

NAVIGATING DECENTRALIZED FUTURES

A FINANCIAL SERVICES PERSPECTIVE: TAXONOMY
AND IMPLICATIONS

Contents

Abstract	03
Introduction	03
Evolution Of Blockchain	03
Blockchain and financial services: It's a match! Or is it?	04
Decentralized finance (DeFi)	05
Central bank digital currency (CBDC)	06
Digital assets and tokenization	07
Cryptocurrencies	07
Non-fungible tokens (NFT)	08
Navigating decentralized futures: building blocks for an enterprise	09
Technology	10
Tokens	10
Interoperability	10
Business model	11
Capgemini's ecosystem and assets: a trusted orchestrator for DLT services	12
Future Thinking	13
Change Making	13
Call to Action	13
Conclusion	13
Authors	14
References	15

Abstract

The modern financial system is based on a centralized, hub-and-spoke model of interconnected networks. While this interdependent system has facilitated global exchange to an extent, it could cause ripple effects if one part of the system is affected. The financial crisis of 2008, which highlighted this flaw in a centralized architecture that radiated the effect from hubs to spokes triggering a global recession, is a case in point. While developments such as open banking have opened the doors for innovation, most of the current financial landscape relies on complex legacy systems. What's more, although the current financial systems, that are centered around institutions, have their own complexities, inefficiencies, and challenges, it is still not clear how we could overcome these issues, and more importantly, what the role of blockchain technology will be.

This paper presents an umbrella view to define and clarify different terms evolving in the decentralized world. Our aim is to equip business and technology leaders with a clear understanding of key concepts, highlight the potential implications to incumbents, and provide a framework to navigate different building blocks of blockchain technology. If you are someone looking to navigate decentralized futures, we hope this paper will be a good starting point.

This paper will address the following questions: Can blockchain-led decentralization of financial services solve the inefficiencies without introducing any inherent risks? Are decentralized financial systems a threat to incumbents or can they coexist with the current system?

We believe that a step towards decentralization can help solve inefficiencies associated with the traditional financial system, of speed, cost, security, transparency, and convenience. Blockchain technology brings with it the benefits of smart contracts, cryptography, auditability, immutability, and transparency of information. However, a fully decentralized and autonomous financial system appears far-fetched and comes with inherent risks of scalability, accountability, and security. We conclude that the future will witness an equilibrium between centralized and decentralized systems that will drive innovation in financial services while ensuring regulatory compliance.

Disclaimer: Please note that this is not a static document, given the rapid pace of development and expansion in this space. The document will be available online, and each section will be expanded as it evolves.

Introduction

At Capgemini, we have adopted a "Future Thinking" approach to anticipate and assess the evolving technology landscape on an ongoing basis to help our clients achieve competitive advantage and differentiation. Through a global, dedicated

network of capabilities, we constantly track 10 technology domains. "Decentralized Futures," which encompasses blockchain and other distributed ledger technologies, is one of the ten domains. This paper is intended to provide a financial services perspective on "Decentralized Futures" amid rapid developments in this area.

Evolution Of Blockchain

"Blockchain" has been a buzzword for more than a decade, yet it feels neoteric, such have been the developments in this area for the past few years. What began with the hype surrounding the rise of bitcoin has now attracted several industry sectors to consider the potential applications of the underlying technology. And yes, bitcoin (and other cryptocurrencies) are finding their own ways to impact and be impacted by market movements.

Blockchain forayed into the world through cryptocurrencies in 2008, devised as an alternative to fiat currency at the backdrop of the financial crisis. By 2014, the technology began gaining interest for enterprise applications with the release of Ethereum that came with smart contracts. Scepticism regarding the public nature of blockchain then led to more enterprise-centric developments during the next couple of years: private blockchains emerged through Hyperledger and later Corda; a large number of consortia were formed; large tech companies started providing blockchain-as-a-service; and investments in blockchain startups skyrocketed.

All these developments provided a test bed for enterprises to test the waters with the technology. Through 2016 to 2018, large numbers of blockchain projects were established. However, most of the projects were limited to a proof of concept or pilot, as enterprises struggled to achieve the balance between technology (platform, scalability, and interoperability) and business (use cases, governance, and ROI). Yet the good news is that there has been a significant uptick in new blockchain projects deployed at scale during the past two years, especially in financial services.

In this paper, we examine the recent developments in blockchain applications for financial services, stress test hype vs reality, and assess the building blocks for enterprises to manoeuvre the future, which certainly seems to be decentralized. With changing technology dynamics, customer expectations, and regulatory pressures, how should financial institutions prepare for a decentralized future? In particular, we look at five major developments – decentralized finance (DeFi), central bank digital currency (CBDC), cryptocurrencies, digital assets, and non-fungible tokens (NFT) – and their implications for incumbents.

The background is a vibrant blue gradient with abstract geometric shapes, including a large dark blue circle and several parallel lines that create a sense of depth and movement. The text is centered within the dark blue circle.

**Blockchain and
financial services:
It's a match! Or
is it?**

The story of the adoption of blockchain in financial services has been fascinating, perhaps more so than in any other industry. In the early days, blockchain was seen as a threat to the financial system, given how it can be used to eliminate intermediaries through cryptocurrencies. As the technology gathered mainstream adoption in supply chains, mostly as a trusted and immutable database, financial services was one of the sectors that was most reluctant to adopt blockchain, owing to regulatory and privacy concerns. However, market movements during the past two to three years have changed the dynamics, with regulators themselves undertaking research and development projects that leverage blockchain.

So how does blockchain fit in the financial services world? Traditional financial system is plagued by inefficiencies, of speed (due to multiple layered processes), cost (due to the presence of intermediaries), security (due to susceptibility of centralized systems), transparency (due to duplications and no single source of truth) and convenience. Blockchain can improve latency (through peer-to-peer transactions), reduce cost (by eliminating intermediaries through smart contracts), improve privacy (through cryptographically secure transactions), increase transparency (by providing an immutable, verifiable ledger of transactions), and enhance convenience (by improving the overall efficiency).

As financial institutions started to realize the value blockchain technology can deliver, interest and investments in blockchain-led transformation programs have gathered pace. More than 60 central banks are actively exploring central bank digital currency projects.¹ Decentralized finance is booming, and incumbent players are increasingly exploring the various applications of the technology. Cryptocurrencies have gained mainstream attention, with major players already exploring related services. For instance, DBS Bank launched a crypto trust service that provides custody of digital assets, tokenization of securities, and cryptocurrency trading services.² Similar services are also being explored by Goldman Sachs, Citi, Bank of New York Mellon, and State Street.³ PayPal, which opened its digital currency platform last year, now allows users to withdraw cryptocurrency to third-party wallets.⁴ Facebook has revitalized its ambition to launch a digital currency.⁵ Finally, insurance companies, such as AXA and Metromile, have announced that they will accept bitcoin for premiums payments and claims settlements.⁶

When it comes to technology, while Big Tech firms have gone slightly cold, even withdrawing investments in blockchain-as-a-service,⁷ a number of new players have emerged, enabling a convergence between traditional financial institutions and decentralized technologies. Consensus' Codefi Blockchain suite for financial institutions contains nine product modules for end-to-end digital asset management, peer-to-peer trading and the acceleration of enterprise blockchain solution deployment. R3's Corda, meanwhile, allows businesses in highly regulated industries to build permissioned distributed solutions and networks. Along with these established players,

a number of niche players are also bubbling up. For instance, Algorand developed the world's first pure proof-of-stake blockchain, which is being used by a number of startups and financial institutions for DeFi projects.⁸

Despite the advantages, there are some roadblocks for blockchain adoption in the financial services sector. Firstly, a fully autonomous financial system is a radical change to hitherto highly centralized set-up and comes with inherent risks such as the DAO attack.⁹ Secondly, decentralization could reduce the performance and thereby impact scalability. Recently, however, a number of platforms have emerged, offering higher throughput comparable to traditional systems. Lastly, a proper legal and regulatory framework is yet to be established to govern transactions on blockchain.

This calls for a mixed approach to centralization vs decentralization in the financial services sector. And in order to stay abreast this rapid evolution, we believe there are 5 major areas for enterprises to keep an eye on. In subsequent sections, we explore each category in detail and assess the implications for incumbent players.

Decentralized finance (DeFi)

Put simply, DeFi refers to a financial system built on a public decentralized blockchain network that lets users interact and transact without an intermediary. Transactions are carried out using peer-to-peer decentralized applications (DApps) and executed through smart contracts. DeFi can help to improve the accessibility, interoperability, transparency, security, and integrity of the financial services ecosystem. Key DeFi applications include decentralized peer-to-peer lending, decentralized payments, stablecoins, and decentralized exchange.

More than \$80 billion is locked in DeFi contracts as of Aug 2021,¹⁰ up from \$7 billion in Aug 2020. While price volatility has been a major concern, and the liquidity of some tokens in circulation is a challenge, this sizable market capitalization cannot be ignored. DeFi has given rise to automated market makers (AMM) and decentralized exchanges (DEX), such as Compound Finance, Uniswap, Balancer, Synthetix, and Aave. These protocols offer users a variety of DeFi products, including yield farming, flash loans and quadratic funding.

Yield farming lets users lend or add funds (tokens) to liquidity pools (smart contract-based protocols) and earn returns. Similar to yield on bonds or dividend on stocks, yield farming is a way to earn rewards on existing cryptocurrency holdings. Flash loans provide secure crypto loans without any collateral that can be used for arbitrage, swapping collateral or self liquidation. A leading player in the decentralized lending space is Aave, which operates on a dual DeFi token model. It allows users to deposit and borrow money (aTokens) via smart contracts on Ethereum.¹¹ Flash loans have also been popularized by DyDx, which offers perpetual trading on

Layer 2 of Ethereum.¹² Similarly, MakerDAO is an open-source protocol on Ethereum with its DAI token pegged to the US dollar. Trading on decentralized exchanges has been shooting upwards recently, with aggregate volume crossing \$75 billion in August 2021, representing a whopping 476% YoY increase. Uniswap v3, a leading decentralized exchange, made up over 50% of the total trading volume with its competitor Sushiswap, accounting for 13%.¹³

Another example of a DeFi product is that of quadratic funding, which provides a democratic way of funding public goods. Quadratic funding relies on the number of contributions to prioritize projects that benefit the public, rather than on the value of contributions. While quadratic funding has been used by Gitcoin Grants for funding public goods in the Ethereum ecosystem,¹⁴ it could be potentially applied for other open-source projects or causes such as sustainability.

A number of other platforms and developments are triggering massive growth in the DeFi space. Solana, which claims to be the fastest blockchain in the world¹⁵ (50,000+ TPS), is gaining rapid interest in the DeFi space where transaction throughput is a critical success factor. Lately, there has also been a rise in the development of CeDeFi initiatives, which combine the best elements of traditional centralized finance with mature DeFi applications. For instance, Binance launched a \$100 million seed fund to empower emerging projects and drive collaboration between CeFi and DeFi.¹⁶

Implications: DeFi will create a composable, borderless and trusted financial system that can operate without any central authority. DeFi will give more control in the hands of the users, thereby democratizing finance. Banks and capital market players need to be cognizant of recent developments and prepare for future changes to avoid becoming obsolete. Decentralization will redefine the role of financial institutions, and they will have to adapt to provide new products and services in the digital and distributed economy. Some of the key developments we anticipate: retail banks will need to provide new services around decentralized payments, stablecoins and wallet management; commercial banks will have to adapt to decentralized lending; and capital market players will need to embrace new technologies and systems to support new asset classes and offer digital asset custody services..

By eliminating a single point of failure, DeFi can create a secure, trusted, tamper-proof and reliable financial ecosystem. However, despite the advantages, there are still unanswered questions around performance (speed), accountability (risk), and technical know-how (user experience). While over-collateralization can potentially offer a hedge against market crashes, liquidation is still a major challenge for DeFi products. Further, scammers can drain liquidity pools through DeFi “rug pulls”, causing investors to lose their funds.¹⁷ Similarly, though flash loans are secure by design (they have to be executed in the same transaction), risks associated with flash-loan attacks¹⁸ have to be mitigated to support wider, trusted adoption.

Considering that DeFi relies on multiple interconnected components, could it potentially lead to an intertwined network of debts and obligations, thereby triggering another financial crisis? Will the flexible and borderless nature of DeFi provide a breeding ground for fraudulent activities? How will the DeFi system enforce accountability in case of a technical glitch or bug, and how can smart contracts capture the full essence of the law? The DeFi ecosystem will have to provide answers to these questions before we see widespread acceptance. Further, since decentralized finance is reliant on the internet, there are concerns about sections of the population that do not have broadband access but who might need decentralized finance more than others.

Central bank digital currency (CBDC)

A CBDC is a tokenized representation of a nation’s fiat currency. Unlike other decentralized cryptocurrencies, CBDCs are issued, regulated, and controlled by the country’s central bank and backed by reserves of the fiat currency. According to a 2021 study by the Bank of International Settlements, 86% of central banks are exploring CBDCs, with 60% experimenting with the technology and 14% already deploying pilot projects.¹⁹ Countries such as China and South Korea have already piloted their digital currencies. Chinese citizens in major cities are already using Digital Yuan for day-to-day transactions, and the country aims to operationalize international use by 2022.²⁰ The European Central Bank recently announced the launch of Digital Euro project²¹ with a 2-year investigation about to begin in October 2021, the Bank of England has created a CBDC taskforce to coordinate exploration of a potential UK CBDC,²² while the United States has partnered with the Massachusetts Institute of Technology for its digital dollar. In Asia, a hub for innovation in digital payments, India has adopted a cautious approach with trials expected to start later this year²³, while The Monetary Authority of Singapore has shortlisted 15 finalists for its global CBDC challenge aimed at discovering and developing retail CBDC solutions.²⁴

Demands for digital money and a cashless society have accelerated during the coronavirus pandemic. CBDC is not just “digital” money. Most transactions today are processed electronically (credit cards, payment wallets, etc.), eliminating the need for physical money. CBDC goes a step further and makes money programmable through code. Widespread use of digital currencies can fuel a new wave of economic transformation and overcome many of the challenges associated with the traditional payment landscape. Further, CBDC could also push the concentration of power away from the US dollar and other major currencies and towards new international payment systems, where all players have greater independence and autonomy.

Implications: Central banks are under pressure to improve the efficiency of payments systems due to the growing influence of cryptocurrencies. By leveraging the underlying technology and innovation of the blockchain, central banks can reimagine the currency landscape. The rollout of digital currencies will change the role of central banks and commercial banks as the financial market and payment landscape undergoes rapid transformation. Retail banks will play the role of custodian, providing services that include management of e-wallets and the provision of new products and services built for the digital economy.

Given the centralized nature of currency issuance, blockchain technology is not quintessential at every layer for CBDC implementation. People Bank of China's Digital Yuan, for instance, uses conventional technologies at the core layer for issuance by the central bank, while banks use smart contracts and act as intermediaries.

While a number of models are under consideration for CBDC, there is no consensus yet on whether a wholesale, retail, or a combination of both models would be the ideal basis for adoption. Interoperability with traditional financial infrastructure, as well as between different jurisdictions will be pivotal to drive CBDC adoption globally. Further, uncertainty remains around important areas, such as impact on interest rates and broader macroeconomic implications. As CBDC gains mainstream adoption, retail banks might suffer from lower deposits which will have repercussions on the financial market. There are grey areas around issuance (supply vs demand), distribution (for retail CBDC, how can it effectively reach everyone alike?), storage (central bank, as the sole custodian vs retail banks, as intermediaries vs users, through wallets), privacy, and security, that has to be addressed to create a resilient framework for CBDC

Digital assets and tokenization

The financial services industry is witnessing the convergence of the real world with its tangible assets, and a virtual world with blockchain and other digital assets. This convergence gives rise to a decentralized, "token" economy. Some of the factors that are driving interest from industry players in tokenization are: a large number of intermediaries in the financial services ecosystem; high transaction costs; and an increased demand for real-time and efficient transactions, with robust data privacy and security. Blockchain can enable digital asset issuance, custody services, digital issuance of bonds and provide end-to-end services for securitized products.

Tokenization, which refers to digital representation of a real asset (physical or nonphysical) on a distributed ledger, can help unlock several benefits, such as greater liquidity for illiquid assets through asset fractionalization, faster and cheaper transactions, and increased transparency and security. Several banks have embarked on the journey to

streamline financial processes leveraging DLT. DBS has launched and expanded its digital exchange²⁵, Standard Chartered is planning to launch a digital assets brokerage and exchange²⁶, while BBVA has launched a digital asset offering for its private banking clients.²⁷ Wall Street has invested \$9.5 billion to ramp up tokenization infrastructure as the institutional interest in digital assets has started to grow manifold.²⁸

Tokenization is also paving the way for the emergence of new asset classes. For example, real estate assets are being converted to tradable tokens, which is increasing liquidity of this asset. A Texas-based real estate marketplace tokenized \$2.2 million worth of real estate assets in partnership with a security tokenization firm and plans to tokenize assets worth \$4 million in the future.²⁹ Carbon credits have also been tokenized via the launch of Universal Token, which is the world's first carbon token.³⁰

Implications: Digital assets will not only enable faster and efficient trade cycle for financial instruments, but also allow completely new types of financial products to be created. Capital market players are exploring issuance of equity tokens on blockchain, introducing an end-to-end platform for issuance, trading, settlement, and custody of digital native bonds, and facilitating retail investors to access corporate or government bonds through tokenization. Investors prefer accessing digital asset investment products through traditional financial firms, creating a new business opportunity for incumbents.³¹ Banks can also leverage their credibility to offer custody management of digital assets.

Players in the payment ecosystem can use tokenization to improve transaction speeds and security. For instance, Mastercard announced in June 2020 that it will tokenize card credentials for its Amazon customers across 12 countries.³² This process will result in higher security because the tokens can only be used by a specific merchant and the credentials will be updated automatically when customers receive a new card.

Transforming a highly regulated capital market would require significant efforts and collaboration between policy makers, regulators, and incumbent financial institutions. Financial services firms will have to carefully assess business cases and work to break silos within their organizations.

Cryptocurrencies

Cryptocurrencies have steadily gained mainstream adoption, with companies such as AXA, PayPal, Flipkart and Metromile allowing customers to pay using cryptocurrencies, primarily bitcoin. El Salvador recently became the first country to adopt bitcoin as a legal tender,³³ in what could be the first of many such moves. Investor interest, both institutional and retail, surged heavily in 2020, helping to push the market capitalization of bitcoin and Ether past the \$1 trillion and \$500

billion mark respectively.³⁴ By August 2021, there were close to 6,000 cryptocurrencies, a staggering 100x increase compared to 2013, with an overall market cap of more than \$2 trillion.³⁵ Despite the huge number, about top 20 cryptocurrencies make up around 90 percent of the total market.³⁶ Most of the users of cryptocurrencies come from relatively under-banked countries in Africa, Southeast Asia, and Latin America, such as Nigeria, Vietnam, Philippines, Turkey, and Peru³⁷. This rate of adoption in under-banked nations highlights how cryptocurrencies can help boost financial inclusion. A growing user base of more than 100M crypto users worldwide³⁸ has given rise to hundreds of crypto marketplaces and exchanges, with Binance being the world's largest exchange by trade volume.

In addition to being accepted as a means of payment, crypto has also fuelled an innovative means of fund raising for early-stage startups through Initial Coin Offerings (ICOs)³⁹.

Despite the numerous benefits of cryptocurrencies in multiple areas of the payment value chain, their volatility remains a key challenge, with the price of coins such as bitcoin and Dogecoin swinging wildly based on tweets by Elon Musk. Stablecoins offer an alternative to this by pegging the market value to an underlying asset. Stablecoins have grown from \$30 billion in January 2021 to more than \$120 billion market in September 2021⁴⁰, with the low risk compared to cryptocurrencies making it an attractive proposition. However, regulators are wary of accountability and financial instability risks stablecoins can create in case of a plunge.⁴¹

In addition, as the crypto market soars, the environmental impact it creates is generating sustainability concerns. According to some estimates,⁴² the energy consumption of Ethereum totals around 51.62 TWh annually, which is comparable to the power consumption of Portugal, and a carbon footprint of 24.52 Mt CO₂, comparable to that of Jordan. On the other hand, research from the University of Cambridge found that as much as 78% of the energy being used for crypto mining comes from renewable energy sources.⁴³ There is also the upcoming launch of Ethereum 2.0, which is based on a proof of stake mechanism and is expected to be 99% more energy efficient than a proof of work model, according to some forecasting models.⁴⁴

Further, some countries are discouraging crypto investments and launching their own digital currencies. China recently banned financial institutions in the country from offering services related to crypto, warning investors about speculative trading.⁴⁵ While individuals are allowed to hold crypto assets, the country views crypto as a disturbance to normal economic and financial order.

Implications: Banks and capital market players must reorient themselves to remain relevant in a world increasingly powered by cryptocurrencies. One of the avenues they can pursue is to assist customers in selecting the right cryptocurrencies in which they can invest. They can also

explore cryptocurrency trading services, crypto-enabled digital payments and transactions, and wallet management. However, the inconsistency and lack of clarity around regulatory compliance aspects remains a roadblock for the growth and adoption of cryptocurrencies by industry players.

Non-fungible tokens (NFT)

What do Twitter CEO's first tweet and a 10-second video by digital artist Beeple have in common? Both had their NFTs sold for millions of dollars. NFTs have emerged as the latest buzzword. According to CoinDesk, a total of \$174 million has been spent on NFTs since November 2017.⁴⁶ Auditability and traceability make each NFT distinct and non-replicable, giving immutable ownership to unique assets. One of the first uses of NFTs was for a game launched by Dapper Labs called Cryptokitties, which allowed users to breed and trade digital kittens. In addition to in-gaming assets, NFTs have paved the way for virtual worlds such as Decentraland.⁴⁷ NFTs could also revolutionize intellectual property. NFTs have become hugely popular with artists in the digital art and music space, as the tokens open up an additional revenue stream. Royal, for instance, is a blockchain-based music investment platform aimed at enabling fractional music ownership.⁴⁸ Recently, Tim Berners-Lee announced that the source code for the world wide web would be auctioned as an NFT.⁴⁹

There are a number of marketplaces that have emerged in recent years, with millions of dollars' worth of NFTs being exchanged on these platforms. These marketplaces are aiming to take NFTs beyond the world of finance. Some of the prominent players in this space are: OpenSea, which saw \$95 million worth of merchandise being sold on the marketplace in February 2021⁵⁰; Lukso, which operates in the fashion and lifestyle segment and could potentially launch NFTs for Karl Lagerfeld's photographic legacy⁵¹; and other players, including Rarible and Meta Factory.

While DeFi advocates democratization of finance, NFTs open up a traditionally illiquid market and create a new platform for ownership and exchange. While NFTs let individuals claim ownership for unique digital art, music, poems, and collectibles, it is yet to be seen how financial services firms might move into this space. Just like bitcoin, NFTs also require huge amounts of energy, which is creating sustainability concerns.

NFTs open up a traditionally illiquid market and create a new platform for ownership and exchange.



Navigating
decentralized
futures: **building
blocks for an
enterprise**

As applications such as digital currencies and asset tokenization gather mainstream adoption, enterprises are at a crossroads and struggling to find the right approach for decentralization. We believe there are four major dilemmas any enterprise needs to address to effectively harness the power of decentralization: technology for platform; tokens for governance; interoperability for co-existence; and a business model for return on investment. The following sections examine each dilemma in detail.

Technology

When it comes to blockchain, enterprises struggle to find the right approach to use the technology in the most effective way. Blockchain technology has evolved over time. However, there is still a lack of clarity around what is the best way to leverage this technology. There are important technological considerations, particularly around platform (network infrastructure), decentralized storage, and cryptography (security).

While many blockchain platforms have emerged over recent years, according to HFS research, Ethereum and Hyperledger Fabric account for over 60% of enterprise blockchain engagements. Similarly, there are a plethora of smart contract platforms that have emerged. While Ethereum is one of the most established names in this space, Polkadot and Solana are new entrants and offer unique features, such as Polkadot's ability to run multiple chains in an existing blockchain and Solana's unique Proof of History consensus mechanism. DAML, from Digital Assets, is an open-source purpose-built language that allows faster, efficient and secure smart contracts to be deployed on various blockchain platforms.

Additionally, there are a number of new types of consensus mechanisms that aim to move away from the energy-guzzling proof-of-work algorithm. Some of the newer ones include proof of stake (PoS), delegated proof of stake, proof of elapsed time, and proof of identity. Although still at a nascent stage, PoS is seen as the best alternative to proof of work (PoW). Cardano has been a pioneer in PoS through its Ouroboros protocol-enabling secure and sustainable development of global distributed networks.⁵² Ethereum is also working to move to this consensus mechanism with Ethereum 2.0.⁵³ Similarly, Algorand's pure proof of stake (PPoS) uses a verifiable random function to achieve all 3 features of a fully decentralized network-security, decentralization, and scalability.

The blockchain space is also witnessing the rise of a new generation of solutions that allow PoW blockchains to scale. For instance, Polygon (Matic) is a Layer 2 scaling solution that speeds up transactions made on Ethereum-based DApps. It is also known as "Ethereum's Internet of Blockchains"⁵⁴, as it aims to create a multi-chain ecosystem of blockchains compatible with Ethereum.

When thinking about technology, enterprises need to take a holistic view of their entire architecture and consider aspects relating to infrastructure, data, security, and legacy co-existence. Enterprises will have to arrive at a robust framework to select the right technology and partners.

Tokens

While choosing the right platforms and technologies is critical, another important aspect, especially from a governance perspective, revolves around tokens. Tokens are the lifeblood of a decentralized economy and, irrespective of the use case, they are an important factor to consider. The typical lifecycle of a token consists of multiple steps, such as issuance, registration, exchange, settlement, and management.

One dilemma facing organizations is whether to use existing tokens (mostly built on the Ethereum network) or mint new ones. Another dilemma concerns on-chain versus off-chain transactions. While the former offers extreme security and reliability, it comes with relatively higher transaction times and costs. On the other hand, off-chain transactions offer lower transaction costs and settlement time, but might require capital to be locked up and potentially sacrifice some of the trust associated with on-chain transactions.

Tokens are becoming central to the governance mechanism due to the PoS model and staking pools. Users can join a pool by locking tokens in a wallet, and the size of the stake will be proportional to the number of tokens held.

When it comes to CBDCs, central banks could choose to go with a token-based or account-based CBDC and each will have its own set of implications for industry players. Depending on the level of centralization in a token-based system, a central bank could act as the sole validating node or it could allow other parties to act as nodes in the technological infrastructure. Similarly, in an account-based system, a central bank could assume responsibility for managing accounts or it could delegate this responsibility to other entities such as commercial banks. Financial institutions need to carefully navigate these dilemmas and balance aspects relating to security, reliability and governance.

Interoperability

Interoperability with new or existing networks and systems has been a major impediment to blockchain deployments at scale. With the development of standards (such as ERC-20 and ERC-721), the technology has achieved on-chain standardization to an extent. But there is still a lot of work to be done to create a fully interoperable, global network. Here is where other aspects, such as decentralized storage, web 3.0, and other peer-to-peer technologies, have a key role to play.

Web 3.0 aims to decentralize the internet by distributing data ownership across users, making each user the sovereign owner of their data. When applied together, these technologies can solve issues pertaining to privacy and security, realizing the full benefit of decentralization.

Proof-of-stake sidechains can help build a bridge between on-chain and off-chain data through cryptographically secured value-exchange protocols.⁵⁵ Cardano has used sidechains to create an interoperable and scalable “internet of blockchains.”⁵⁶

Another aspect for interoperability is how the blockchain network can interact with off-chain data sources or oracles in a secure manner, and how the data sovereignty on oracles can be ensured. Chainlink, for instance, is a decentralized oracle network that offers secure connections for smart contracts with off-chain data. This is particularly useful in use cases such as payments. In addition, business interoperability concerns also need to be factored in. With blockchain technology tokenizing fungible assets, it is essential that data can interoperate across networks as well as with the traditional financial system.

Business model

According to HFS, 17% of businesses want to achieve process excellence and efficiency gains, and 15% hope to achieve better business outcomes in the near term. Over the medium term, the focus for businesses shifts to competitive differentiation, with 10% hoping to achieve additional trust in multi-party collaboration. From a long-term perspective, 11% of businesses are looking to create new business or revenue models.⁵⁷ Financial institutions need to identify where they want to play in the value chain and which use cases they want to tackle with the help of blockchain.

One dilemma facing incumbents is whether to extend their existing business models to DLT or to branch out to offer new products and/or services. Further, for each of these strategies, companies also need to decide if they want to adopt a greenfield strategy or partner with some of the existing players in the decentralized space. For instance, Deutsche Borse and Commerzbank have chosen to create a joint venture called 360X to tokenize art and real estate. Although enterprises are exploring different models, each one will bring with it its own set of dilemmas around the underlying technology infrastructure (permissioned vs permissionless, type of consensus mechanism, etc.), operational models and regulations that companies will have to navigate their way through.

There is still a lot of work to be done to create a fully interoperable, global network...





Capgemini's
ecosystem and
assets: a **trusted
orchestrator for
DLT services**

Future Thinking

Our robust “Future Thinking” methodology helps to assess emerging technologies and provide rationale to make informed business decisions. We have a dedicated team for technology assessment who maintain an online database of more than 2,000 technology items assessed for their maturity, and reviewed periodically through TechRadar. TechRadar is a robust tool to assess emerging technologies and provides rationale to make business decisions. The TechRadar looks at core technologies, use cases, partners, and unique concepts and approaches, and positions them for enterprise-readiness. Given the rapid pace of change in technology, TechRadar will help our clients to navigate a plethora of technologies which are at different levels of maturity. The technology assessment is validated by our CTIO network – a global technology network of Capgemini experts. Some of these technologies are also validated through our Technology Validation Network (TVN) comprising labs, centers of excellence, and partners, including academia.

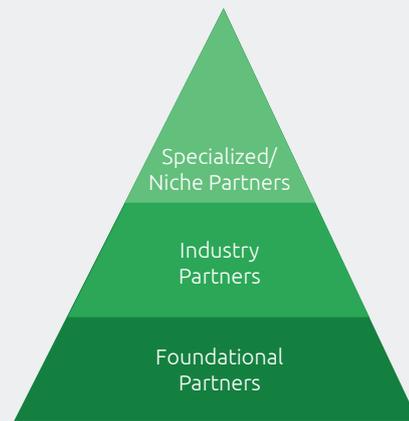
Change making

Digital asset custody: We can help clients as an orchestrator of enterprise-grade custody solutions by partnering with financial institutions, banks and scaled FinTechs in this space. We have the capabilities to enhance existing custody solutions incrementally to support digital assets and/or co-develop a greenfield setup partnering with niche platform providers to support digital assets custody, with options to build, buy or integrate with a full suite of application programming interfaces (APIs).

Trusted data exchange: An accelerator that connects different entities or systems to exchange data on a need-to-know basis in a direct, traced and secure way. Our trusted data exchange solutions leverage enterprise blockchain technology to support multiple data sharing use cases (financial services, supply chain, compliance, etc.) This approach unlocks value while ensuring privacy, traceability, and security.

Our partner network: We have developed a robust partnership framework that assesses end-to-end needs for any blockchain implementation.

- **Foundational partners:** Blockchain platform providers with either built-in smart contracts, or an option to integrate. Allows development of custom DApps. E.g. R3
- **Industry partners:** Platforms/networks with pre-designed features (such as privacy, identity, etc.). Allows custom applications for specific industries to be built. E.g. DAML
- **Specialized/niche partners:** Startups/niche players offering unique offerings aligned to use cases. Can be technology-led, domain-led or business partner-led. E.g. Algorand



Call to Action

We believe every organization will have a role to play in the decentralized world. For enterprises, there could be a three-layered approach based on business and technology priorities. For beginners, every line of business within the organization should do an assessment of how each of the development addressed in this document will impact their business operations. For pacesetters, the CTO/CIO organization must explore how blockchain technology can improve efficiency of existing processes through the application of smart contracts, oracles, and APIs. For frontrunners looking for next wave of growth opportunities, new financial products and solutions like crypto-enabled exchanges, digital assets and new asset classes would create new revenue opportunities.

Conclusion

The current centralized financial system demands innovation to tackle the key challenges of high cost, low efficiency, low transparency, and low outreach. Decentralization of the financial system powered by blockchain could solve all of the above challenges – by eliminating intermediaries it can reduce cost, by increasing the transaction speed it can improve latency, by providing an immutable ledger of transactions it can eliminate double spending and improve transparency, and by creating a self-reliant system it opens up the financial world for all.

While digital currencies and tokenization are steps towards a decentralized future, a vision of a 100% virtual economy might be far-fetched. Further, decentralization brings with it the challenges of fraudulent transactions, privacy concerns, and threats to a sustainable future. To enable a virtual economy, we need to ensure that autonomy doesn't lead to anarchy, and traceability does not come at the cost of environmental liability.

We believe the future will see a convergence of both systems, where the traditional financial system can offer regulatory and macro-economic guidance, and blockchain technology will mature further to adopt energy-efficient consensus mechanisms, resulting in a robust and resilient financial infrastructure.

Authors



Sudhir Pai

Chief Technology and Innovation Officer
Financial Services SBU
Sudhir.pai@capgemini.com



Muhammed Ahmed

Senior Manager
Financial Services SBU
Muhammed.ahmed@capgemini.com



Srishti Sachan

Senior Manager
Financial Services SBU
Srishti.a.sachan@capgemini.com

With special thanks to: Michiel Boreel, Nilesh Vaidya, Kary Bheemaiah, Dolo Miah, Ketan Talele, Mathias Ros, Bobby Ngai and Pratibha Sharma

TECHNO VISION

References

- ¹ BIS Papers No 114. Ready, steady, go? – Results on the third BIS survey on central bank digital currency, January 2021.
- ² DBS Launches Bank-Backed Crypto Trust Service in Asia First (<https://www.coindesk.com/dbs-private-bank-asia-crypto-trust>)
- ³ Citi weighs launching crypto services after surge in client interest (<https://www.ft.com/content/d90ed3bf-2c8d-46c9-98b7-67859f6598e5>)
- ⁴ <https://www.reuters.com/technology/paypal-allow-users-withdraw-cryptocurrency-third-party-wallets-2021-05-26/>
- ⁵ <https://www.cnbc.com/2021/04/20/facebook-backed-diem-aims-to-launch-digital-currency-pilot-in-2021.html>
- ⁶ <https://www.coindesk.com/axa-switzerland-allows-customers-to-pay-in-bitcoin>, <https://www.pymnts.com/cryptocurrency/2021/auto-insurer-metromile-allow-bitcoin-payments-payouts/>
- ⁷ <https://www.ledgerinsights.com/microsoft-retires-azure-blockchain-service-consensus-steps-in/>
- ⁸ <https://www.algorand.com/technology/algorand-protocol>
- ⁹ <https://www.coindesk.com/markets/2016/06/25/understanding-the-dao-attack/>
- ¹⁰ <https://www.theblockcrypto.com/data/decentralized-finance/total-value-locked-tvl>
- ¹¹ <https://aave.com/>
- ¹² <https://dydx.exchange/>
- ¹³ <https://www.theblockcrypto.com/data/decentralized-finance/dex-non-custodial>
- ¹⁴ <https://gitcoin.co/grants/>
- ¹⁵ <https://solana.com/>
- ¹⁶ [https://www.binance.com/en/blog/421499824684900972/Bridging-DeFi-and-CeFi-Introducing-a-\\$100M-Support-Fund-for-DeFi-Projects-on-Binance-Smart-Chain](https://www.binance.com/en/blog/421499824684900972/Bridging-DeFi-and-CeFi-Introducing-a-$100M-Support-Fund-for-DeFi-Projects-on-Binance-Smart-Chain)
- ¹⁷ <https://coinmarketcap.com/alexandria/glossary/rug-pull>
- ¹⁸ <https://coinmarketcap.com/alexandria/article/what-are-flash-loan-attacks>
- ¹⁹ <https://www.bis.org/publ/bppdf/bispap114.htm>
- ²⁰ <https://www.wsj.com/articles/china-creates-its-own-digital-currency-a-first-for-major-economy-11617634118>
- ²¹ <https://www.forbes.com/sites/emilymason/2021/07/14/european-central-bank-launches-digital-euro-project/?sh=2f1e95571b5d>
- ²² <https://www.bankofengland.co.uk/news/2021/april/bank-of-england-statement-on-central-bank-digital-currency>
- ²³ <https://www.cnbc.com/2021/08/27/india-central-bank-rbi-digital-rupee-trials-could-begin-by-december.html>
- ²⁴ <https://www.mas.gov.sg/news/media-releases/2021/mas-announces-15-finalists-for-the-global-cbdc-challenge>
- ²⁵ https://www.dbs.com/newsroom/dbs_digital_exchange
- ²⁶ <https://www.ledgerinsights.com/standard-chartered-to-launch-digital-assets-exchange-brokerage/>
- ²⁷ <https://www.ledgerinsights.com/bbva-switzerland-digital-assets-solution-launches/>
- ²⁸ <https://thetokenizer.io/2021/09/08/wall-street-ramps-up-tokenization-infrastructure-as-second-wave-of-digital-assets-builds/>
- ²⁹ <https://www.bitcoininsider.org/article/83420/red-swan-and-polymath-tokenize-22-billion-high-end-real-estate>
- ³⁰ <https://www.prnewswire.com/news-releases/worlds-first-tradable-carbon-token-is-set-to-democratize-access-to-the-most-important-new-asset-class-for-generations-301182669.html>
- ³¹ <https://www.businesswire.com/news/home/20210913005118/en/Fidelity-Digital-AssetsSM-Research-Finds-Digital-Asset-Investment-Products-Gaining-Favor-Among-U.S.-and-European-Institutional-Investors-Surveyed>
- ³² <https://www.mastercard.com/news/press/press-releases/2020/june/mastercard-powers-faster-seamless-online-shopping-experiences-for-amazon-customers/>
- ³³ <https://www.forbes.com/sites/roberthart/2021/06/09/el-salvador-makes-history-as-worlds-first-country-to-make-bitcoin-legal-tender/?sh=2e95a5c0eaa3>
- ³⁴ <https://fortune.com/2021/02/19/bitcoin-market-cap-1-trillion-price-crypto/>
- ³⁵ <https://www.investopedia.com/tech/most-important-cryptocurrencies-other-than-bitcoin/#:~:text=One%20reason%20for%20this%20is,communities%20of%20backers%20and%20investors.>
- ³⁶ <https://www.statista.com/statistics/863917/number-crypto-coins-tokens/>
- ³⁷ <https://www.statista.com/chart/18345/crypto-currency-adoption/>
- ³⁸ <https://coinmarketcap.com/headlines/news/total-cryptocurrency-users-across-the-globe-reach-106-million-crypto-com/>
- ³⁹ <https://www.investopedia.com/terms/i/initial-coin-offering-ico.asp>
- ⁴⁰ <https://coinmarketcap.com/view/stablecoin/>
- ⁴¹ https://www.business-standard.com/article/international/stablecoins-face-crackdown-as-us-discusses-risk-council-review-121091100480_1.html
- ⁴² <https://digiconomist.net/ethereum-energy-consumption>
- ⁴³ <https://www.jbs.cam.ac.uk/wp-content/uploads/2020/08/2019-09-ccaf-2nd-global-cryptoasset-benchmarking.pdf>
- ⁴⁴ <https://www.weforum.org/agenda/2021/06/how-blockchain-and-cryptocurrencies-can-help-build-a-greener-future/>
- ⁴⁵ <https://www.cnbc.com/2021/05/18/china-bans-financial-payment-institutions-from-cryptocurrency-business.html>
- ⁴⁶ <https://www.coindesk.com/what-are-nfts>
- ⁴⁷ <https://decentraland.org/>
- ⁴⁸ <https://cointelegraph.com/news/3lau-introduces-blockchain-music-platform-royal-with-16m-raise>
- ⁴⁹ <https://www.cnbc.com/2021/06/15/web-nft-source-code-is-being-auctioned-by-inventor-tim-berners-lee.html>
- ⁵⁰ <https://fortune.com/2021/03/18/nft-art-crypto-marketplace-opensea-amazon/>
- ⁵¹ <https://www.voguebusiness.com/fashion/karl-lagerfelds-photographic-legacy-is-moving-to-the-blockchain-what-does-that-mean>
- ⁵² <https://cardano.org/ouroboros/>
- ⁵³ <https://ethereum.org/en/developers/docs/consensus-mechanisms/pos/>
- ⁵⁴ <https://economictimes.indiatimes.com/markets/cryptocurrency/heres-how-india-based-polygonmatic-outperformed-other-major-cryptos/articleshow/83329658.cms>
- ⁵⁵ <https://eprint.iacr.org/2018/1239.pdf>
- ⁵⁶ <https://why.cardano.org/en/introduction/sidechains/>
- ⁵⁷ <https://www.hfsresearch.com/research/hfs-top-10-enterprise-blockchain-services-2020/>



About Capgemini

Capgemini is a global leader in partnering with companies to transform and manage their business by harnessing the power of technology. The Group is guided everyday by its purpose of unleashing human energy through technology for an inclusive and sustainable future. It is a responsible and diverse organization of 290,000 team members in nearly 50 countries. With its strong 50 year heritage and deep industry expertise, Capgemini is trusted by its clients to address the entire breadth of their business needs, from strategy and design to operations, fueled by the fast evolving and innovative world of cloud, data, AI, connectivity, software, digital engineering and platforms. The Group reported in 2020 global revenues of €16 billion.

Get The Future You Want | www.capgemini.com