. Because when you are trading derivatives, you need collateral management. So you need to post collateral in your trades. And you can also tokenize that collateral. So that's a huge efficiency case. That's been implemented correctly. So I think these, let's say, public market cases, or OTC cases, where it's about highly fungible, highly liquid assets, actually like derivatives, like money market funds - these are the most interesting tokenization cases, because now the big asset managers, the big banks are moving there, and they're identifying efficiency potential targets up to them pretty much.

Interviewer: Right, definitely. And what do you personally think? What do you think are the primary benefits of asset tokenization? In finance?

Interviewee III: Yes, so I think contrary to what makes a lot of media about new asset classes, increase of liquidity, democratization of access. Quite the contrary, I think that some examples

that I've just mentioned, they show pretty clearly that the most important economic benefits are coming from cost efficiency optimizations regarding the issuing process, and as I've said, also the settlement process and the post-trade process, so when we talk about, for instance, derivatives or options or warrants for instance, or even money market funds, they usually have short timeframes when these securities are reissued. Or you can do that via tokenized assets, then the whole process can be much more effective. So that's, that's definitely the biggest cost case. And also when it comes to the transfer of ownership rights behind that. So if you trade these assets in secondary markets, so if you can do that via blockchain, particularly when collateral comes into play, when there is integration of collateral obligations until the settlement of those, for instance, in the execution of derivatives and so on. We see a lot of investments in the part of the big banks that I've mentioned, just an example is JP Morgan.. The whole idea is that for derivatives trading, we have a blockchain, where it can integrate collateral which is useful for trading. Sounds maybe a bit technical and exotic. But actually, these are huge global markets. When you look at the volumes of derivatives globally, it's five, six, whatever times you can look at the figure up of the actual underlying assets. And when you start to tokenize that of course, you have a whole different range of use cases. I think these are really the most important things. cost efficiency when it comes to emissions and issuing of securities. And the second case, I think, is the integration into Portfolio Management mentioned already. Yeah. So that's a share of wallet argument, of course, for wealth managers, and asset managers. If you're able to also include further asset classes more easily, you might have private market allocation in your portfolio.

Interviewer: But in this case, we'll be talking about non-bankable assets?

Interviewee III: Not necessarily. So I mean, you also have to see they become bankable to a certain extent if they are tokenized. Yeah, of course, the private equity is a good example of typically a non-bankable asset, even though I mean, you can because it can be a custodian of private equity shares.

Interviewer: Because you mentioned also market liquidity, although you don't believe that it is one of the main benefits, how do you perceive the impact on market liquidity? Especially traditionally illiquid assets?

Interviewee III: I mean, I think that the biggest discourse around tokenization is when it comes to illiquid assets. Now, when you look at actual platforms, which do that, I mean, they are able to increase liquidity. Or maybe just one example is, for instance, Addex in Singapore. This is a marketplace for private market investments, private debts, private equity, and so on. But the shares on there are tokenized. So it's one of the biggest marketplaces in the world actually that could tokenize private market investments, and of course, they have a secondary market, there is some liquidity on there. But just when it comes to this asset class, usually investors want to have certain illiquidity because that gives you that illiquidity premium in that case. So, the attractiveness of private market assets is actually coming from the fact that they are illiquid. So, now we look, we have been in exchange with Singapore last November, they themselves, they are saying that the most activity that they have on the secondary market is fund redemptions. So that goes to show that it's actually not so much about liquidity.

Interviewer: What is it about then?

Interviewee III: So, in this case, when you are tokenizing, let's say alternatives, and so on, of course, that can increase the liquidity sort of by a factor. But the reason why a lot of actors do that is of course, as I've said, the issuing process is much more easy here. And also the fractionalized access to that. So if you like tokenization, you can post shares about 10,000 US dollar investments in private equity and stuff like that. That, of course, opens up a whole new range of new market segments, but also new diversification opportunities, right. So if you can have this access then you can buy much more of this asset class. And so it's much more about the portfolio integration, as I've said, the actually issuing process here. And on the other hand, maybe to juxtapose that to what I've said before, I've talked about the most important use cases being in highly liquid markets, obviously, derivatives, OTC bonds, funds and so on. These are already highly liquid. However, there is a lot of, as I've said, sort of cost efficiency potential when it comes to issuing and settlement and so on. So that also shows you that it's not so much about liquidity per se maybe.

Interviewer: But do you believe, though, that this can lead to a more efficient and accessible market?

Interviewee III: Yes, definitely. Sure. So maybe, I mean, as I've said, if you talk about asset classes, which are illiquid by their nature, and investors want to have that, that doesn't mean that these markets can't become more efficient by other means, right. So I mean, if you're tokenizing these assets as I said, this conception process, also the distribution process might become more easy. So if you talk about for instance, fund distribution. There are platforms being built currently, one interesting example is token bridge, you might look that up as well. And that's a platform whereby investment managers can tokenize their funds and then via the same platform, they can distribute them. So there is a network of distributors like private banks, like asset managers, and so on, connected to a platform. And via this the tokenization of these funds solutions, maybe they are also able to automate the, for instance, the fee management process behind the whole distribution process. So when it comes to fees, and so on, if you can do that via a platform that is based on tokenized assets, of course, there's a whole raft of new automation cases, that could come in as well. So that's, that's another big, big topic. And then I think the third one is transparency, right? So via blockchain solutions, if you're able to tie in the case of derivatives post collateral directly token as collateral, or if, for instance, in the area of private markets, if data about the private companies such as annual reports, revenue statements, and so on, that might also be integrated via smart contracts, onto the blockchain solutions tokenized asset solutions, that, of course, increases market transparency. And by that, of course, that also increases market efficiency. Liquidity might be some aspect that comes into that increasing market efficiency, but it's a small aspect when compared to the other efficiency gains.

Interviewer: Interesting, then, now, I'd like to move on to the challenges. What do you think are the main challenges or obstacles to the widespread adoption of tokenization?

Interviewee III: Yeah, I think when you visit conferences, and so on, it's always about technological challenges. And so I think the use case is that you see, they proved that technology wise, of course, there is still some evolution. But basically, the solutions are there. I think rather,

it's about on the one hand, investor confidence, and client confidence with regard to the platform, and so on. There's a lot of skepticism, linked to everything that we have seen around crypto investments, of course, although that's a different topic, but nonetheless. But still, there is really much sort of skepticism around the investment community when it comes to tokenized assets. So I think that might be the biggest hurdle to prove via these business cases that actually, there are a huge efficiency gains. I mean, with that comes also the problem of building platforms. So I've mentioned token bridge, for instance, as a distribution platform. For that, you need to have platform effects, means you have to have a critical mass of both investment managers on the one hand, and distributors on the other hand, and to build that up, of course, that can take 10 years, 20 years forever. And only if investors, distributors, and so on, they can clearly see these efficiency gains, you can start to build up these platforms. And just by nature of it takes takes time. Of course, I think that's a big topic as well, just to build up these platforms eventually. I mean, all financial services are based on some kind of platforms. So where end investors or intermediaries meet with other intermediaries and so on, to build that up, to build up the trust and so on. That's, I think, the most important now, that being said, of course, regulatory wise, there are problems still, the big one here is the actual property rights, how they are executed between the token and the actual underlying asset. Of course, you can tokenize some representation of real estate, but the legal link between the actual real asset and the token, that's still something that's from a regulatory point of view, it's a bit murky. So definitely, that's also something that still needs some legal evolution.

Interviewer: How significant is this regulatory uncertainty in hindering any efforts related to asset tokenization?

Interviewee III: I think it's actually pretty big, because particularly when you talk about retail banking, also institutional investment management and so on. These are highly conservative industries. And you're eventually talking here about big macro economically relevant asset volumes, you're talking about pension funds, assets, and so on of retail banking clients eventually, and so on. So that there's a certain amount of skepticism, both on the part of banks, but also the part of regulators. Of course, that's also warranted. Particularly when, in worst case, when there is a problem actually accessing your assets, and then you can't, by legal means establish the link between the token and the actual assets. Of course, very unfortunate. I think that's one of the major concerns.

Interviewer: Because you also mentioned technological complexities. Are there any particular technological hurdles or limitations that you have encountered, which still have to be solved or that present a challenge to the implementation overall?

Interviewee III: I think on one hand, there are a lot of, let's say, direct technological problems when we talk about coding about how these platforms work, particularly blockchain, large blockchain networks from a governance point of view. But I don't want to go into that particular, whole different world of very technical, mathematical kinds of problems. Rather, I think, from a business point of view, what's the most important hurdle is that now you have a huge hole and heterogeneity of platforms of different blockchains and to make that interoperable. I think that's a major issue. Because as I've said, different governments are pushing local initiatives that leads to a highly fractionalized technological landscape, on the part of different blockchains. In

particular, when it comes to private blockchains, which are implemented on a huge scale currently.

Interviewer: And now, if we talk about the future, how do you see the future of this whole topic evolving over the next five to 10 years, let's say.

Interviewee III: I mean, I think, from my point of view, that everything is going to be around alternatives, access to new kinds of asset classes, be it in the private market space, for instance, or in real assets, and so on, I think that's going to remain a niche case. Still, there's market potential, and the adoption of that will increase over the next 5-10 years. But if you compare that to what's to be gained in these highly fungible liquid markets that I've talked about, just by means of investment volumes, and so on, I think this is the second part. So if we talk about, as I've said, fund tokenization, OTC bond tokenization That's going to be far more important. It's also completely opposite to the initial idea of decentralized finance, right? Where you have a decentralized network of different actors. Rather, what we see now is that the big banks with you guys like Citigroup, JPMorgan, and so on they are building these new trading platforms with respect to the asset classes that I've mentioned. And of course, they will be able most likely to also defend the unique position. So they already have the infrastructure network and so on. So I think in the next 5 to 10 years, most importantly, it will be the tokenization of financial assets. That's what's going to be huge over the next time.

Interviewer: So you mean bankable assets?

Interviewee III: Yeah, exactly. Particularly, as I've said, the ones on the shorter end of the maturity spectrum, basically, everything that needs to be reissued on a regular basis. Because I've talked about the major efficiency cases of the services issuing process. I mean, if you talk, for instance, to a small investment manager, a small asset manager, there are a lot of them. One of the big problems that they have that it costs a lot of money for them to issue a fund. And if you can do that via tokenized platforms much more easily. Of course, here you have a major economic gain for the whole asset management industry. So I think that's rather underestimated by a lot of industry participants.

Interviewer: Definitely. It's an interesting aspect definitely. What do you think, which role will regulatory bodies play in shaping the future of asset tokenization?

Interviewee III: Yeah, I think, as I mentioned before, I mean in changing the investor perspective and that there is a very robust regulatory framework. That's a very important sort of basic factor. So in so far, they play a very important role. The question is also, how are they interacting with the industry. So if you're just issuing standards, which are far away from the actual practice, compared to something that's developed in tandem very closely with the major industry participants, that's a much more promising sort of approach. So what we see currently is that I mean, the US is pushing things, because a lot of these markets I have talked about are still sort of US dollar and US based from an original point of view. And then also in Asia. And in both places, governments are heavily involved in also pushing regulatory frameworks, which are closely aligned with the industry interest. Because as I've said, it's also linked to geopolitics. Eventually, it's about location politics, increasing the attractiveness of local markets. And I

would also say that the most likely scenario is that we're going to see regulatory improvements, regulatory bodies, which are very much closely aligned with industry interest.

Interviewer: And, we talked about it before, but do you think that technological advancements will majorly impact the development and adoption of tokenization? Or will it be other advancements or other changes that will have more of an impact?

Interviewee III: I think technological advancements insofar as they are just further developing tokenization use cases with respect to new asset classes, new cases, and trading and so on. But I think that the major sort of technological advances in how blockchain is structured, what the code framework behind that, and so on. So, which is I think that's, that's a minor factor, compared to the big problems that I've mentioned before, like building platforms, like, also having harmonized standards to trade these assets.

Interviewer: you have any recommendations for other stakeholders looking to implement, but also navigate the challenges associated with this?

Interviewee III: Yeah, so I think that's, of course, from my perspective, I think what's really worthwhile doing is looking very closely at who does what, so what are the use cases currently being experimented with? And then very selectively starting to pose the question to yourself as an industry actor, okay, what is my sort of big problem here? My big cost problem, for instance, when it comes to emissions, and so on? And might that be solvable? By some kind of application of blockchain technology? Because the problem is also, you know, that of course, technology looks for a solution use case, rather than the other way around. And if you start really from the core business problems, like okay, well, as an asset manager, where are my where's my cost structure exploding? Where do I have sort of scalability and limits and in investment management, same thing as as a private bank, to bring asset classes, new asset classes, or just traditional asset classes to my existing client base? How can I do that more profitably, and so on? I think if you then start to look very specifically at the use cases, which have proven some efficiency gains in his very basic business use cases, then that's an interesting approach. So rather than going to conferences, where everyone talks about mathematical models of limitations and so on, I think from an industry point of view, it's much more worthwhile to see, okay, well, what are the Hong Kong banks currently doing? What are the US banks currently doing? And starting from your own business problems, what might be interesting use case to proceed? And then do it in an experimental approach, having that patience to well invest 2-3-4 years in certain projects, to see whether that gives you some return.

Interviewer: And with all of these things in mind that were just discussed, do you personally believe that there's a future for tokenization?

Interviewee III: Oh, yes, definitely. So I think as I've said, I mean, in short term, fungible liquid assets, that might be the most interesting use case. I mean, you can't tell the future but it's possible that in 20-30 years, the majority of these assets will be issued as tokens. That's a very, very realistic scenario. And also, as I've said maybe more as a niche segment for alternatives, assets and so on, of course, if you want to integrate into standard portfolio solutions, some kind of allocation to alternatives, and you can do that in a more efficient way. But as I've said, these

highly illiquid assets, part of the reasons why they are sought after is their illiquidity, and you don't want to market that away, so to speak with tokenization, they also lose to the liquidity premium. So as I've said, it is highly fungible, liquid markets, that's got to be the sort of biggest use case.

Interviewer: Thank you so much. That was my last question. Thank you for all of these valuable insights. I will stop the recording here.

Interviewee III: Great. Okay. Thank you.

Interview IV: Digital Asset Risk Management Specialist, Global Bank

Interviewer: How do you personally see tokenization being implemented across various asset classes such as real estate, securities, and art?

Interviewee IV: In both traditional and non-traditional financial services industries, there is a strong exploration of using tokenization on both private and public chains. Larger banks focus on what their clients want from a distribution perspective, emphasizing tokenization of securities. Asset managers are also keen on tokenizing funds. For commodities and non-bankable assets, this remains more exploratory. The tokenization of funds, money market products, and securities is considered low-hanging fruit for large institutions due to their established processes and regulatory understanding. Notably, I see a positive trend toward exploring tokenization on public chains like Ethereum and Polygon.

Interviewer: Which factors do you think are influencing the adoption of tokenization in the financial sector?

Interviewee IV: There is a significant question in the industry about whether supply creates demand or demand creates supply. I believe large institutions need to create demand by demonstrating the benefits of tokenization to clients. Key drivers include internal adoption by institutions, the ability to increase liquidity, reduce costs, and connect issuers to new client groups. This also involves addressing barriers like ticket sizes for certain products. Importantly, standardization and collaboration between the private sector and regulators are crucial for advancing this technology.

Interviewer: Could you describe any specific examples or case studies of asset tokenization that you find particularly illustrative or impactful?

Interviewee IV: A notable example is BlackRock's tokenization of money market funds, which shows immediate benefits to the industry. In Switzerland, tokenization is being tested with central bank digital currencies (CBDCs), exploring on-chain settlement solutions. This illustrates the next level of tokenization applications, emphasizing the need for a payment leg to realize full benefits. Examples like Helvetia and other Swiss banks working with regulators on technological advancements highlight the collaborative efforts in this space.

Interviewer: What do you think are the primary benefits of tokenization in finance?

Interviewee IV: Tokenization can connect new types of issuers to new types of clients by reducing ticket sizes and fragmenting assets, making previously inaccessible products available to a wider client base. It increases market efficiency and accessibility. Additionally, it fosters innovation, which is essential in the financial services industry. This innovation can impact traditional operations, leading to reconsideration of traditional business models.

Interviewer: How do you perceive the impact of tokenization on market liquidity, especially for traditionally illiquid assets?

Interviewee IV: In theory, tokenization has a significant impact by breaking illiquid assets into parts, making them accessible to a broader client base. However, the practical implementation is still uncertain. Examples include the tokenization of art by digital-native banks in Switzerland and the tokenization of equity for small companies, allowing them to raise capital efficiently and giving clients access to previously inaccessible investments.

Interviewer: What are the main challenges or obstacles to the widespread adoption of tokenization?

Interviewee IV: The biggest challenge is the misconception of what the technology truly is, with many equating blockchain to crypto and being unwilling to engage. This is exacerbated when regulators share this view. Legal frameworks and processes were designed with central intermediation, creating gaps when trying to implement peer-to-peer transactions. Additionally, there is a lack of sufficient know-how among regulators and traditional financial service participants, which hinders adoption.

Interviewer: How significant is regulatory uncertainty in hindering tokenization efforts?

Interviewee IV: Regulatory uncertainty is a major hindrance. Traditional financial services participants will not engage without regulatory certainty. This uncertainty also leads to a negative perception of crypto firms, creating a misconception that all crypto firms are bad. Clear, non-punitive regulation is essential for encouraging innovation and adoption.

Interviewer: Do you think technological complexities also present challenges to implementation?

Interviewee IV: Yes, attracting know-how in this space is crucial. It requires a staggered approach, taking small steps, learning, and scaling gradually. There are significant technological hurdles, especially regarding public blockchains and the need for more permissioned environments on public, permissionless blockchains. Digital identity is another area that needs advancement.

Interviewer: How do you see the future of tokenization evolving over the next five to ten years?

Interviewee IV: There will be more standardization as participants realize the need to collaborate and define requirements at technological levels. This includes harmonization of smart contract standards and regulatory frameworks. The industry will mature, moving from an

exploratory phase to a more standardized and refined phase, with regulations adapting accordingly.

Interviewer: What role will regulatory bodies play in shaping the future?

Interviewee IV: Regulatory bodies should act as enablers, approaching regulation with an open mind and focusing on principles like "same risk, same activity, same regulation." They should avoid punitive measures that hamper innovation. Enabling innovation through balanced regulation is crucial for the industry's growth.

Interviewer: Do you anticipate that technological advancements will impact the development and adoption of tokenization?

Interviewee IV: Yes, technological advancements will drive both the maturation of existing technologies and innovation. This will include new smart contract standards, products, and enhanced automation, pushing towards more peer-to-peer transactions.

Interviewer: Do you have any recommendations for stakeholders looking to navigate the challenges associated with tokenization?

Interviewee IV: Take small steps, test new things, and learn from the experiences. Scale only when comfortable and ensure flexibility in processes to adapt to this fast-moving space.

Interviewer: With all these things in mind, do you personally believe there is a future for asset tokenization?

Interviewee IV: Yes, definitely. Asset tokenization is a new technology that allows for more efficient and effective operations, creating new market spaces and engaging new clients.

Interviewer: Thank you so much for your time and insights.

Interviewee IV: Thank you, happy to help.

Interview V, Georg Brameshuber, CEO of Validvent, tax advisor & lawyer

Interviewer: Can you briefly describe your background in finance and blockchain and how you are connected to this field?

Interviewee V: My connection to this field involves around the classification of crypto in finance, focusing on legal and regulatory aspects. I approached this space through research in tax and financial law, particularly examining the fundamental classification of crypto as a new financial phenomenon. This includes defining and specifying crypto within the legal and regulatory framework.

Interviewer: How do you currently see tokenization being implemented across various asset classes, both bankable and non-bankable, such as real estate, finance, art, and collectibles?

Interviewee V: Tokenization is essentially the process of bringing assets on-chain. It's especially relevant for asset classes with high exposure to liquid markets. Tokenization plays a significant role in markets where liquidity is crucial. For example, illiquid assets like real estate and art are being explored for tokenization.

Interviewer: Which factors do you think are influencing the adoption of tokenization, specifically in the financial sector?

Interviewee V: The primary factor is liquidity. Additionally, regulation has been crucial. The establishment of trading venues for tokenized assets is essential for providing liquidity and regulatory clarity. Recent developments like the DLT pilot regulations are facilitating this.

Interviewer: Could you describe any specific examples or case studies of tokenization that you find particularly impactful or interesting?

Interviewee V: One interesting case is the Vienna Culture Token, which combines CO2 certificates with vouchers for cultural events. This use case demonstrates the potential of tokenization beyond traditional finance. In the financial realm, security tokenization is significant, with examples like the European Central Bank's 2016 paper on using blockchain for security transactions.

Interviewer: What are the primary benefits of tokenization in finance?

Interviewee V: Tokenization enables the creation of transparent market environments with reduced intermediation. It provides the potential for fully liquid markets, allowing for permanent on-chain settlements. This could transform real estate transactions and other asset classes, making markets more efficient and accessible.

Interviewer: How do you perceive the impact of asset tokenization on market liquidity, especially for traditionally illiquid assets?

Interviewee V: Tokenization creates liquid markets where they previously didn't exist. For example, real estate markets, which are traditionally illiquid, could become more liquid through tokenization, allowing for buy and sell transactions on-chain.

Interviewer: Do you believe tokenization can lead to a more efficient and accessible market? If so, how?

Interviewee V: Yes, tokenization can lead to more efficient and accessible markets by providing transparent market information and reducing ticket sizes, making assets more accessible to a broader range of investors. However, it's important to recognize that this also has political implications regarding accessibility.

Interviewer: What do you see as the main challenges or obstacles to the widespread adoption of tokenization?

Interviewee V: The main challenge is the cost-benefit ratio of tokenization projects. The cost of tokenizing assets is high, and the benefits, such as increased liquidity, are not always immediately

evident. Regulatory uncertainty also remains a significant hurdle, as legal certainty is crucial for investor confidence.

Interviewer: How significant is regulatory uncertainty in hindering tokenization efforts?

Interviewee V: Regulatory uncertainty has been a major hindrance, as legal certainty is essential for investors. However, we are seeing improvements in legal frameworks, especially in the DACH region, which is providing more clarity and encouraging adoption.

Interviewer: Do you think there are certain technological limitations or complexities that present challenges to implementation?

Interviewee V: Yes, there are technological complexities, particularly when it comes to integrating legal and technological aspects. For example, determining the finality of blockchain transactions is a fundamental issue in capital markets. Additionally, the development of digital identities and other technological advancements is necessary for widespread adoption.

Interviewer: How do you see the future of tokenization evolving over the next five to ten years?

Interviewee V: I foresee capital market infrastructure becoming increasingly tokenized, with more assets being managed on-chain or hybrid chains (public-private stacks). This will lead to more efficient and transparent markets.

Interviewer: What role will regulatory bodies play in shaping this future?

Interviewee V: Regulatory bodies are already playing a significant role by creating frameworks like the DLT pilot in the EU and similar initiatives in Brazil. These frameworks provide the legal certainty needed for widespread adoption and investor protection.

Interviewer: Do you anticipate any technological advancements that will impact the development and adoption of tokenization?

Interviewee V: Yes, advancements in digital identities and their integration into on-chain use cases will be crucial. This will enable secure and legally recognized transactions, further enhancing the utility and adoption of tokenization.

Interviewer: Do you see any emerging trends or innovations in asset tokenization that could influence its trajectory?

Interviewee V: The emergence of CBDCs and their integration with tokenization is a significant trend. Additionally, the use of tokenized assets in gaming and fashion industries shows the potential for broader applications beyond traditional finance.

Interviewer: Do you have any recommendations for stakeholders looking to navigate the challenges associated with asset tokenization?

Interviewee V: Stakeholders should focus on token engineering, which involves defining the purpose and functions of the token. It's crucial to ensure that tokens meet the requirements of all stakeholders and provide legal certainty and liquidity.

Interviewer: With all these things in mind, do you personally believe there is a future for asset tokenization?

Interviewee V: Yes, definitely. As markets increasingly operate on-chain, the tokenization of assets will become necessary. Additionally, emerging use cases in gaming, fashion, and other industries will further drive the adoption of tokenization.

Interviewer: Thank you so much for your valuable insights.

Interviewee V: Thank you, happy to help.

Interview VI Alexander Rapatz, CEO of Black Manta Capital Partners, lawyer

Interviewer: Could you describe your experience related to finance and blockchain and how familiar you are with the concept of tokenization?

Interviewee VI: My professional background is as a lawyer, working in law firms focused on capital markets, corporate finance, and banking. I then moved into the venture capital industry, setting up funds and investing in deep tech startups. Around 2015-16, I was introduced to blockchain, and during the ICO hype in 2017, we explored how to use the technology for regulated financial instruments. This led to founding a company focused on tokenization services for regulated instruments. We were the first in Europe to conduct a cross-border retail STO and received a BaFin license in 2019.

Interviewer: How do you currently see asset tokenization being implemented across various asset classes, both bankable and non-bankable?

Interviewee VI: Initially, it was all about real estate tokenization, along with some funds and corporate finance products—mainly illiquid and non-bankable assets. There was a lack of trust due to the ICO frauds. Recently, we've seen a shift towards more traditional financial products being tokenized, with institutions like BlackRock and major banks exploring this space.

Interviewer: Which factors do you think are influencing the adoption of tokenization in the financial sector?

Interviewee VI: Two main factors are influencing adoption: education and technical infrastructure. The general understanding of blockchain and wallets has improved, but previously, asset managers couldn't invest in security tokens due to lacking technical infrastructure. This is changing now.

Interviewer: Could you describe any specific examples or case studies that you find particularly illustrative or impactful?

Interviewee VI: JP Morgan's Onyx project is an interesting example. They, along with other major investment banks, are creating their own blockchains and developing products to leverage the advantages within their systems. We also started a project with Citibank that shows institutional interest in tokenization.

Interviewer: What are the primary benefits of tokenization?

Interviewee VI: The primary benefits include interoperability, which makes transactions more efficient and cost-effective. Tokenization also allows for the fractionalization of assets, enabling institutions to

manage various asset types in one system. This can also be used for capital market transactions, using tokenized real estate as collateral.

Interviewer: How do you perceive the impact on market liquidity, especially for traditionally illiquid assets?

Interviewee VI: While theoretically significant, the impact on market liquidity is not yet fully realized due to the lack of a real secondary market. Tokenized real estate, for example, does not have daily transactions and will never have the volatility seen in other markets. The assumption that crypto investors would transition their profits into real estate tokens hasn't materialized as expected.

Interviewer: Do you believe tokenization can lead to a more efficient and accessible market?

Interviewee VI: Yes, tokenization can lead to more efficient and accessible markets. It allows for paperless transactions, reduces the need for intermediaries, provides cost efficiency, and enhances price transparency.

Interviewer: What do you currently see as the main challenges or obstacles to the widespread adoption of asset tokenization?

Interviewee VI: Education and trust remain significant challenges. The end consumer should not need to understand the underlying technology or manage a wallet. Additionally, regulatory uncertainty and technological complexities also present obstacles, though we have been able to navigate these by using existing regulatory frameworks.

Interviewer: How significant is regulatory uncertainty in hindering tokenization efforts?

Interviewee VI: For real-world assets, regulatory frameworks are in place, so uncertainty is less of an issue. However, for other crypto assets like utility tokens and cryptocurrencies, regulatory uncertainty remains a concern. The introduction of MiCA will help provide a more standardized regulatory environment in Europe.

Interviewer: Do you anticipate any technological advancements that will impact the development and adoption of tokenization?

Interviewee VI: Yes, technological advancements will certainly impact the development and adoption of tokenization. The interoperability between different blockchains is crucial, and improvements in this area will drive further adoption.

Interviewer: Do you see any emerging trends or innovations in tokenization that could influence its trajectory?

Interviewee VI: There are interesting developments in staking products and DeFi instruments being wrapped into securities. These provide new profit opportunities but also come with high risks. It will be exciting to see where these innovations lead and how regulators respond.

Interviewer: Do you have any recommendations for stakeholders looking to navigate the challenges associated with asset tokenization?

Interviewee VI: Education is key. Stakeholders should thoroughly understand the technology and the market before investing. Conducting detailed research and staying informed about new projects and protocols is crucial for success.

Interviewer: With all these things in mind, do you personally believe there is a future for asset tokenization?

Interviewee VI: Yes, I firmly believe in the future of asset tokenization. It will become an integral part of capital markets, providing efficiency and transparency. However, the timeline for widespread adoption is uncertain, and it will depend on both technological and regulatory advancements.

Interviewer: Thank you so much for your valuable insights. I'll stop the recording here.