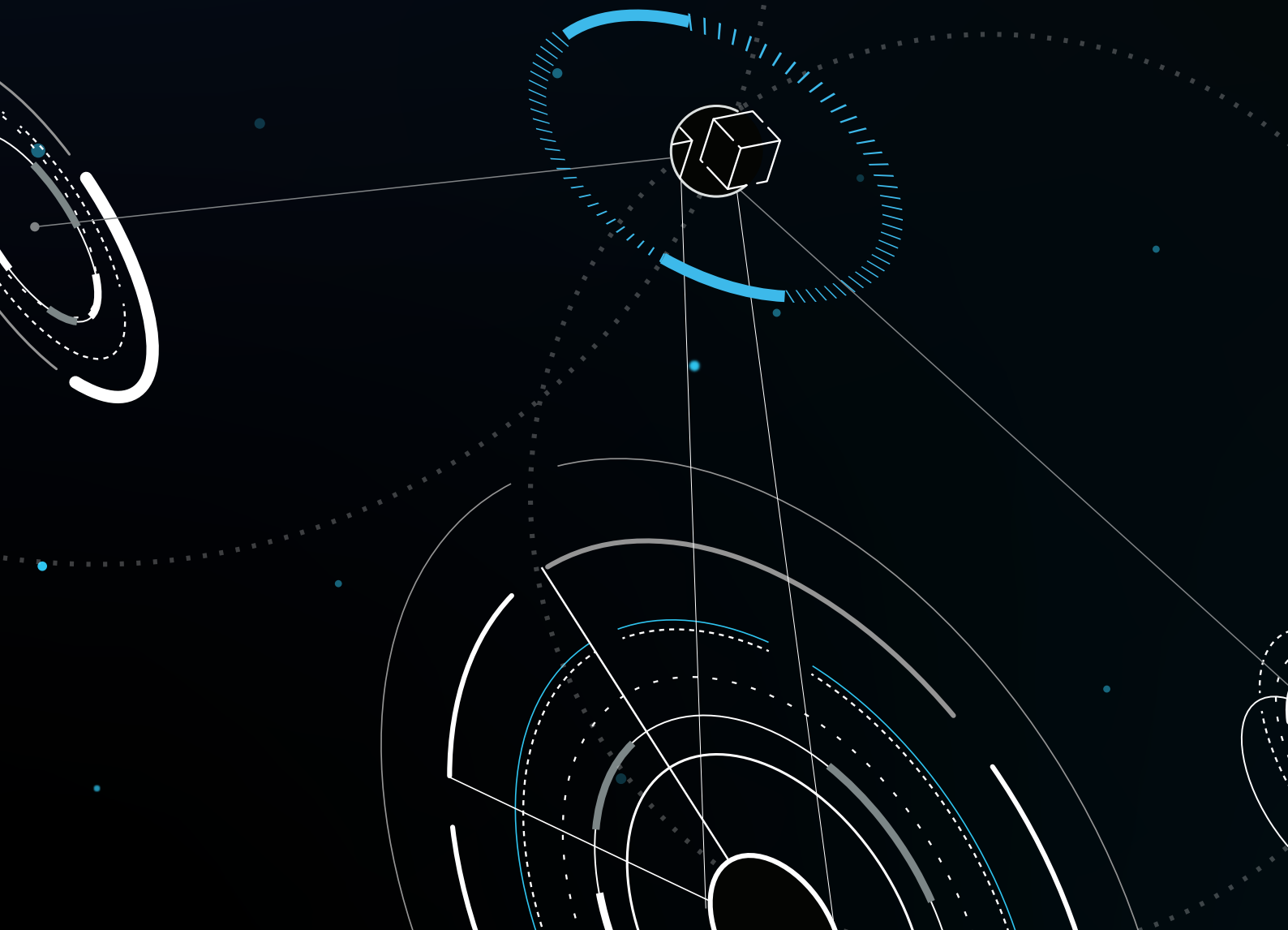# Institutional DeFi

## The Next Generation of Finance?

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# Foreword

The aim of this joint report by the Oliver Wyman Forum, DBS, Onyx by J.P. Morgan, and SBI Digital Asset Holdings is to help business executives understand the potential benefits of adapting decentralized finance (DeFi) protocols in the finance industry using tokenized real-world assets. DeFi protocols are self-executing applications on a blockchain that can automate financial services such as lending and borrowing, trading, and asset management while reducing manual involvement from intermediaries. Such protocols have emerged rapidly, capturing billions of assets in the crypto-asset industry, but financial institutions need to address a number of considerations before they can use DeFi protocols at scale. We believe a version of DeFi called "Institutional DeFi", which combines the innovations of DeFi protocols with the safeguards of today's finance industry, has the potential for growth and transformative impact. This paper explains what industry participants need to do to achieve regulatory clarity, drive commercial adoption, and get the greatest benefits out of Institutional DeFi for their clients and themselves.

# Contents

# Executive Summary

Decentralized finance (DeFi), which uses blockchain-based smart contracts to execute a variety of financial services activities, has seized the attention of technology developers, investors, and financial institutions. DeFi protocols have already enabled nascent markets in the crypto-asset industry on public blockchains, such as borrowing and lending as well as decentralized exchanges. Imagine the potential if the technology were to be applied to streamline transactions in foreign exchange, equities, bonds, and other real-world assets. This will require the creation of digital representations, or tokens, of real-world assets to bring them onto the blockchain. The cost savings and new business opportunities of creating a "tokenized" version of real-world assets for transacting through DeFi protocols could be significant for issuers and investors, as well as for financial institutions that can adapt their technology and business models.

That's an alluring prospect, but many DeFi protocols today are not designed for use in mainstream finance. Firms that wish to apply DeFi in their client offerings must incorporate the same, if not higher, levels of safeguards and security standards that have been developed over decades in the finance industry.

This is where we look to the idea of Institutional DeFi – a system that combines the power and efficiency of DeFi protocols with a level of safeguards to meet regulatory compliance and customer-safety requirements. Many existing DeFi protocols lack identity solutions to enable institutions to meet anti-money laundering (AML), know

your customer (KYC), and combatting the finance of terrorism (CFT) requirements. Cybersecurity is another major risk, as recent high-profile hacks demonstrate. There is also limited, if any, recourse for investors should something go wrong. Firms need to develop safeguards to address these challenges before DeFi protocols can be adopted at scale in mainstream finance.

To create viable Institutional DeFi solutions that fit their purpose and ambitions, we believe financial institutions need to make several key design choices to implement appropriate safeguards and drive innovation. These design choices will influence everything from the level of privacy and efficiency in transactions to the pace of user adoption and the extent of interoperability with other tokenized assets. The choices lie in three critical areas: 1) **blockchain** – which underlying network to build on and what information is visible to whom; 2) **participation** – the mechanisms that determine who can develop and access solutions, and 3) **token design**– how tokens are issued, transacted, settled, and standardized.

In an effort to advance industry thinking on these issues, the Monetary Authority of Singapore launched Project Guardian in May 2022. The project aims to test the feasibility of applications in asset tokenization and DeFi while managing risks to financial stability and integrity. Project Guardian will help MAS build a framework for a digital asset ecosystem, develop and enhance relevant policies, and provide direction on required technology standards. The project's first pilot was being led by our co-authors DBS, Onyx by J.P. Morgan, and SBI Digital Asset Holdings. The Project Guardian pilot carried out transactions involving foreign exchange with tokenized deposits and separate transactions with government bonds, in each case, on a public blockchain network, using digital identity solutions and logic adapted from existing DeFi protocols.

The pilot demonstrated the feasibility and transformative potential of using DeFi protocols in financial markets with appropriate guardrails. It also validated the crucial role of two key factors in this process: 1) the use of regulated institutions to act as "trust anchors," issuing and verifying the credentials of participating entities to establish the identities of transacting parties and connect with existing legal frameworks, and 2) the need for an agreed set of technical standards

around business logic and token standards for interoperability. Both are essential elements for Institutional DeFi and can be helpful across systems and jurisdictions to drive adoption, and improve transaction efficiency for a globally integrated finance industry.

Broader efforts are needed, however, to unlock the full potential of Institutional DeFi and make it scalable. The Project Guardian pilot identified seven key areas where further work is needed, such as legal clarity, adoption incentives, and technical standards alignment, which are detailed in section 3. We believe these areas need joint actions from multiple parties across regulators, financial intermediaries, clients, and other third parties, including DeFi communities. The joint actions should address legal and regulatory uncertainties, establish shared standards, and seek to forge a common vision of how the industry should operate.

Given the transformative potential of Institutional DeFi, financial institutions need to develop a playbook for getting the most value out of it. Institutional DeFi will likely vary by jurisdiction and market structure, and we suggest three ways financial institutions should start responding:

**Develop a house view on Institutional DeFi implications** across business portfolios. We share potential future paradigms and their implications for key sectors.

**Decide on a participation strategy** to adapt existing business and embrace new opportunities enabled by Institutional DeFi. We suggest several questions that can help firms on their journey.

**Get the organization ready** to fulfill its ambitions by developing the required capabilities. We identify three areas, including organizational structure, delivery model, and talent strategy.
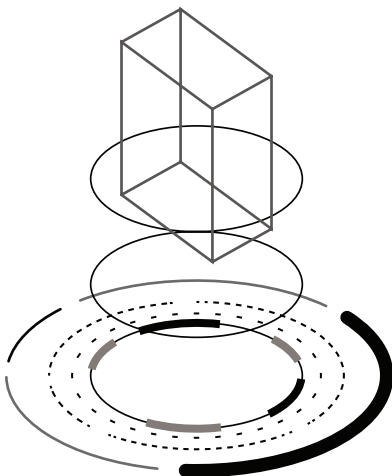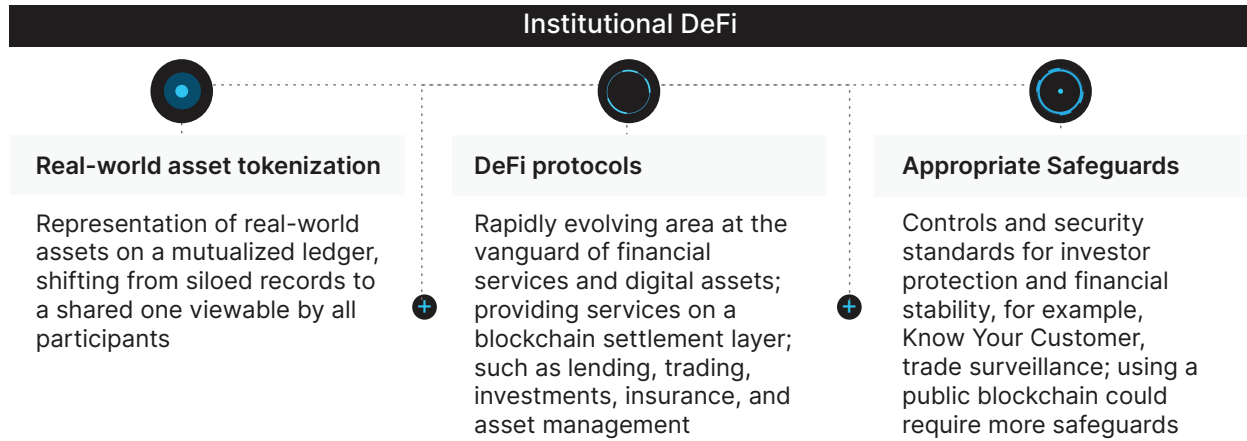
# The Value of Institutional DeFi

Financial services are built on trust and empowered by information. This trust rests on financial intermediaries who maintain the integrity of records covering ownership, liabilities, conditions, and covenants, among other areas, across a variety of siloed ledgers that are separate from the means they use to communicate. As each intermediary has a different piece of the puzzle, the system requires much post-transaction coordination to reconcile the various ledgers and settle transactions. For example, many securities transactions, particularly cross-border ones, can take anywhere from one to four days to settle.

Distributed ledger technology (DLT), such as blockchain, has the potential to resolve some of those inefficiencies by presenting transactional and ownership information on a single shared ledger. The growing acceptance of tokenization, which creates digital representations of assets such as a stocks and bonds on a blockchain, can extend the benefits of DLT to enable exchange and settlement of a wide range of asset classes. Institutions can generate further efficiency by adopting DeFi protocols, which use software code to automatically execute a range of financial transactions pursuant to present rules and conditions.

We define **Institutional DeFi** as the application of DeFi protocols to tokenized real-world assets, combined with appropriate safeguards to ensure financial integrity, regulatory compliance, and customer protection. *(It is important to note that in this joint paper we do not refer to Institutional DeFi as institutional players participating in crypto DeFi.)* The prize for innovators who hone this model for use in the world's trillion-dollar finance industry could be substantial.

**Exhibit 1: What Is Institutional DeFi**

| Institutional DeFi | | |
| --- | --- | --- |
| **Real-world asset tokenization** | **DeFi protocols** | **Appropriate Safeguards** |
| Representation of real-world assets on a mutualized ledger, shifting from siloed records to a shared one viewable by all participants | Rapidly evolving area at the vanguard of financial services and digital assets; providing services on a blockchain settlement layer; such as lending, trading, investments, insurance, and asset management | Controls and security standards for investor protection and financial stability, for example, Know Your Customer, trade surveillance; using a public blockchain could require more safeguards |

Source: Oliver Wyman Forum, DBS, Onyx by J.P. Morgan, SBI Digital Asset Holdings
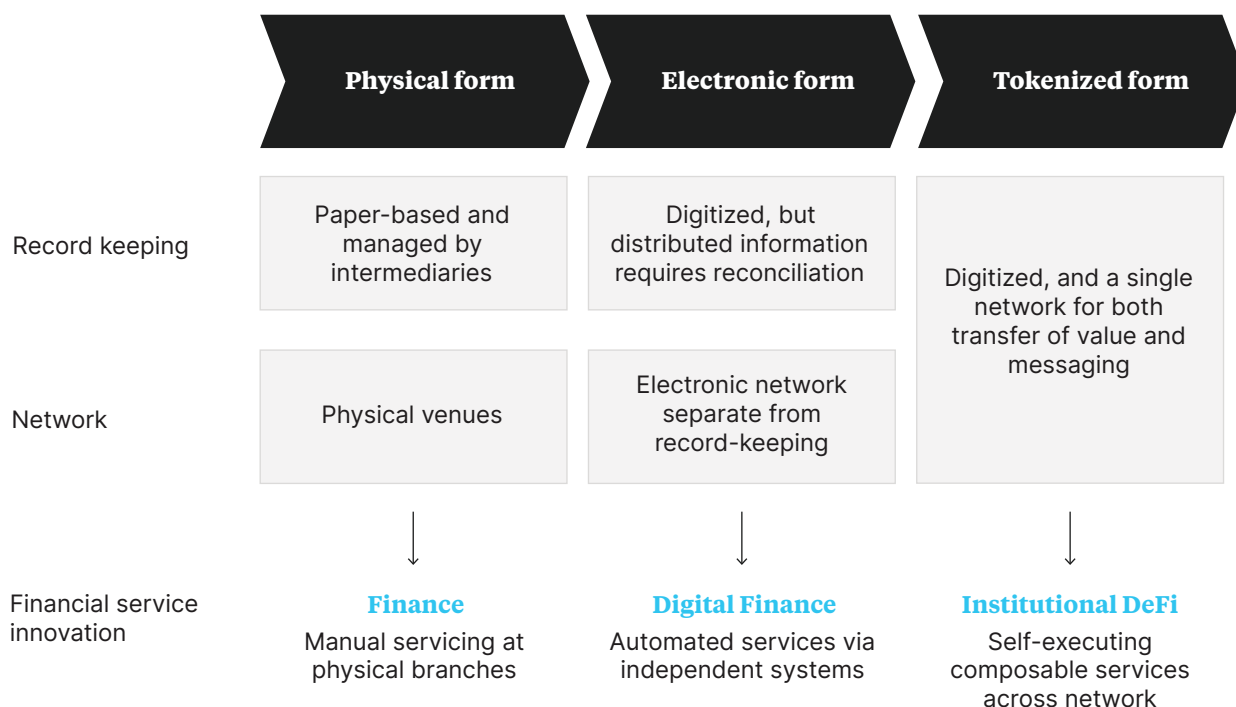
## 1.1 Tokenization is already bringing new potential to money and assets

Technology continually evolves and modernizes financial services by creating new ways of executing and recording transactions. Each step in this evolution brings new business opportunities. For example, dematerialization replaced paper certificates with digital ones in the form of electronic book-entries, fostering the rise of electronic payments and trading. That, in turn, made securitization possible, which added value to previously illiquid assets such as mortgages.

Despite recent waves of digitization, trillions of dollars' worth of real-world assets are recorded in a multiplicity of ledgers that remain separate from messaging networks. This means that financial intermediaries have to record transactions on siloed ledgers and then message each other to reconcile their books and finalize settlement. The need

for coordination across ledgers and networks between entities creates inefficiencies that increase costs and risks, lengthens settlement times, and in general adds overhead to financial services.

The past few years have witnessed an increased focus on blockchain technology as a potential panacea for resolving these inefficiencies. The promised value of blockchain comes from combining ledgers and networks in a way that allows multiple parties to see the same information, hence greatly reducing the need for reconciliation after a trade or transaction. In addition to creating a shared view of information (transaction balances, ownerships, etc.), blockchains also enable business rules and logic to be executed and viewed with high transparency and in a deterministic manner. For example, lending business logic can be codified transparently in smart contracts, thereby enforcing adherence to rules and automating settlement.

**Exhibit 2: History of Asset and Money Representation**

| | Physical form | Electronic form | Tokenized form |
|---|---|---|---|
| Record keeping | Paper-based and managed by intermediaries | Digitized, but distributed information requires reconciliation | Digitized, and a single network for both transfer of value and messaging |
| Network | Physical venues | Electronic network separate from record-keeping | |
| Financial service innovation | **Finance** Manual servicing at physical branches | **Digital Finance** Automated services via independent systems | **Institutional DeFi** Self-executing composable services across network |

Source: Oliver Wyman Forum, DBS, Onyx by J.P. Morgan, SBI Digital Asset Holdings

In the process of adopting blockchain technology, financial firms are exploring representing real-world assets as tokens on a blockchain. Such tokenization can reduce settlement risk and decrease settlement times, which typically takes one to two days even for low-risk assets such as G10 government bonds, by enabling so-called "atomic" settlement – the instant exchange of two assets on the condition that assets are simultaneously transferred. No party to a transaction is then left waiting for delivery. The application of smart contracts in asset tokenization also has delivered a number of benefits, including enhanced and new offerings. For example, J.P. Morgan leverages tokenization to offer intra-day repo solutions for clients on its Onyx Digital Assets platform, and DBS Digital Exchange offers corporates a platform to raise capital through the digitization of their securities and assets, with options to offer smaller denominations. These tokenization benefits are also welcomed by asset managers, as 70% of institutional investors expressed willingness to pay extra for increased liquidity and faster asset turnover, according to a recent survey conducted by Celent.[1]

Tokenization efforts in the industry are well under way covering both payment instruments and assets, which creates the potential for end-to-end asset exchange on blockchain.

| | |
|---|---|
| **Tokenized payment instruments** are gaining scale through public- and private-sector efforts | **Tokenized assets** are growing as multiple pilots have validated their feasibility and value |

## 88%

**Of global institutional investors are comfortable with digital representations of cash using blockchain-based technology, according to a 2022 Celent survey**[2]

Tokenized payment instruments are being explored by both the public and private sector. On the public sector side, a 2021 survey of 81 central banks by the Bank for International Settlements (BIS) found that 90% of central banks were investigating the potential of central bank digital currencies (CBDCs), including 26% that were actively developing CBDCs or conducting pilot projects.[3] The transaction volume of China's digital yuan, or e-CNY, reached RMB 100 billion ($13.9 billion) at the end of August 2022,[4] nearly three years after its launch. The European Central Bank in September selected five companies to develop potential user interfaces for a digital euro; it expects to complete its investigation on whether to launch a CBDC in October 2023. Central banks are broadening the scope of their CBDC experiments. As of October 2022, the BIS was running seven CBDC projects with various member central banks.[5] More recently, the Banque de France announced a new project to look at using DeFi for wholesale CBDC liquidity management.[6]

On the private sector side, privately issued stablecoins, which are cryptocurrencies typically pegged to fiat money such as the US dollar, have grown to a nearly $150 billion market.[7] There are increasing efforts from regulators to clarify the status of stablecoins. Recently, MAS published a consultation paper to support the development of stablecoins as a credible medium of exchange in the digital asset ecosystem.[8] In 2022, the European Union agreed on the first major regulatory framework for the crypto-asset industry, including stablecoins.[9] Japan also passed a bill providing a legal framework for stablecoins that allows licensed banks, money transfer agents, and trust companies to issue them.[10]

## 91%

**Of institutional investors are interested in investing in tokenized assets, according to a 2022 Celent survey**[11]

We see many firms entering the space across multiple asset classes including equities, bonds, real estate, commodities and others. For example, J.P. Morgan's intra-day repo application on Onyx Digital Assets has processed more than $430 billion of repo transactions since its launch in November 2020; the daily transaction volume of Broadridge's Distributed Ledger Repo platform using tokenized government bonds reached $35 billion in the first weeks after launch;[12] DBS has successfully issued the DBS Digital Bond in May 2021 via security token offering (STO); Mata Capital, a French asset manager, tokenized €350 million ($343 million) worth of funds.[13] Last year, Switzerland implemented a so-called DLT Act granting tokenized securities the same legal status as traditional ones.[14] Furthermore, in May 2021, Germany's Parliament passed a law allowing securities to be issued in electronic form, not paper, enabling the issuance of tokenized assets. The European Investment Bank subsequently issued a digital bond on a public blockchain in 2021 under this German law.[15]

ion DeFi

## 1.2 DeFi protocols enable new ways to deliver financial services

In parallel to industry efforts to develop real-world asset tokenization, the concept of decentralized finance has flowered in the public crypto-asset space. DeFi, as it is popularly known, refers to decentralized applications (DApps), which provide financial services via sophisticated and automated computer code on a blockchain as the settlement layer. These services include payments, lending, trading, investments, insurance, and asset management. DeFi protocols are the code and procedures that govern these applications. These protocols typically operate without centralized intermediaries or institutions, use open-source code, and allow for flexible composability (code or applications can be taken from one protocol/service and plugged into another).

DeFi has rapidly emerged in the past three years and grew more than tenfold to $160 billion in 2021 in terms of total value locked before retreating to stand at a little over $50 billion as of October 2022.[16] DeFi innovations have flourished across various financial ecosystems and attracted billions of dollars of liquidity across decentralized exchanges (such as Curve and Uniswap), lending protocols (such as Aave and Compound), and other DeFi solutions, such as liquidity staking and collateralized debt positions, which lock up collateral in a smart contract in exchange for stablecoins.

Some noteworthy innovations in the DeFi space involve crypto lending/borrowing protocols and decentralized exchanges:

- Liquidity pools, for instance, create all-to-all markets. These pools link buyers and sellers along with liquidity providers in decentralized exchanges, or DEXes, and lenders and borrowers in lending protocols. Aave and Compound are examples of large crypto lending and borrowing protocols in terms of total value locked,[17] whose operations involve liquidity pools. Both retail and institutional investors can deposit, borrow, or trade crypto from the pool using business logic that is governed by smart contracts. If pools are on the same chain or made interoperable, this aggregates liquidity by attracting more investors.

- Automated market markers (AMM) provide a new method of price discovery. An AMM facilitates buy and sell orders in a self-executing manner, always standing ready to provide quotes and setting a price based on a predefined, transparent formula considering supply and demand. Uniswap and Curve are examples of a decentralized crypto exchange that uses an AMM. When a user wants to swap crypto A for crypto B, the AMM automatically calculates how much crypto B the user can get and at what price rather than relying on a market maker to quote a price or to match a buyer and a seller.

>12

DeFi, as described above, is prevalent in the public blockchain space and applies mostly to transactions in the largely unregulated crypto-asset industry. Yet the logic embedded in DeFi protocols, which are programmable, self-executing business processes, can be applied to interact with any tokenized asset.

Building full-scale financial services that leverage tokenization and programmability could have far-reaching implications for the finance industry. It could generate substantial cost savings, as code dramatically reduces middle and back-office operations across firms and intermediaries. In the exhibit below we list some notable benefits of DeFi solutions. New business opportunities are also likely to emerge as financial institutions take advantage of the composability of DeFi protocols, packaging multiple DeFi protocols together to offer new solutions. First, however, firms must adapt the DeFi protocols to the regulatory standards of today's trillion-dollar markets for money, stocks, bonds, and other assets.

**Exhibit 3: Notable Benefits of DeFi**

Atomic settlement **reduces risk** by providing a secure way to deliver securities for payment

Mutualized and transparent ledgers facilitate **real-time value movement, cheaper settlement**

Composable nature (ability to interact with one another) of DeFi protocols allows for **seamless collaboration** across multiple services

Interoperability across asset classes and markets **aggregates liquidity and enables a more globally integrated** finance industry

Programmable logic **allows automation of multi-party operational activities** and thus reduces middle- or back-office overhead such as transfers and post-trade reconciliation

Transparent and automated business logic **enables new product features**, such as liquidations for collaterals and new product offerings

Innovative DeFi solutions **amplify liquidity** of tokens and tokenized real-world assets, given lower participation threshold, such as decentralized exchanges

Source: Oliver Wyman Forum, DBS, Onyx by J.P. Morgan, SBI Digital Asset Holdings

## 1.3 Safeguards are the key to Institutional DeFi

Today's finance industry rests on an array of safeguards that protect investors from fraud and abusive practices, combat financial crime and cyber malfeasance, maintain investor privacy, ensure that industry participants meet certain minimum standards, and provide a mechanism for recourse in case things go wrong. Institutional DeFi will need to incorporate the same, if not higher, level of standards to meet regulatory requirements, create trust, and drive adoption by issuers, investors, and financial institutions.

Here are some of the key safeguards needed to build DeFi-based solutions for institutions:

- **AML/KYC risk controls.** Mechanisms that ensure AML/KYC compliance for participants can avert the potential legal liability of dealing with sanctioned parties or unqualified investors, and also prevent inadvertently enabling or participating in money laundering. Designing appropriate risk controls however are not easy. In 2021, financial institutions were fined $2.7 billion for their deficiencies and failures in AML compliance policies, procedures, and processes.[18] To avoid the severe consequences that could arise from control failures, the average mid-size to large organization spends $22.7 million annually on financial crime compliance operations to build up effective standards.[19] Appropriate controls are needed if regulated financial activity is to take place through DeFi protocols, and regulators have begun to set expectations. In August 2022, the U.S. Department of the Treasury's Office of Foreign Assets

Control (OFAC) imposed sanctions on Tornado Cash, a cryptocurrency mixer that facilitates anonymous transactions by obfuscating their origin, destination, and counterparties, alleging that it had facilitated the laundering of more than $7 billion worth of cryptocurrency.[20] Blockchain technologies may offer novel ways of ensuring appropriate controls at lower cost. For example, there are methods for ensuring compliance with AML/KYC without necessarily revealing one's personal information, such as using zero-knowledge proofs combined with pseudonymous identity mechanisms.

- **Data privacy.** Data privacy is crucial for clients in certain segments, in particular to protect their trading history and positions for certain asset markets. Information on public blockchains is permanently visible to all by default, and investor orders can at times be inferred from publicly available data, something that becomes increasingly more likely as time goes on and data is accumulated. For example, whale tracking tools on Twitter and Telegram are widely used by the public to track large crypto-asset transactions done via decentralized exchanges and other DeFi protocols, whereby people have strong assumptions or hypotheses on who these whales (investors holding a vast number of crypto-assets) are.[21] In the finance industry, client information in respective transactions is masked and protected through brokers, without being revealed to the market. Appropriate privacy protections will be necessary.

- **Cybersecurity protections.** While almost anything digital can be vulnerable to hackers, cybersecurity protections are especially important for digital assets and DeFi protocols due to the nature of blockchain. Although the

underlying blockchain technology makes it difficult to alter data, firms seeking to develop Institutional DeFi solutions must address cybersecurity vulnerabilities in cross-chain bridges, private digital keys, and on-chain price oracles, as well as guarding against market manipulation. Such controls are needed to enhance client trust and protect the safe ownership of digital assets. A rise in thefts from DeFi protocols led to a 58% increase in crypto hacking losses, to $1.9 billion, in the first seven months of 2022.[22] Bridges connecting different networks are particularly vulnerable, as hackers demonstrated in July 2021 by attacking the cross-chain DeFi platform Poly Network, and causing roughly $600 million in losses in Ethereum and other tokens.[23] Users manage their own private keys to access their crypto assets, which can also compromise security. Losses due to compromised private keys have totaled $274 million in the first eight months of 2022 alone.[24]

- **Mature governance and conduct models.** Reliable DeFi protocol governance and stakeholder conduct standards are needed to ensure that the quality of Institutional DeFi solutions offered are in alignment with financial services professional standards. Financial institutions are highly regulated with mature quality assurance processes. For example, there are more than nine different federal financial regulators in the United States on top of multiple regulators in each of the 50 states.[25] Multilateral organizations help coordinate financial regulation internationally. Banks invest over $270 billion a year and dedicate an average of 10% to 15% of their staff to comply with regulatory obligations.[26] Standards for conduct exist for both institutions and individuals. Existing DeFi protocols are based on different

governance and conduct assurance mechanisms, most often done through governance tokens that bestow holders with voting rights. This is similar to most common equity structures but without the same level of corporate governance. Also, many DeFi protocols have a very high concentration of voting control: Research by Chainalysis into 10 major governance tokens found that fewer than 1% of token holders held 90% of the voting rights.[27] Indeed, participants could consider whether to and how to cover DeFi protocols under a corporation construct – such as trusts, special purpose vehicles, or other limited purpose corporations – to allow for structured governance and liability recourse.

- **Proper recourse mechanisms.** Recourse and dispute management should be properly established upfront. Incidents such as theft or loss due to operational errors can occur in any financial system. The finance industry today is built with robust recourse mechanisms or legal remedies to protect users and investors in most cases. For instance, the London Court of International Arbitration, one of the world's leading arbitral institutions, managed 86 international dispute cases from the banking and finance industry in 2021.[28] Such mechanisms are lacking in public DeFi solutions, giving rise to uncertainty in arbitration procedures. When a hacker stole $130 million in crypto assets from users of DeFi platform BadgerDAO, they were unable to afford full restitution immediately with a mere $53 million in their treasury and no insurance coverage.[29] Without an available legal recourse mechanism, this left a handful of affected users uncompensated.

- **Legal clarity around smart contract-based business activity.** The legal status of financial business activity has been

continuously clarified by countless acts of legislation and major litigation efforts over past decades. The UK High Court, for example, typically hears 80 to 100 important banking and finance cases annually.[30] That level of clarity does not yet exist for smart contract-based DeFi activity. According to international law firm Norton Rose Fulbright, it remains unclear which smart contracts are legally enforceable, which could depend on the intentions of contracting parties or local jurisdictions.[31] In the United States, the enforceability and interpretation of contracts in the United States is commonly governed by state law. Some states such

as Arizona and Nevada have amended their respective laws (such as the Uniform Electronic Transactions Act) to explicitly incorporate blockchains and smart contracts.[32] Some code-only smart contracts would be enforceable under state laws governing contracts. The International Swaps and Derivatives Association (ISDA) also developed legal guidelines for smart derivatives contracts to provide general guidance for different jurisdictions.[33] More legal clarity in commercial law is necessary to reinforce these requirements and foster a trusted environment for smart contract-based business.

# Conclusion

**Now is the time to actively explore Institutional DeFi**
The foundation for Institutional DeFi is being established by the growth of real-world asset tokenization and the innovations observed in DeFi. Financial institutions have the opportunity to transform parts of their business by adapting DeFi protocols and combining them with the level of safeguards that regulators and clients expect. Institutional investors' appetite for digital assets is growing and they are willing to pay extra for increased liquidity and faster transactions. 88% said they are still planning to move forward with current plans around digital assets despite market downturn.[34]

In May 2022, the Monetary Authority of Singapore launched Project Guardian to test the feasibility of applications in asset tokenization and DeFi while managing risks to financial stability and integrity. Project Guardian will help MAS build the digital asset ecosystem framework, enhance and develop relevant policies, and provide direction on the technology standards. Sections 2 and 3 of this report will explore how financial services providers could adopt Institutional DeFi based on different considerations, leveraging findings from the first pilot under Project Guardian. Section 4 will discuss how financial institutions should collaborate to get the most out of the transformation.

**Section 2**

# Institutional DeFi Design

While Institutional DeFi has potential, financial institutions need to consider areas where tokenization and programmability are most valuable, and tailor DeFi protocols for their purposes accordingly instead of simply reusing what works in the crypto-asset industry.

## 2.1 Start by defining objectives of Institutional DeFi solutions

Institutions interested in exploring Institutional DeFi solutions should start by asking themselves, "why DeFi?" The answer will depend on the commercial viability, adoption feasibility, and competitive advantage of such a solution. Objectives could range from creating new products and reducing data reconciliation tasks, to cutting costs and speeding up settlement times.

Firms also need to consider a number of broader objectives when designing Institutional DeFi solutions. These should include:

- **Ecosystem objectives,** such as encouraging widespread adoption by providing seamless interconnectivity to and compatibility with existing trading systems, preparing for interactions with upcoming CBDC frameworks, and fostering an open innovation environment that encourages the development of market-driven solutions

- **Protection objectives,** such as ensuring compliance with the existing legal and regulatory frameworks, allowing access to only qualified users, and mitigating various financial and operational risks, including cybersecurity risks.

## 2.2 Make design choices that fit the objectives

After firms have established their objectives, they need to make choices in three key areas: 1) **blockchain** – which underlying network to build on and what information is visible to whom; 2) **participation** – the mechanisms that determine who can develop and access

solutions; and 3) **token design** – how tokens are issued, transacted, settled, and standardized.

It is critical that firms weigh the options and their associated trade-offs carefully, as these design choices are paramount in influencing how the offerings achieve their objectives.
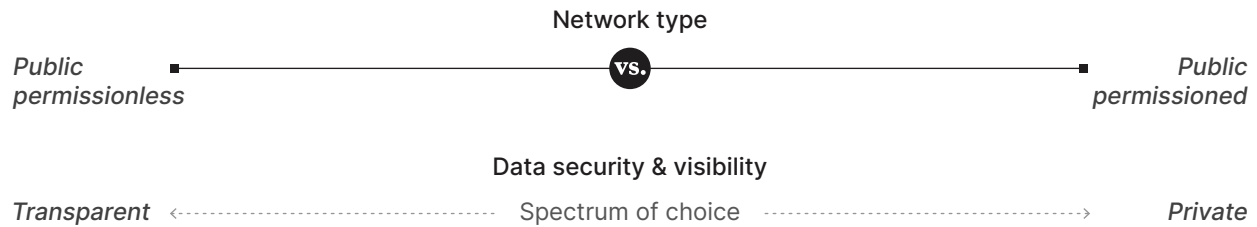
**Exhibit 4: The Three Key Design Choices**
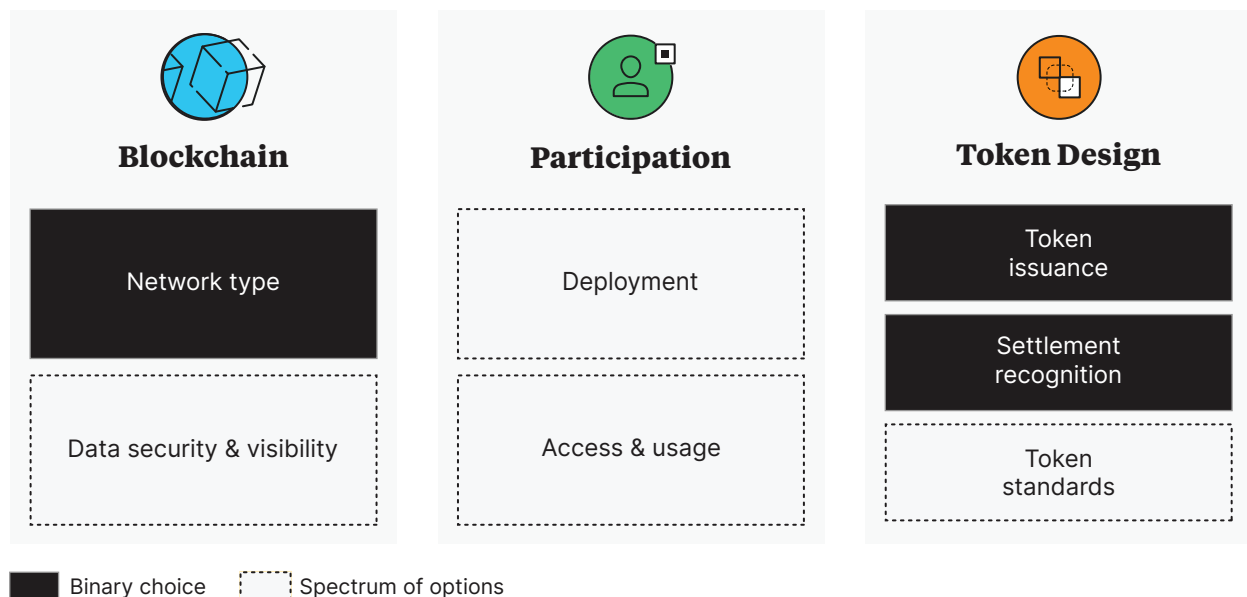


Source: Oliver Wyman Forum, DBS, Onyx by J.P. Morgan, SBI Digital Asset Holdings

**Exhibit 5: The Three Key Design Choices – Blockchain**



# Blockchain

Blockchain refers to the type of network used, along with the level of data security and privacy.

Network type

Public
permissionless ────────────────── **vs.** ────────────────── Public
permissioned

Data security & visibility

Transparent ← - - - - - - - - - - - Spectrum of choice - - - - - - - - - - - → Private

**Network type**

Network type refers to the underlying network and database used to deploy an Institutional DeFi solution with asset tokens. This design choice is critical because it affects so many important design objectives, such as user access, interoperability, and the strength of the developer ecosystem.

*Public permissionless networks*, such as Ethereum and Polygon, impose no restriction on access, and therefore have the potential to encourage wider participation. They are better equipped to facilitate interoperability with existing digital assets and DeFi protocols, which are on public permissionless networks. There is already a wide base of DeFi developers and open-source code that have been tested and deployed on *public permissionless networks*. This helps kickstart and facilitate continued innovation, using

software components and applications that are leverageable and composable. On the flipside, this openness is also a potential source of risk unless additional safeguards are put in place.

*Public permissioned networks*, on the other hand, can facilitate the use of controls to authorize user access and restrict the visibility of transactions on these networks. This enables easier implementation of checks and balances, along with traceability for investigation purposes. As Institutional DeFi models are still being explored, it is possible a *public permissionless blockchain* could be modified to ensure it is usable at scale by institutional participants.

**Data security and visibility**

This informs the level of data transparency of the solution, and its implied level of data security. Data transparency is itself a multifaceted concept and the choices vary along a spectrum. On one end of the spectrum, all transaction data is transparent and available for all participants to view, as is common with many public blockchains today. On the other end of the spectrum, participants may access only data relating to their own transactions. Function-level access management can provide different levels of access to users, while encrypting data and providing a viewing key to selected participants can enable authorized viewership. Moreover, different techniques, such as zero-knowledge proofs (ZKP) and ensuring DeFi protocol uses only private messages, can be implemented for data privacy on public blockchains.

The choice of transparency level primarily depends on the solution's value proposition – but data ideally should be private while discoverable to customers or authorized stakeholders (such as regulators). For example, the preferred approach for a central limit order book-based venue may be to make order and transaction data available, while a dark pool solution may prefer to conceal order information.
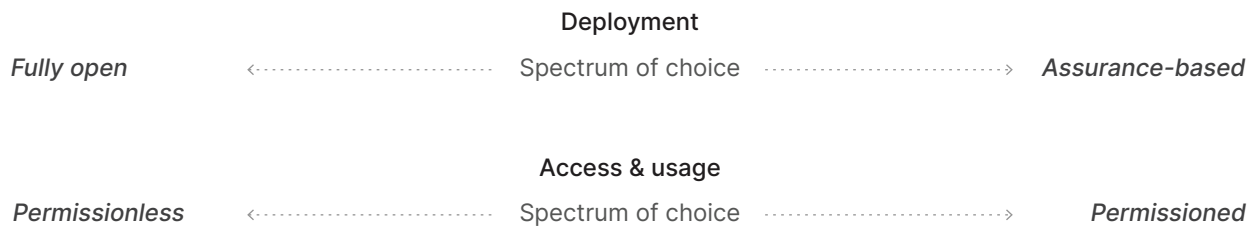
Mechanisms for data management and protection need to be properly designed to comply with regulatory data requirements to prevent issues introduced by DeFi such as maximal extractable value (MEV), where each of the validators or "miners" updating the blockchain can determine which transactions are executed and when, thus affecting market prices and opening the door to front-running and other forms of market manipulation.[35] This is especially important for solutions on the public blockchain as data is permanently and immutability recorded on a publicly available ledger, introducing a higher risk of loss of privacy.

**Exhibit 6: The Three Key Design Choices – Participation**



## Participation

The choice of participation mechanism for an Institutional DeFi solution is nuanced and never binary. There is a spectrum of choice regarding protocol deployment and access and usage.

Deployment

*Fully open*      ⟵┄┄┄┄┄┄┄┄┄┄┄   Spectrum of choice   ┄┄┄┄┄┄┄┄┄┄┄⟶      *Assurance-based*

Access & usage

*Permissionless*      ⟵┄┄┄┄┄┄┄┄┄┄┄   Spectrum of choice   ┄┄┄┄┄┄┄┄┄┄┄⟶      *Permissioned*

**Deployment**

This choice governs how new smart contracts and protocols are developed and deployed, and embodies different approaches to innovation and risk. On one end of the spectrum, *in a fully open model*, anyone can develop and deploy smart contracts. This lowers barriers for application development and encourages competition, but it also entails risk as there are fewer checks and balances before protocols are deployed. This is not to say that assurance standards are not used. For example, some DeFi protocols today make use of code audits. But such standards are not mandated nor instituted for deployment.

On the other end of the spectrum, *in an assurance-based model*, control and review/approval mechanisms are put in place to ensure adherence to specific standards before deployment. These can be industry standards widely accepted by institutional investors and clients or standards instituted through regulatory requirements. One approach is to allow only selected developers or firms to develop new processes. Another approach is to ensure specific checks are made to protocols, allowing only verified protocols to be deployed.

**Access and usage**

This design choice relates to how controls are put in place to manage user access and usage. Restrictions can be imposed at the service level (such as by controlling who can access a liquidity pool) or at the level of underlying functions (for example, by controlling trading permissions, such as instrument types and ticket size).

A *permissionless participation model* is one where anyone can access the DeFi protocols and use all functions without restrictions (such as the Uniswap DEX), while a *permissioned participation model* is one where only authorized or verified participants can access specific services and use selected functions. While a *permissionless participation model* could help maximize the potential userbase and foster growth, *a permissioned participation* model helps comply with regulatory requirements (such as KYC, qualified access) by ensuring only the right participants can use the appropriate functions. Note that a permissioned model can still be enabled on a public permissionless blockchain, via access management mechanisms.
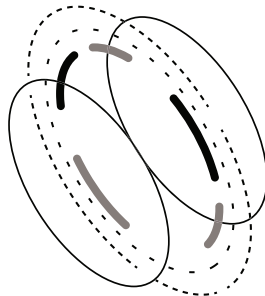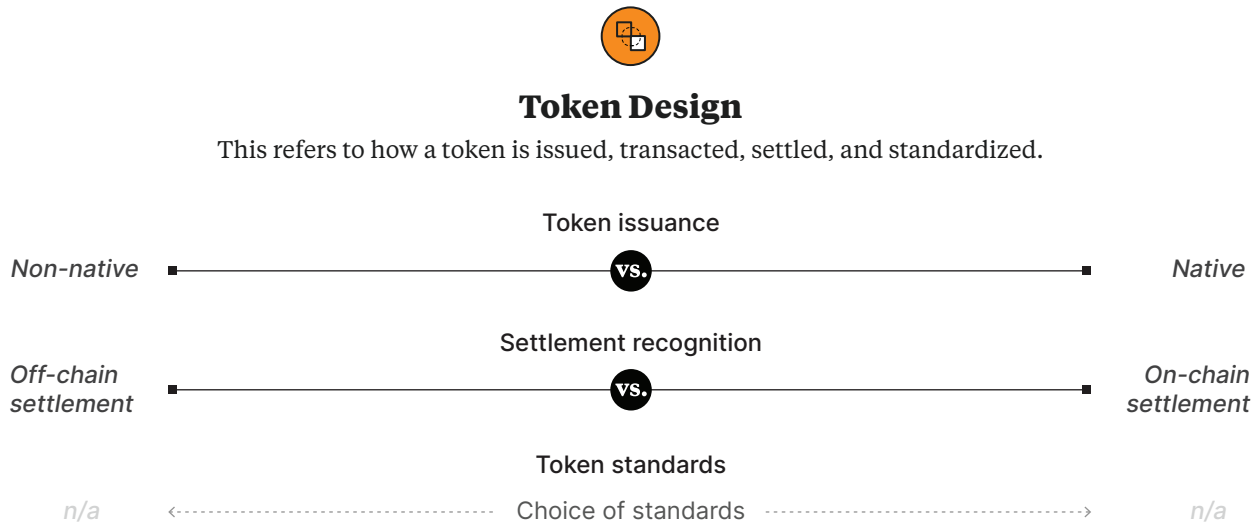
**Exhibit 7: The Three Key Design Choices – Token Design**

## Token Design

This refers to how a token is issued, transacted, settled, and standardized.

Token issuance

Non-native ————————— vs. ————————— Native

Settlement recognition

Off-chain settlement ————————— vs. ————————— On-chain settlement

Token standards

n/a  ←----------- Choice of standards -----------→  n/a

**Token issuance**

*Non-native tokens* are issued to represent existing real-world assets. These non-native tokens are bound to existing off-chain processes and control mechanisms, such as custody and reconciliation. For example, on the Onyx Digital Assets platform, securities accounts holding US Treasuries maintained by J.P. Morgan for the benefit of its clients are tokenized to enable intraday repo transactions. On the other hand, real world assets can be issued directly on a blockchain as native tokens, such as through security token offerings (STO). It is worth noting that asset tokenization is rapidly evolving, and there may be more ways to issue tokens in the future.

There is currently legal uncertainty involved for both *native and non-native tokens*. Depending on the nature of the *native token*'s asset class, there can be a lack of legal clarity on whether such *native tokens* can exist by themselves and rely on the blockchain alone

for record of its existence. For example, bonds in the EU have to be registered with a central securities depository (CSD), and having a natively issued bond token without separately registering with the CSD may not meet such requirement. We note that this leaves space for innovation in regulation as well as the creation of blockchain-native CSDs and similar actors. For *non-native tokens*, there are considerations such as on-chain settlement finality, which we discuss in the next sub-section.

Both *non-native tokens* and *native tokens* can interact with DeFi protocols, allowing for automatic execution of asset servicing and transactions without the need to rely on legacy systems. However, transactions with non-native tokens may ultimately require interactions with off-chain processes as noted above. The choice of token issuance will depend on the nature of the asset which is intended to be reflected, whether such asset requires linkage to an off-chain asset,

whether blockchain ledgers may serve as the determinative books and records in respect of the issuance and ownership of such asset, and whether there is the desire or need to tokenize an existing asset that lives in legacy off-chain systems.

### Settlement recognition

Settlement recognition depends on whether or not a token transfer on-chain is recognized by law, regulation, or contractual arrangement as a final transfer. This is a notable issue for consideration in respect of non-native tokens, where additional steps may be required to be taken with respect to the off-chain asset being represented. However, as noted above in respect of CSD registration requirements, this issue may arise due to regulation in respect of native tokens as well. Off-chain settlement is when a token transfer is not recognized as a transfer of the underlying asset. In this case, settlement finality is recognized off-chain, in which an off-chain ledger is updated to reflect ownership change. On-chain settlement is when settlement finality is recognized on-chain, whereby the on-chain ledger is recognized as the single source of truth for transfer and ownership.

The determination as to whether settlement can be recognized on-chain mainly depends on whether regulators and transaction participants can legally recognize the blockchain records as the final books and records of transactions, allowing the blockchain to function also as a de facto ownership ledger. This requires an understanding of the regulation and commercial law applicable to the transaction at issue, as well as any contractual arrangements in place. The analysis here will determine whether transactions need to rely on legacy ledgers and processes, or whether legacy systems can be entirely replaced.

### Token standards

Token standards are the set of principles on which tokens are issued and smart contracts are developed. These standards influence the ability to interact with different DeFi protocols, and hence the interoperability and functionality, of the asset tokens. Different public standards might be appropriate depending on the type of token to be issued. For example, the ERC-721 standard is designed for non-fungible tokens (NFTs) while ERC-1155 is suitable for both fungible and non-fungible tokens and can be explored for tokenized assets.

## Conclusion

### There is no one-size-fits-all Institutional DeFi solution

Design choices for Institutional DeFi solutions need to be tailored for specific, prioritized business objectives. However, a specific design choice may help achieve one business objective while imposing limitations on another. As such, the task for any firm considering an Institutional DeFi solution is to choose a complementary set of options within each design choice to address its business objectives, taking into account asset classes, jurisdictions, and the target value proposition.

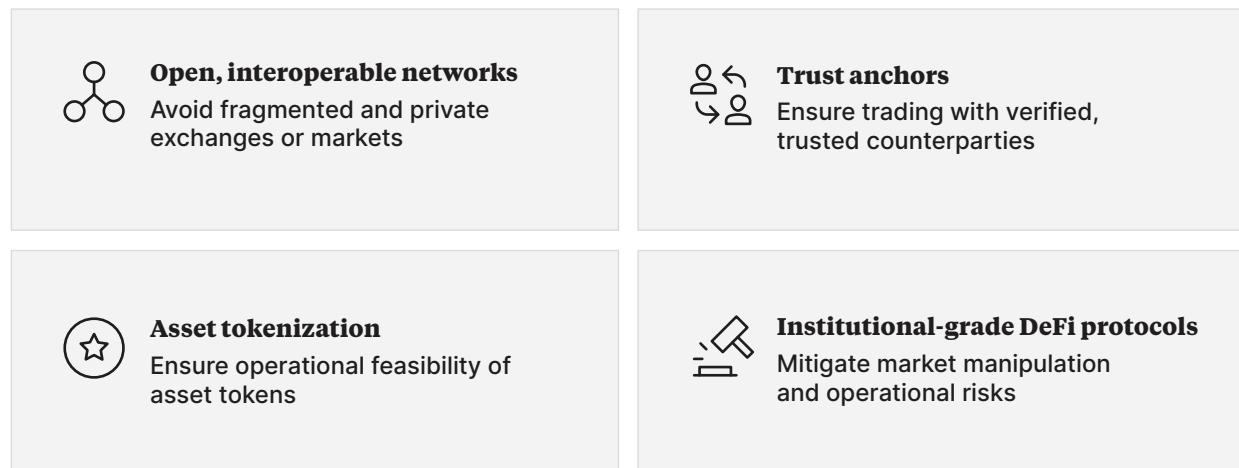**Section 3**

# Institutional DeFi Design in Action

Experimentation is crucial to understanding different approaches to Institutional DeFi. Finance industry participants around the world are increasingly conducting pilots and experiments to explore different design objectives and choices.

This report draws on the hands-on experience of the co-authors in running a joint pilot under Singapore's Project Guardian. The Monetary Authority of Singapore (MAS) launched this collaborative initiative with the financial services industry to explore the economic potential and value-adding use cases of asset tokenization and DeFi. Using a controlled, sandbox environment, it aims to test the feasibility of applying asset tokenization and DeFi protocols, while managing financial stability and integrity.

## 3.1 Introduction of Project Guardian

Project Guardian is designed to help MAS build a digital asset ecosystem framework, develop and enhance relevant policies, and provide direction on technology standards. Project Guardian will test the feasibility of applications in asset tokenization and DeFi, while managing risks to financial stability and integrity. The central bank aims to develop and pilot use cases in four main areas (see next page).

**Exhibit 8: Project Guardian objectives**

**Open, interoperable networks**
Avoid fragmented and private
exchanges or markets

**Trust anchors**
Ensure trading with verified,
trusted counterparties

**Asset tokenization**
Ensure operational feasibility of
asset tokens

**Institutional-grade DeFi protocols**
Mitigate market manipulation
and operational risks

**Open, interoperable networks**

Explore the use of public blockchains to build open, interoperable networks that enable digital assets to be traded across platforms and liquidity pools. This includes interoperability with existing financial infrastructure. Open, interoperable networks can mitigate against the formation of walled gardens in digital exchanges and fragmented private markets.

**Asset tokenization**

Examine the representation of securities in the form of digital bearer assets and the use of tokenized deposits issued by deposit-taking institutions on public blockchains. The project aims to build upon existing token standards, incorporate trust anchor credentials, and enable asset-backed tokens to be interoperable with other digital assets used in DeFi protocols on open networks.

**Trust anchors**

Establish a trusted environment for the execution of DeFi protocols through a common trust layer of independent trust anchors. Trust anchors are regulated financial institutions that screen, verify, and issue Verifiable Credentials to entities that wish to participate in DeFi protocols. This ensures that participants interact only with verified counterparties, issuers, and protocol developers.

**Institutional-grade DeFi protocols**

Study the introduction of regulatory safeguards and controls into DeFi protocols to mitigate against market manipulation and operational risk. The project will also examine the use of smart contract auditing capabilities to detect code vulnerabilities.

Source: Monetary Authority of Singapore

## 3.2 Project Guardian Pilot One

In the first pilot, our co-authors gained first-hand experience in implementing DeFi solutions in the financial markets, including foreign exchange and government bond markets. This section details the pilot's business objectives, design choices, and the lessons learned to date.

### 3.2A – Business Objectives: What did we set out to achieve?

Pilot One was led by co-authors DBS, Onyx by J.P. Morgan, and SBI Digital Asset Holdings. It sought to determine whether tokenized real-world assets and deposits could be transacted on a public blockchain leveraging DeFi protocols, in a compliant manner that preserves financial stability and integrity. The intent was to explore the delivery of traditional financial services in a more open manner, fostering broader participation in foreign exchange and government bond markets through an open and efficient ecosystem that attracts liquidity providers and liquidity takers.

There were two workstreams in this pilot to ensure comprehensiveness. Workstream one focused on foreign exchange transactions using SGD tokenized deposits issued by J.P. Morgan and JPY tokenized assets issued by SBI Digital Asset Holdings,[36] and workstream two focused on the trading of foreign exchange and government bonds using tokenized cash (deposit) and tokenized securities between entities of DBS and SBI Digital Asset Holdings.[37] Transactions under both workstreams were conducted on public blockchain main net, focused on technical and operational feasibility, and participants established bilateral terms and other controls to avoid actual financial impacts, such as planned trade unwinding for workstream one.

To fully assess the efforts needed for the implementation of Institutional DeFi, the pilot went through the complete lifecycle from trade order placement, to trade execution, token settlement and clearing. Relevant business and operational teams from front office to back office were involved to assess potential gaps ahead of the potentially scaled implementation of Institutional DeFi, reducing adoption friction and encouraging internal buy-in. Transactions were executed using modified public DeFi protocols and leveraged Verifiable Credentials issued by trust anchors to ensure transactions were executed in a safe and compliant manner.

We illustrate the design choices made under the four focus areas (see next page).

**Exhibit 9: Project Guardian Pilot Setup**

| | |
|---|---|
| **Open, interoperable networks**<br>Avoid fragmented and private exchanges or markets<br><br>↓<br><br>Pilot<br>**Public blockchain**<br>Deploy solution on public blockchain for transactional activities | **Trust anchors**<br>Ensure trading with verified, trusted counterparties<br><br>↓<br><br>Pilot<br>**Verifiable credentials**<br>Issue digital Issue digital identities to trade only with verified counterparties |
| **Asset tokenization**<br>Ensure operational feasibility of asset tokens<br><br>↓<br><br>Pilot<br>**Tokenized deposits & bonds**<br>Issue and transfer tokenized assets using a public blockchain | **Institutional-grade DeFi protocols**<br>Mitigate market manipulation and operational risks<br><br>↓<br><br>Pilot<br>**Refined DeFi protocols**<br>Adapt open-sourced protocols to effect transaction terms |

Source: Oliver Wyman Forum, DBS, Onyx by J.P. Morgan, SBI Digital Asset Holdings

- **A public blockchain**, Polygon was selected for its potential to allow higher interoperability of tokenized real-world assets and DeFi protocols, which allowed participants to develop their own solutions based on a set of agreed upon technical standards.

- **Trust anchors** were developed to ensure all trades were conducted within a controlled, trusted environment. W3C Verifiable Credentials issued by trusted financial institutions were used to enable compliant access to the DeFi protocols. Verifiable Credentials consisted of tamper-resistant information (identifiers and metadata) that cryptographically attested to the identity of the entity/person using them. These credentials were developed using W3C standards to reinforce Project Guardian's interoperability objective.

- The pilot leveraged **tokenized assets** created by the co-authors across two workstreams. In workstream one, Onyx by J.P. Morgan focused on tokenized Singapore dollar (SGD) deposits and SBI Digital Asset Holdings focused on tokenized Japanese Yen (JPY) assets. In workstream two, DBS focused on

tokenized SGD deposits and tokenized Singapore Government Securities (SGS), and SBI Digital Asset Holdings focused on tokenized JPY deposits and tokenized Japanese Government Bonds (JGB). Our co-authors played unique roles to complete bilateral trades within these workstreams.

- Participants used **modified public DeFi protocols** to conduct the transactions – a lending and borrowing protocol (Aave) was applied to a foreign exchange use case in workstream one, and a decentralized exchange protocol (Uniswap) was applied to the trading of foreign exchange and government bonds.

The pilot found that DeFi protocols have potential to be adapted and tailored for foreign exchange and government bond markets activities on a public blockchain. Further details of the pilot will be explored in subsequent sub-sections. Continuous improvements and testing of solutions are on the horizon to better serve participants' circumstances, needs and objectives. The use of specific protocols by the pilot participants does not constitute an endorsement of such protocols by any author of this report. The participants will continue to experiment, both adapting existing protocols and building new ones. Independent judgment should be exercised in selecting an appropriate protocol to suit any individual's or organization's circumstance, needs, or objectives.
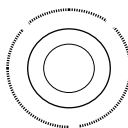
## 3.2B – Design Choices: What did we do to make DeFi work?

Among multiple design aspects, our co-authors believe at least two were critical: 1) a trusted method to establish identity for financial institutions to participate in transactions against known and attested counterparties on a public blockchain, and 2) alignment on technical standards underpinning interactions on the public blockchain, using tokenized deposits and assets.

1. **A trusted compliant method:**
Trust anchors and Verifiable Credentials were used to authenticate identity and connect with existing legal frameworks.
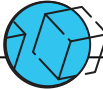
Trust anchors were regulated financial institutions that verified and issued Verifiable Credentials to participating traders, enabling them to transact on the public blockchain. The trust anchors can be viewed as the universal trust layer, providing participants with a compliant gateway to the Institutional DeFi solution. The implementation of the trust anchor mechanism was flexible and could vary across institutions. For example, authorized traders were issued credentials by their parent institutions, through various internal processes and credential issuing software. These credentials were attached to trade instructions to the DeFi pool, and on-chain verification of these credentials ensured that only instructions with legitimate credentials were forwarded to the DeFi pool.

2. **Alignment on technical standards:**
Standards such as ERC-20 and W3C were used to allow potential interoperability among pilot participants.

The participants aligned on technical standards to allow interoperability between specific DeFi protocols and existing legacy off-chain systems. Interoperability also drove the choice towards the use of ERC-20, the most-common token standard in the Ethereum ecosystem, to define token ownership, supply, type of issuance, and data to be stored on-chain, such as the token name and ticker. Moving forward, there may be other standards such as ERC-1155 that could better represent traditional instruments on-chain and for trading. The Verifiable Credentials were developed based on W3C standards to enable participants to transact in a compliant manner on a modified version of the permissioned Aave protocol on the Polygon network.

**Exhibit 10: Summary of Project Guardian Design Choices**

| Design choice | | Rationales (non-exhaustive) |
| --- | --- | --- |
| **Blockchain** | | |
| Network type | Polygon (public blockchain) | • Compliant with Ethereum Virtual Machine and could potentially inherit data availability and security provided by Ethereum Layer 1<br>• Strong developer ecosystem; Open-source DeFi protocol resources available for feasibility assessment and rapid development<br>• Instances of institutional participation on the network (or in the ecosystem)<br>• Use of proof of stake (PoS) consensus ensuring less energy consumption in validation |
| Data security and visibility | Only wallet address disclosed with identity kept confidential. Transaction data stored in public blockchain with no details disclosed to non-participants | • Fulfil the purpose of pilot and experiment data security and visibility on public blockchain to prepare for scalable adoption by the industry<br>• Minimize identifiable data on-chain in a controlled environment to avoid leakage of confidential data to public during the Pilot |

| Participation | | |
|---|---|---|
| Deployment | Assurance-based model, authorizing only pilot participants to deploy modified open-source smart contracts, such as permissioned version of Aave, to interact with other participants | • Developers are limited to pilot participants, who are known regulated entities and individuals<br><br>• Institutional-grade development standards were applied to aid client protection, such as smart contract audits, Verifiable Credentials of the participants, and product/code management process<br><br>• Potential for rapid parallel developments by leveraging composable DeFi protocols, reducing time and cost of innovation |
| Access and usage | Trust anchors verify and authorize participants, using W3C-based Verifiable Credentials (VCs) | • Participant firms function as trust anchors to run Verifiable Credentials (VCs) issuance software to issue VCs to authorized traders<br><br>• VCs were held by traders in custom-built wallets. The wallets enabled VCs to be attached to trade instructions and on-chain verification ensured only instructions with legitimate credentials were accepted<br><br>• The smart contract system was designed to enable use of VC verification without requiring the DeFi protocols to be aware of the actual credentials, thereby enabling the use of this system with a wide variety of DeFi protocols "out of the box" for future scaled adoption. The verification of VCs was done on-chain by smart contracts before being forwarded to the DeFi pool<br><br>• The issued credentials followed a chain of trust, every authorized trader credential (including various control mechanisms such as trading limits) was irrevocably anchored to a trusted entity<br><br>• Traders never had direct access to firms' funds. The solution enabled verification of traders' identities on chain, based on which they were authorized to trade on the application<br><br>• These Verifiable Credentials could be revoked. Upon revocation, traders would be prevented from trading<br><br>• The use of W3C open standards ensured that the implementation aligned with Project Guardian's interoperability objective |

| Token Design | | |
|---|---|---|
| **Token issuance** | Multiple issuance approaches were taken, such as<br><br>• DBS issuing tokenized SGD and non-native Singapore Government Securities (SGS) tokens<br>• J.P. Morgan issuing native Singapore dollar deposits (SGD) tokens<br>• SBI issuing non-native Japanese Government Bonds (JGB) tokens | • The use of tokenized form enables interactions with DeFi protocols for real-world assets, and the use of different token issuance approaches can test the interoperability of tokens issued by different mechanisms and players, e.g.:<br>  – Different token structures were used for payments, including DBS's tokenized SGD representing tokenized cash against customer deposits; native deposit tokens such as JPM's tokenized SGD deposits (evidence of demand deposit claims for fiat amounts against the issuing bank, in native token form on blockchain, as an alternative to recoding balances in a demand deposit account (DDA) in traditional ledger system); and SBI's non-native JPY assets (claim against a non-bank issuer for an asset held with a third-party bank)<br>  – Tokenized securities experimented included non-native tokenized SGS and JGB, which were designed as representations of underlying assets and not as standalone securities, value of tokens anchored to the value/price of underlying assets |
| **Settlement recognition** | On-chain atomic settlement finality without intermediary, followed by off-chain ledger update (for reporting purposes) | • Integrated with legacy trading systems and processes for governance and controls<br>• Enhanced transaction transparency and traceability, and the blockchain deemed to be the definitive record of trades<br>• Underpinning legal agreements deemed to be determinative in the event of any dispute, in the absence of established regulations<br>• Off-chain record for reporting purpose |
| **Token standards** | ERC-20 | • ERC-20 is a recognized standard that 1) could work with multiple existing open-source DeFi protocols, 2) ensures tokens are fungible when minted by same issuer/smart contract<br>• Note: There is a potential to explore other standards (e.g., non-fungible token standards) for better on-chain representation and trading |

Source: Oliver Wyman Forum, DBS, Onyx by J.P. Morgan, SBI Digital Asset Holdings

## 3.2C – Lessons Learned to date: What needs to be done to reach scale?

Scaling the solution to benefit global financial markets will require more work. From experience with Pilot One to date, our co-authors have jointly identified seven areas that would need broader industry efforts to build the scalable foundation for Institutional DeFi offerings.

### #1 Legal clarity on frameworks

Participants need to actively identify areas that need clarity within the prevailing legal and regulatory framework and engage with regulators and legislatures to drive regulatory and legislative solutions that account for this new financial environment enabled by the new technology. These efforts should address issues such as recourse mechanism, on-chain settlement treatment, KYC and AML, usage and holding of crypto-assets, and legal and accounting treatment of business activities:

- **Recourse mechanism:** Existing legal recourse and dispute management processes may be insufficient to address potential disputes in a blockchain environment in the absence of separate contractual arrangement, especially for issues currently handled by an intermediary or agent. For example, crypto bridge Nomad alerted law enforcement about a loss from a cyberattack, but there was limited recourse as authorities could not retrieve the funds, and Nomad had to bear a $200 million loss.[38] Pilot One utilizes bilateral agreements to resolve potential

legal disputes and address this issue. A multilateral framework and pre-defined participation rulebooks could reduce legal complexity among more participants.

- **On-chain settlement treatment:** Token-based trading and settlement require enhanced forms of record keeping and synchronization across on- and off-chain ledgers. For example, transactions were recorded (manually) in Pilot One on an off-chain legacy system for reporting and auditing purposes. Clear guidelines are needed to clarify roles of on-chain and off-chain operations, such as accounting and redemption processes, to comply with regulations and controls.

- **KYC and AML:** Further regulatory guidance is needed with regards to dealings with KYC, AML, and sanction issues for on-chain financial transactions, given the pseudonymous nature of existing DeFi protocols. Pilot One's Verifiable Credentials-based identity solution serves as an example of how to ensure each counterparty is a permissioned and trusted entity. The pilot established that trust mechanisms can be universally accepted despite being implemented in different ways as long as they adhere to a common fundamental standard.

- **Usage and holding of crypto-assets:** Different regulators have imposed different restrictions on financial institutions with regards to holding crypto-assets, which are needed to pay for verification/processing of the transactions (gas fees) on public blockchain networks. Regulation will play a key role in reducing this friction.

- **Legal and accounting treatment of business activities:** It is currently uncertain how to classify certain transactions that use DeFi protocols when there is an interaction with a common asset pool. For example, it is currently ambiguous, from accounting and legal perspectives, when and how to classify contributions into liquidity pools, as the transaction may be treated as a sale, an investment in a fund, or not recognized until a trader trades the asset against the pool. While Pilot One mitigated this ambiguity via bilateral agreements, clarity on accounting and legal recognition will be required at a broader level to achieve scale.

#2 Adoption incentives

In addition to the efficiency gains of Institutional DeFi solutions, appropriate incentive mechanisms could encourage scalable adoption. Novel tokenomics arrangements in the crypto-asset industry, which enable liquidity providers and developers to earn tokens as participation rewards, might not apply readily in mainstream finance. Targeted incentives will be needed to encourage adoption and such incentives are likely to differ across various stakeholders and participants. Further iteration is required as the Institutional DeFi space is at a very early stage of development.

#3 Guardrails or tools

To ensure transactions happen in a safe and trusted manner, preserve transaction privacy, and provide security assurance against potential hacks, more tools are needed to streamline DeFi protocol development

and improve the integration experience to drive usage. Pilot One participants engaged with third-party auditing services to conduct complete smart contract audits prior to deployment. Participants also used Verifiable Credentials to establish a strong framework for instituting trusted identities and the accompanying qualifications to 'permission' the participation in the DeFi liquidity pools. Nonetheless, more can be done to facilitate industry adoption, such as establishing an industry-recognized smart contract standard for interoperability. Other feasible actions include formalizing how Verifiable Credentials and similar solutions can be leveraged, limiting a trader's access to company funds/assets, protecting against concepts such as maximal extractable value (MEV), and lowering the threshold for developers to deploy and participants to use Institutional DeFi solutions.

#4 End-to-end co-ordination

Orchestration between legacy systems and blockchain-based assets and business logic is required to enable process and data interoperability. Participants need to explore Institutional DeFi in a comprehensive manner, involving all relevant business lines and evaluating and updating existing processes to capture/realize the potential benefits. For example, as transaction data is recorded on a mutualized public ledger, workflows can be adapted to refer to the ledger instead of legacy systems for faster reconciliation. At a broad level, programmable smart contracts could enable a high degree of automation, transparency, and efficiency in financial transactions.

**#5 Continuous test-and-learn and improvements**

Modifying DeFi protocols to force-fit them for institutional use is a test-and-learn process. DeFi protocols are designed to ensure that key market metrics, such as interest rates, collateral haircuts, and the like, follow supply and demand dynamics of the assets trading within them. For Pilot One, some of these codified rules had to be tailored to force-fit the business objective, such as altering interest rates of the lending protocol to zero, to avoid unintended behavior during transactions.

**#6 Alignment on industry-wide technical standards**

Standardized, well-adopted frameworks lay a strong interoperability foundation on which DeFi applications could be built and interact. Furthermore, seeking and collaborating with like-minded participants – and moving from proofs of concept to production – are critical in creating such a foundation. The value of this approach was demonstrated by Pilot One's

rapid solution development by leveraging an Ethereum-compatible public blockchain, ERC token standards with W3C Verifiable Credentials standards, and open-source DeFi protocols.

**#7 Refined business models**

he pilot demonstrated that DeFi protocols can unlock benefits associated with tokenized asset transactions. A key value-add of using DeFi protocols is the ability to codify core and non-core functions within financial services. The use of blockchain as the book of records allows for potential minimization of post-trade reconciliations between participants, thereby reducing operational overhead. Other potential benefits include greater transaction transparency, lower settlement risk, as well as enhanced efficiency and trading velocity due to atomic settlement. Nonetheless, the use of DeFi could lead to alteration of exiting business operations, requiring participants to refine business and operational models to capture the incremental business value.

## Conclusion

**Institutional DeFi is feasible, but work is needed to drive adoption at scale**

While Pilot One demonstrates the feasibility of Institutional DeFi solutions when paired with tokenized assets, more work is needed to drive adoption and scale. Drawing on the seven lessons learned, we believe the industry should focus its collaborative efforts in three areas: a) addressing legal and regulatory uncertainties, b) establishing shared standards, and c) envisioning a target market structure.

**Section 4**

# Strategic Implications for the Finance Industry

We are seeing emerging efforts to tap into the value of Institutional DeFi and transform the finance industry by creating new solutions or enhancing existing ones. This process is still in its early days and more work is needed by both individual firms and the broader industry to scale these efforts.

In Section 4.1, we examine three areas where the industry could take collaborative actions to facilitate the adoption of Institutional DeFi. Then in Section 4.2,

we will share preliminary perspective on areas where individual firms could develop their own approach – aka a "playbook" – to Institutional DeFi. Worth noting, the perspectives in the joint report are not recommendations and they might become dated quickly given the rapidity with which the industry is evolving. All industry participants should create their own bespoke approaches to collaborate to maximize benefits for end-clients.

## 4.1 How the finance industry can foster Institutional DeFi

In Sections 2 and 3, we showed how an Institutional DeFi solution can be designed to fit business objectives while navigating industry constraints. But we observed that more could be done at an industry level to lower the threshold for adoption and amplify the value to be unlocked.

Drawing on lessons learned from industry pilots, we see three areas where industry could work together (see exhibit 11). Coordination is essential for widespread adoption of Institutional DeFi. Siloed efforts create the risk of inconsistencies across the industry, potentially stymieing progress and porting existing challenges to this new technology; joint efforts maximize network effects via interoperability and are likely to accelerate adoption.

Industry participants will play different roles toward these ends. We will share perspectives of a general industry framework for roles and responsibilities but be mindful that each business and jurisdiction may require refinement based on its localized specificities.

**Exhibit 11: Key Areas of Institutional DeFi Adoption Efforts**

| 1 | 2 | 3 |
|---|---|---|
| **Addressing legal & regulatory uncertainties** | **Establishing shared standards** | **Envisioning target market structure** |

Source: Oliver Wyman Forum, DBS, Onyx by J.P. Morgan, SBI Digital Asset Holdings

**Exhibit 12: Key Areas of Institutional DeFi Adoption Efforts – Details**

|  | 1. Addressing legal and regulatory uncertainties | 2. Establishing shared standards | 3. Envisioning target market structure |
|---|---|---|---|
| Objectives | Ensure regulatory compatibility across industry and jurisdictions, to minimize frictions such as arbitrages, and provide transparency and clarity | Reduce investment need for adopting Institutional DeFi by creating common technological standards that permits open access | Create a common vision on how the industry should operate – economics, participants, governance, etc. – to reduce uncertainties, encourage adoption, and foster innovation |
| Example actions | Foster public-private partnership to develop the right regulatory framework that supports sustainable market growth and innovation (e.g., token legal status, capital requirements, etc.)<br><br>Drive common framework and approach across jurisdictions to minimize friction across global finance jurisdictions<br><br>Develop dispute management and recourses processes where not currently sufficient | Align blockchain usage and token standards<br><br>Develop digital identity verification tools<br><br>Promote best practices on cybersecurity and development process<br><br>Create adoption tools, such as for blockchain interoperability with off-chain systems, risk and compliance reporting tools | Drive greater collaboration between Traditional Finance (TradFi) and DeFi players – sharing industry challenges, lessons learned from pilots and identify where and how to work together<br><br>Proactively engage regulators on changes needed to unlock value – driven at a use case/pilot level to bring depth and action |

Participant Types and their Primary Roles

|  | Addressing legal and regulatory uncertainties | Establishing shared standards | Envisioning target market structure |
|---|---|---|---|
| Regulators[I] | **Drive** | **Facilitate** | **Facilitate** |
| Financial Intermediaries[II] | **Facilitate** | **Drive** | **Drive** |
| Users[III] | **Contribute** | **Contribute** | **Facilitate** |
| Third parties[IV] | **Support** | **Drive** | **Support** |

| Example actions | | | |
|---|---|---|---|
| ■ Drive<br>Chair efforts and engagements (e.g. sandboxes) | | ■ Facilitate<br>Provide advice; get involved actively in engagements | |
| ■ Contribute<br>Participate in proofs of concept and pilots | | ■ Support<br>Review and validate outputs | |

I. Regulators - e.g., central banks, international bodies, II. Financial Intermediaries - e.g., banks, brokers,
III. Users - e.g., corporates (issuers, borrowers), investors, IV. Third parties - e.g., technology vendors, DeFi community

Source: Oliver Wyman Forum, DBS, Onyx by J.P. Morgan, SBI Digital Asset Holdings

## 4.2 Playbook for financial institutions

The rapid evolution of blockchain technology and the potential disruption it can bring requires institutions to get ahead of the curve to avoid being left behind. This is not meant to suggest every institution needs to be a leader, but it does require institutions to form a house view on the future of DeFi and the implications for the business, and then define the relevant participation and operating models to fulfill on their ambitions. This is not a one-off exercise. It should be iterative given the dynamic nature of blockchain and DeFi protocols.

**Exhibit 13: Key Actions to Build Playbook**
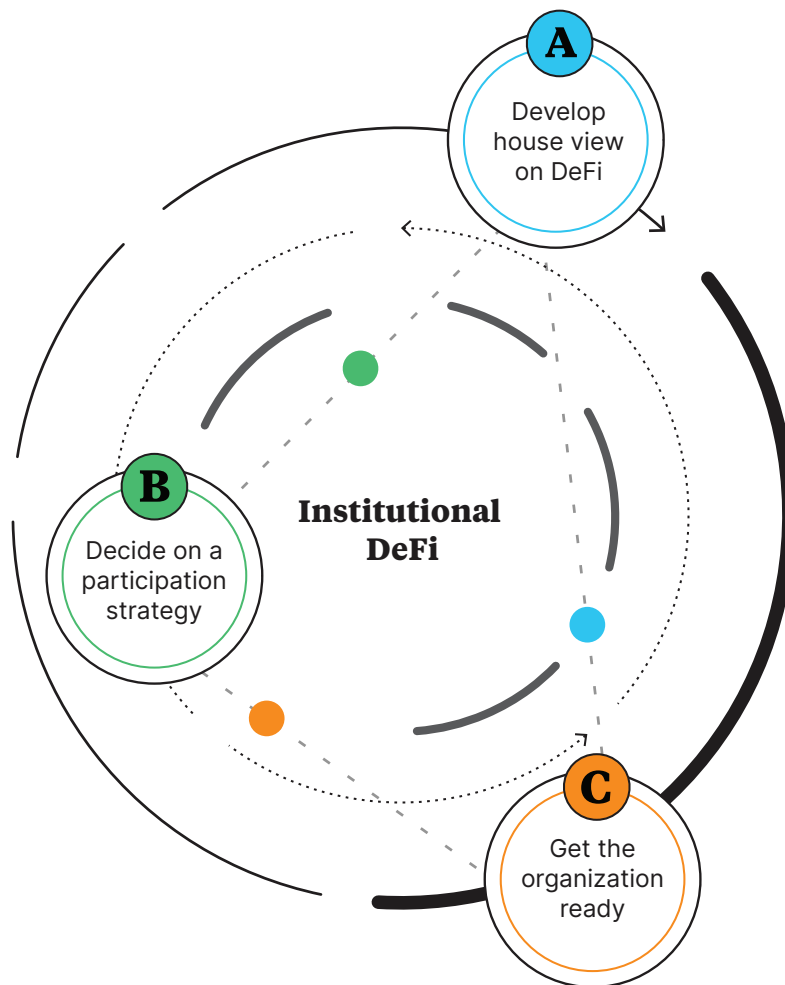


Source: Oliver Wyman Forum, DBS, Onyx by J.P. Morgan, SBI Digital Asset Holdings

## 4.2A – Develop a house view on DeFi

Institutional DeFi efforts are already happening and starting to bring change to the finance industry. The road ahead remains unclear, and the degree of change is likely to vary by business and market segment. We see a spectrum of potential paradigms for the future of financial services, ranging from a modest evolution of existing market structures to a complete revolution that leaves DeFi triumphant. We already observe how both ends of the spectrum are driving change, with financial institutions starting to evolve and develop Institutional DeFi solutions while native DeFi players are looking to disrupt financial services with their decentralized solutions.

**Exhibit 14: Potential Future Paradigms of Financial Services**

Evolution ← → Revolution

**?**

### Future is uncertain

A spectrum of paradigms could arise for example:

DeFi revolutionizes the financial industry

—

The finance industry successfully evolves

—

Parallel evolution of DeFi & the finance industry

### Financial services

Players investing in blockchain-based solutions

### DeFi-native

Players disrupting the finance industry
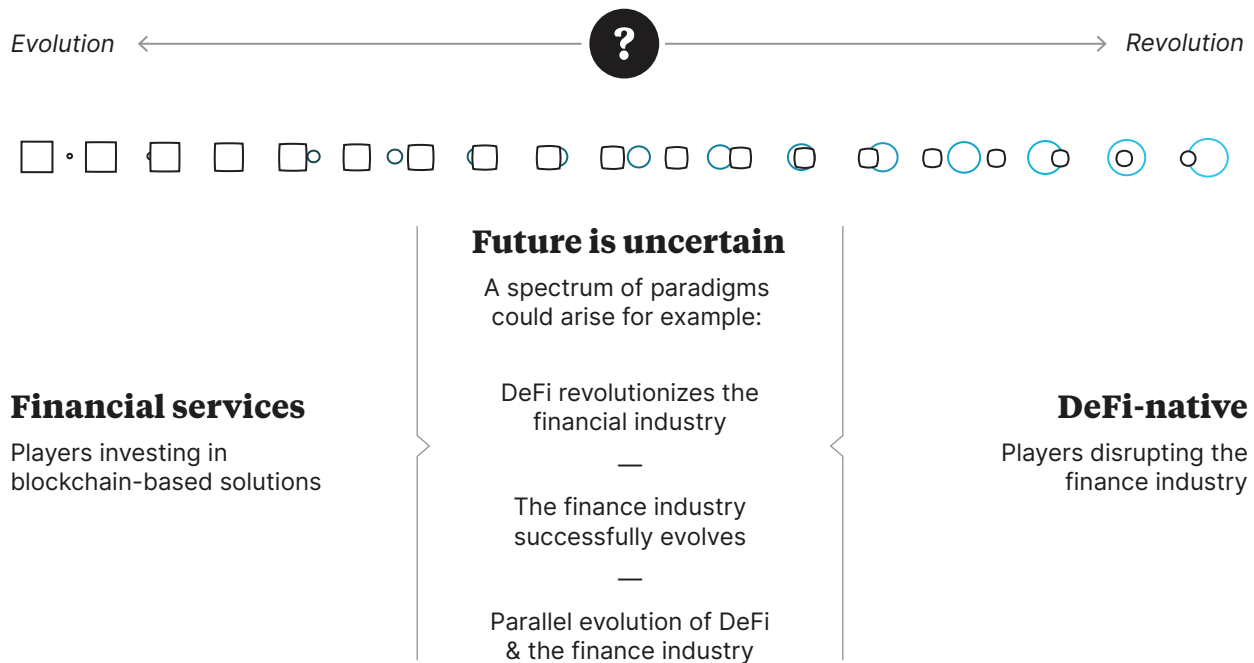
Source: Oliver Wyman Forum, DBS, Onyx by J.P. Morgan, SBI Digital Asset Holdings

Change will likely be significant regardless of the paradigm that dominates, but the specific outcome will likely vary by market, jurisdiction, and business line depending on customer and regulatory acceptance. With all this uncertainty, it is important that industry participants take a scenario-based approach that enables them to examine multiple different potential futures while maintaining analytical discipline by requiring each scenario to use coherent and integrated assumptions. Based on these scenarios, firms could form a house view of the future and assess its implications for their business portfolios, profitability, funding costs, and the like. To get to that view, firms could consider three broad questions:

- What are the future scenarios shaping the industry and key watch points or triggers?

- What are the implications for our clients and competitors?

- What does this mean for our portfolio and financials?

Once they form their view of the future, firms could perform an impact analysis to assess the specific implications on their current business and financials while agreeing on the key watch points to monitor to potentially accelerate or pivot their responses. Depending on the scenarios used, regulatory developments, and the firm's current position, implications could take on varying degrees of scale and urgency. Scenario analyses should aid senior management to align on a view of the future and implications for the business. Based on this, firms can then determine if, where, and how to participate, which we discuss next.

**Exhibit 15: The Implications for Key Industry Sectors**

| Key sectors | Opportunities and challenges |
|---|---|
| **Commercial and investment banks**<br><br>• Equity Capital Markets, Debt Capital Markets<br><br>• Brokers, dealers, inter-dealer brokers | Opportunities<br><br>• Enhance existing offerings, e.g., intraday repo to raise short-term capital, additional sets of collateral such as tokenized funds<br><br>• Innovate in new business models, e.g., 24/7 automated market marking (AMM)<br><br>• Adopt new business and economic models as over-the-counter business becomes exchange-like (likely only for market leaders)<br><br>Challenges<br><br>• Experience heightened competition and potential consolidation, with a rise of capital markets solutions powered by DeFi, squeezing smaller players who cannot afford "cost to participate" to lose market share<br><br>• Face increased revenue at risk from digital-asset native algo traders and market makers, e.g., DRW and RADIX<br><br>• Take on cost and investment burdens from running dual infrastructure and paying up for talent as firms compete |
| **Market infrastructure providers**<br><br>• Exchanges<br><br>• Central Counterparty Clearing Parties<br><br>• Central Securities Depositories (CSD)<br><br>• Securities services (custodians, fund administration) | Opportunities<br><br>• Innovate in new digital assets safeguarding such as verifying digital identity and digital keys to asset tokens, centralized token registries,<br><br>• Develop new digital assets creation and redemption such as on- and off-ramping asset tokens, stablecoin clearing mechanisms<br><br>• Enhance existing data services by leveraging on-chain data, such as machine learning fraud detection, enhanced AML monitoring<br><br>Challenges<br><br>• Experience disruption to existing business model; potential for disintermediation – cost, return pressures for those that do not adapt<br><br>• Face increase in near term CAPEX and run rate to maintain the core and grow into new business<br><br>• Incur additional short-term operational costs due to increased operations to integrate on and off-chain data |

| Other financial intermediaries (OFIs) | Opportunities |
|---|---|
| • Technology vendors<br>• Data providers<br>• Rating agencies | • Provide new governance value-add services, such as smart contract audits, blockchain cybersecurity<br>• Create ecosystem business models with partners such as a platform integrating front and back-end<br>• Tap into new data service opportunities to extract on-chain data for reporting and analysis, such as on-chain big data analyses<br>• Deliver new data services integrating existing off-chain data sources with on-chain venues, such as services to provide off-chain data for on-chain processing via oracles, like Bloomberg data feeds<br>**Challenges**<br>• Face increased pressure to invest as competition for client front-end functionality and access points intensifies<br>• Encounter feature gaps or challenges if current offerings are not adapted to new market structure and activities, e.g., execution management systems and order management systems, new risk guidelines |

Source: Oliver Wyman Forum, DBS, Onyx by J.P. Morgan, SBI Digital Asset Holdings

## 4.2B – Decide on a participation strategy

Where should a firm play in the Institutional DeFi space? This is a question firms will need to work through in defining their strategy. In doing this, firms should look not only to transform existing end-to-end processes with new technology but also think about creating new businesses and new business models. According to a 2022 Celent survey of global institutional investors, 72% showed a preference for working with an integrated provider for all digital asset needs, indicating the need for significant upgrades to current investment management systems.[39]

As strategy is all about trade-offs, being clear on the right trade-offs is critical to aligning an institution and putting in place guardrails to ensure that where and how it participates is in line with its risk appetite and other internal considerations. To think through this, firms may want to consider several questions that can help them agree on a bespoke participation strategy.

**What is our ambition for Institutional DeFi?**

| | |
|---|---|
| Ambition and investment appetite | What do we want to be known for and with what financial impact in near versus medium term? |
| | What has to happen to drive adoption; what are our roles compared to the broader industry and how do we work together to deliver impact? |
| | What is our willingness to invest; how does this align with our risk appetite? |

**Where and how will we participate? What will we not do?**

| | |
|---|---|
| Customer focus | Which client segments are we targeting – size, region, familiarity with DeFi (DeFi IQ), etc., and how will we engage them to drive adoption? |
| | What incentives (carrots/sticks) should we consider to drive adoption with our clients? |
| Serviceable Asset focus | To deliver on our strategy, what is our target asset in our DeFi solutions (i.e., liquid like listed equities versus illiquid like real estate)? |
| | Given our ambition and client focus, what is the range of assets we need and want to serve (large range of assets or specific subsets only)? |
| Offering Proposition | What scale of innovation is required to our proposition – new offerings, evolving existing offerings, single process versus end to end? |
| | Given required innovation, how much can we drive it versus needing to work with the industry to deliver the proposition |

## What is our ambition for Institutional DeFi?

Our co-authors set and share clear ambitions to evolve their business with new technologies over long-term time horizons.

- DBS makes significant technology spending each year which includes experimentation of blockchain technology, as it prepares for a disrupted future where "blockchain will power world's back office in five to 10 years"[40]

- J.P. Morgan started its efforts in the blockchain and digital asset space in 2015, launched its blockchain focused business Onyx by J.P. Morgan in 2020, and is committed to investing further in the space as it plans to "bring trillions of dollars of assets into DeFi."[41]

- SBI established its digital asset arm in 2018, set up its Capital Markets Services subsidiary in 2020, and plans to launch an institutional-grade digital asset securities platform.[42]

## Where and how will we participate? What will we not do?

Our co-authors continuously assess end-to-end business flow to identify where DeFi logic could potentially fit in, whether that is in their non-core functions or core functions. Formulating a firm's participation strategy requires an understanding of their clients' starting point, including their DeFi IQ and willingness to use new technologies. Sell-side firms could guide clients through the adoption journey from a solution-driven perspective, which includes thoroughly understanding clients' pain points, replicating traditional offerings in a new digital format, and building tooling to assist smooth adoption while also testing innovative new products, like intra-day liquidity, and new business models, such as automated market making.

The quality of the new offerings is critical to win the confidence from end-clients. Firms can consider taking gradual approaches to focus on products that are not overly complex and/or markets requiring efficiency improvement on day one, such as illiquid asset classes.

Our co-authors are taking different approaches to participate where they see opportunities to better support end clients:

- DBS offers end-to-end capabilities in the digital assets space. DBS Digital Exchange allows for listing and trading of both digital payment tokens, including crypto and security tokens such as DBS Digital Bond originated by DBS Capital Markets; DBS Digital Asset Custody provides an institutional-grade solution to safekeep digital assets; Partior (a joint venture with Onyx by J.P. Morgan and Temasek) enables atomic settlement of payment transactions.

- J.P. Morgan provides different products and infrastructure in the space, including intraday repo and tokenized collateral services on its Onyx Digital Assets platform, and blockchain-based deposit account products on the JPM Coin System, and continues to explore expanding to other asset types and the other blockchain environments, including public blockchain.

- SBI is actively involved in the space, launching efforts across numerous digital asset classes, including NFTs, Web3 tokens, and tokenized traditional securities, and providing infrastructure and tools, such as AsiaNext, their regulated digital asset exchange joint venture with Swiss Digital Exchange (SDX).

Each finance industry institution needs to tailor their participation strategy for specific markets, business, and clients.

## 4.2C – Get the organization ready

There are a number of "make it happen" areas firms could consider as they work to fulfill their ambitions. In this section we focus on three areas of capabilities. The degree of effort in each requires clear alignment with a firm's ambition:

- Design organizational structure to deliver on the ambition

- Choose the right delivery model given internal capabilities, risk appetite

- Develop the right talent strategy to build propositions

### Design organizational structure to deliver on the ambition

The level of organizational support and engagement determines the feasibility of achieving such transformative opportunities. Each of our co-authors has opted for different operational set ups, with varying extents of centralization, such as focusing on one business unit only, or stretching across the entire business. SBI Holdings created a separate centralized entity, SBI Digital Asset Holdings; JP Morgan established Onyx by J.P. Morgan within the firm to engage on blockchain matters across the entirety of the firm's businesses; DBS leverages an ecosystem approach to engage in blockchain initiatives across the organization and externally with industry partners. DBS established DBS Finnovation, a holding company which houses DBS Digital Exchange and Partior (a joint venture among DBS, Onyx by J.P. Morgan, and Temasek).

### Choose the right delivery model given internal capabilities, risk appetite

There are a number of factors to consider when determining the delivery approach, such as ensuring that proofs of concept are done with scaling in mind; working with like-minded partners to build, test, and evolve the proposition based on lessons learned; and taking a co-creative approach with clients and regulators, being clear on what is needed from regulators to make pilots a scalable reality. External collaborations would require due diligence to ensure suitability of partners and alignment on new solution.

Regarding ways of working with partners, there is no one size that fits all. We observe a few notable delivery approaches depending on a firm's level of belief and participation strategy - in-house builds, use of vendors, or leveraging industry consortiums. For instance, Vanguard partnered with vendor Symbiont and its blockchain platform Assembly;[43] BNY Mellon, Morgan Stanley, and UBS joined a consortium led by iCapital to leverage blockchain-based solutions;[44] J.P. Morgan delivered its blockchain solutions through internal efforts spearheaded by its Onyx by J.P. Morgan unit and predecessor teams; DBS leverages a mixture of options such as tapping internal capabilities for the solutioning in this pilot while also engaging external vendors for some of the other initiatives.

**Develop the right talent strategy to build propositions**

Building out these bespoke solutions requires a mix of talent, not just technologists. Our co-authors have built teams with professionals from a variety of backgrounds while at the same time working to right-skill their existing teams. The co-authors note that to attract the right talent, firms need to complement talent strategies with branding efforts to ensure they have a compelling "digital brand" aligned with their ambitions. At the same time, existing talent needs to be refreshed with internal "mindset change" efforts, such as training and incentive programs.

To help drive change, we also observe peers building specialist task forces. These teams play a role in driving proofs of concept and also act as a catalyst for reshaping the culture and right-skilling teams. The task forces tend to play various roles depending on a firm's ambition. They also can work with relevant middle- and back-office teams to understand requirements and assess new solutions, such as digital identity solutions. They also can work with front-office teams to assess demands from clients and jointly determine whether new solutions are sufficiently valuable for clients. These task forces can be complemented by other efforts depending on a firm's starting point, including driving firmwide education initiatives, running or supporting hackathons and other internal accelerators, and driving co-creation workshops to apply DeFi and identify challenges that need to be worked through.

# Conclusion

**Four effective moves for seizing Institutional DeFi opportunities**
Drawing on the experience of our co-authors, we identified four key effective moves for financial institutions exploring DeFi use cases.

- **Focus on business impact and getting production-ready,** instead of just running proofs of concept for the technological feasibility of employing blockchain, tokenization, or DeFi

- **Collaborate with like-minded peers and clients to advance solutions** and set tokenization and DeFi standards for interoperability as the foundation of scaling and mass adoption

- **Assess improvement areas with multiple teams throughout the existing end-to-end business process,** and innovation areas to build new businesses, rather than siloed efforts

- **Proactively work with regulators, sharing feedback and concrete asks** based on first-hand findings to co-create environments that protect clients and financial stability.

From the telegraph to the mainframe, technology has shaped the finance industry for generations. Institutional DeFi has the potential to be the next great transformative force.

Learn the no-regret moves your business can take now to prepare for the future.

The opportunity is here.
The time to build the future is now.

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