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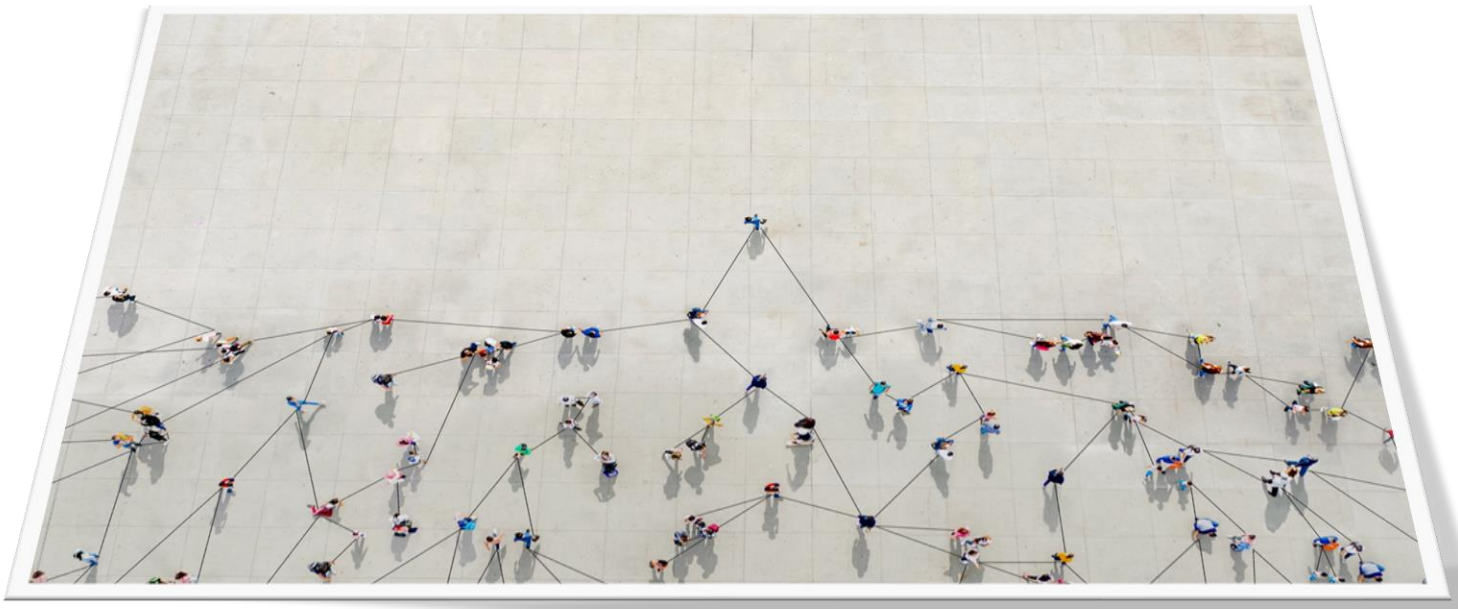

Web 3.0: Mega Cycle Investment

" Whenever you find yourself on the side of the majority, it's time to pause and reflect."

-Mark Twain, *Following the Equator*-

Q1 2022

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Heyokha's Web 3.0

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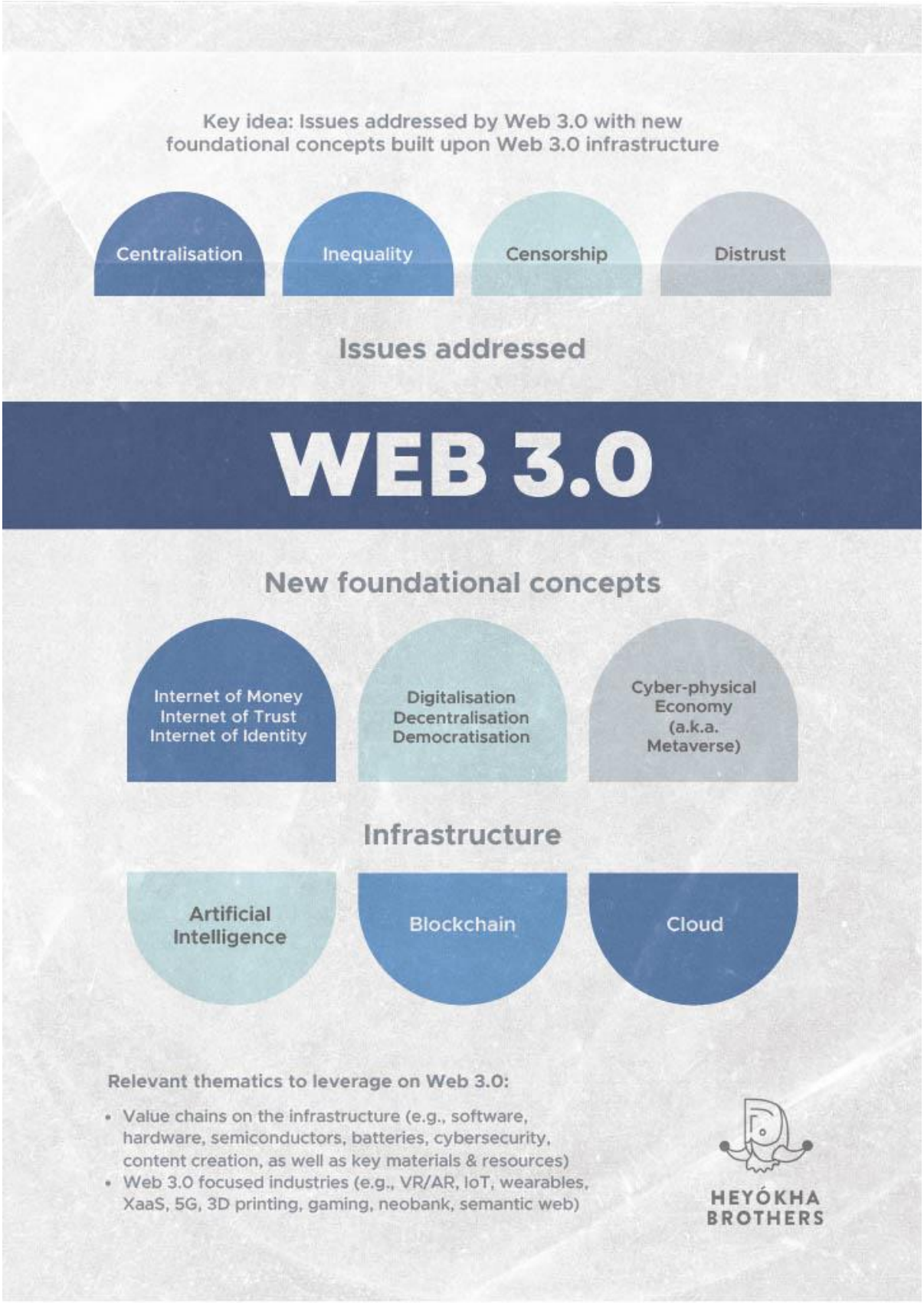

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Preface

In the past decades, economies benefited from globalisation and easy fiat credit with huge improvements in prosperity and stability. However, problems accumulate from widespread globalisation and over-financialisaton, ranging from the heavy indebtedness of all major economies, the return of hyperinflation regime, the risk of the biggest debt bubble on record bursting, the vulnerability of global supply chain disruptions, to the widest wealth gap in history, social divide and polarisation of political opinions. Furthermore, centralisation of (arbitrary) money supply policy and the rise of censorship by technology platforms led to the collapse of trust in governments, institutions and elites. Such lack of trust means that social contracts are failing, internal conflicts are rising, and nations are falling.

"Anyone who studies history can see that no system of government, no economic system, no currency, and no empire lasts forever, yet almost everyone is surprised and ruined when they fail."

-Ray Dalio,
"Principles for Dealing with the Changing World Order: Why Nations Succeed and Fail"-

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De-globalisation, de-dollarisation and decentralisation are the three mega trends ahead of us in the coming decades. In our last report, "Indonesia 2.0", we have discussed the investment implications of de-globalisation and de-dollarisation. In this "Web 3.0: Mega Cycle Investment" report, we ride on the same mega trends and deep dive into decentralisation and its market and investment implications.

The world has reached certain tipping points, so that we should not be surprised to see a new norm of frequent failures. However, history suggests that there is always some natural rebalancing process, often by bringing together game changing and disruptive technologies (which disrupt previous technologies) that could restore the once harmonious and thriving societies. We believe that new technology is 'decentralisation'.

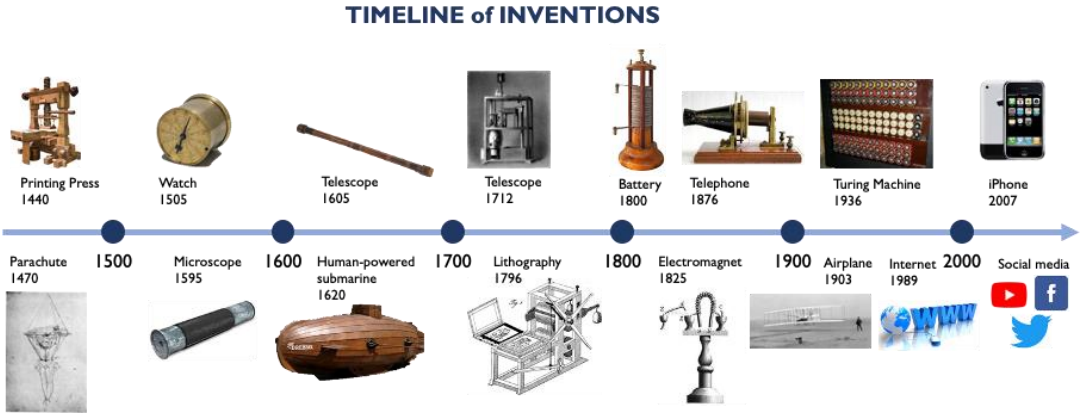
"Technology" comes from the Greek words "Techne" and "-logia". Techne means Art, Craft, Skill and -logia means To Study. The studies of art, craft and skill, or technology, impacts the economic, social, cultural, and political regimes in significant ways. Technology is generally used to automate, improve, inform and protect. History is full of such examples.

15th century witnessed gunpowder, the technology to 'protect', being used by monarchs to provide protection for merchants in exchange for their financial resources, allowed commerce to flourish.

16th century's printing press, the technology to 'inform', liberated knowledge for the common and challenged the Church's monopolistic authority. This ultimately brought down feudalism and censorship by religious authorities, paving the beginning of the Scientific Revolution and the Industrial Revolution.

18th century saw much progress in urbanisation due to the inventions and discoveries of steam engines, electricity, iron and steel, machinery and production lines. Such rises in automation, specialisation, mass production and industrialisation brought unprecedented prosperity in western societies.

As science (the inquiring mind) and technology (the building of tools) started to merge, the pace of technology development is a lot more direct, focused, widespread and impactful to the societies.



Source: Heyokha Brothers, multiple image sources from the internet

However, as with most things in nature, all benefits come with costs and consequences, and technologies are no exception. As time moves along, 'automate' leads to 'obsolescence', 'improve' leads to 'ignorance', 'inform' leads to 'bias', and 'protect' leads to 'destruction'. One cannot underestimate the social, cultural and political impacts of creating, owning, exploiting and censoring technologies.

Gunpowder (to protect) has also played a significant and destructive role during the age of exploration and colonial expansion, as such warfare could be launched at ease by acquiring advanced technological weaponry through faster trades.

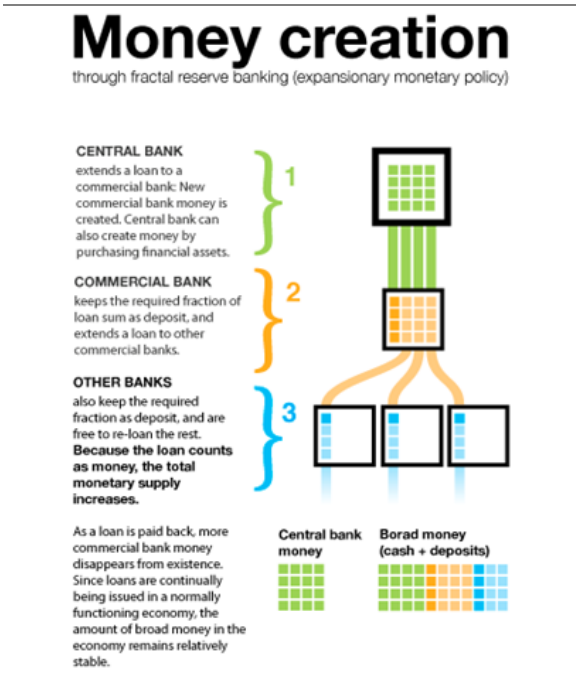
The press (to inform) was controlled and censored by the British political authority through the 1643 Printing Ordinance, licensing printers. Extreme censorship can be seen in the Nazi's totalitarian control over the press and radio in the 1930s, spreading its own propaganda and depriving its objects of the power of independent thoughts.

Technologies (to automate and improve) leading to the industralisation of western societies came at a price. Unskilled labour was made obsolete, leaving parts of the societies in hardship that subsequently led to the conflicts between the rich and poor.

But one of the most powerful technologies in the last 50 years is fiat money (see grey box below). Fiat money enables global payment at ease; and together with the inventions of other technologies such as aerodynamics, semiconductors, and the internet, it facilitates the borderless flow of people, goods and ideas, or in short, globalisation; concurrently it provided the grounds for global financialisaton (refer to chart below).

"Fiat can be defined as a compulsory implementation of debt-based, centralized ledger technology monopolizing financial and monetary services worldwide. The fiat standard was born out of the need for governments to manage their de facto default on their gold obligations. It was not designed to optimize the user experience of currency, transactions, and banking. ... Contrary to what the name suggests, modern fiat money is not conjured out of thin air through government fiat. Governments do not just print currencies and hand them out to societies that accept them as good money. Modern fiat money is far more sophisticated and convoluted in its operation. The fundamental engineering feature of the fiat system is that it treats future promises of payment of money as if they were as good as present money, so long as they are issued by the government, or an entity guaranteed a lending license by the government."

Source: Ammous S. (2021) The Fiat Standard: The Debt Slavery Alternative to Human Civilization (pp. 50-51). The Saif House.



Source: CourseHero, Boundless Economics

However, fiat money being such a powerful technology and owned by central banks, has led to serious repercussions, as seen in one financial crisis after another. Fiat money enables governments worldwide to make repeated financial bailouts by printing unlimited money that is not even backed by any reserves. This not only creates moral hazard for more future financial failures, but also ultimately drives asset price bubbles due to a devaluing currency. Worse is that it is not an equal process. It benefits those who take on debt without bearing the consequences of failures at the expense of savers who cannot afford to purchase in the future due to exploding asset prices.

Fiat money, without being backed by any real value of capital, is owned by centralised powers who allowed financial institutions to create (virtually unlimited) fiat-based debt. The scale of global indebtedness is so huge that no one is looking to repay.

This entire episode started with distrust of governments and reckless financial institutions, and then spread across other parts of the economy as inequality is felt in all areas of life. Inequality is detrimental to the well-being of a large majority of the populace with higher level of violence and lower level of happiness and satisfaction with life. When governments or politicians fail to reduce inequality, or simply to address public interests, individuals lose trust towards their public institutions.

But not all hopes are lost, we believe that trusts can be restored, and power can be redistributed from the hands of a few to many i.e., decentralised with less inequality. This rebalancing process is, once again, made possible by innovative technologies. Such decentralisation which will be led by a new technology – blockchain.

In just 15 years of existence, the foundational blockchain technology that underpins Bitcoin possesses the qualities that we believe will be the fundamental forces that drive the rebalance process by bringing back new trust and therefore, can hopefully avoid the demise of some failed nations. We urge one to pay attention to this pivotal phenomenon, to avoid being totally surprised.

This report, Web 3.0: Mega Cycle Investment helps you to understand and get equipped for what may be coming ahead. In addition, for investors, we hope to help you navigate the next mega investment opportunities as well as avoiding the most disrupted ones.

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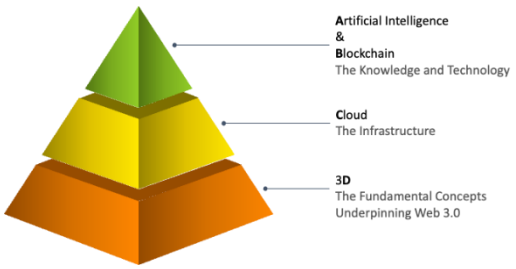
A Thesis of Web 3.0

The Web 3.0 economy is currently more of a concept than a scalable model, and indeed shall be a work-in-progress for decades to come. It is an adoption of foundational as well as disruptive technologies. The core technologies that support the Web 3.0 economy are **Artificial Intelligence**, **Blockchain** and **Cloud** or the ABC pillars that support a mega Web 3.0 economy driven by 3D: ***Digitalisation***, ***Decentralisation*** and ***Democratisation***.

The ABCD Model



Source: Heyokha Brothers

In other words, the ability to create pure digital assets and tokenise all non-digital assets, the ability to create networks or businesses that are owned by none but governed by all, and the ability to incentivize participations and contributions from all walks of life without friction, except for the ability to be on the Web. Conceptually, social (and commercial) contracts are written in programs that can be executed according to what you agree, but not forced upon

However, there are tremendous obstacles to the formation of the Web 3.0 economy. Unlike the last Web 2.0 regime (driven by the 3C model: *Connectivity*, *Content* and *Commerce*) that simply rides on the previous foundational technology TCP/IP or the Internet that started Web 1.0, Blockchain shall bring three foundational innovations to the Web. They are the ***Internet of Identity***, ***Internet of Money***, and ***Internet of Trust***, which are represented by ***tokens***, stored in digital ***wallets***, and transacted through ***smart contracts***. These narratives make it easier for all people to understand and migrate from Web 2.0 to Web 3.0. The motivations to migrate are, however, highly related to the availability of Internet of ID, Money and Trust, which are in turn driven by the need for data privacy, the need to avoid the demise of money printing and the need to express discontent on monopolistic behaviours. These foundational changes could take years of concerted effort to bring gradual, mass adoptions.

Web 3.0 business models will be hampered by those who are currently providing our ID, supplying our money and securing our property. As it stands today, such concentrated powers are so profound in the finance industry, making it natural that ***DeFi*** became the first decentralisation movement in the Web 3.0 space. And since the younger generations that have grown up in the mature Web 2.0 space are also among the biggest groups of discontent who are seeking change, it is also no surprise that ***GameFi*** was born as another decentralisation movement. Notice that capital markets with the motive for prosperity have proven to be extremely effective for human collaboration, ***tokenisation*** is only looking to change the relationships but not the incentives, while hoping to bring more freedom, more fairness, and more reach. Web 3.0, if done right collaboratively, creates a better human environment that will be extremely innovative, and everyone may be incentivised to solve the most complicated human problems.

This report has four main parts. We recommend our readers to read one part of the report at a time. Invest the time to fully digest, reflect and retain the information and principles that we shared. We hope you enjoy reading it as much as we enjoyed writing it.

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How to read this report

To understand the next mega cycle, one must learn from the past, observe the problems at present, in order to predict major economic changes in the future. While our focus is on predicting markets, such predictions are highly dependent and deeply correlated with economics and geopolitics. Markets are ultimately driven by prosperity, and we shall look at the market implications through the prosperity lens of the past, present and future, which are described in Part 1 of this report.

Part 2 of the report explains the How and Why of Web 3.0 from the socioeconomic and technological perspectives. In particular, we introduce our thesis of the Web 3.0 economy built upon the ABCD. Part 3 of the report focuses on the value chains of markets, industries and sectors with an attempt to lay out an investment landscape for Web 3.0, something we believe that every investor should understand. We present an investable universe of listed securities in this space for the coming decade. Last but not least, In Part 4, we equip readers with deeper knowledge of Web 3.0 by explaining 9 essential technological and market developments.

"When you see that in order to produce, you need to obtain permission from men who produce nothing - when you see that money is flowing to those who deal, not in goods, but in favors - when you see that men get richer by graft and by pull than by work, and your laws don't protect you against them, but protect them against you…you may know that your society is doomed."

-Ayn Rand, Atlas Shrugged-

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Part 1: MEGA CYCLES

PAST: Forces of Prosperity

Globalisation, financialization, and technology adoptions have been the key driving forces of prosperity in past decades (if not centuries), largely through increased productivity and decreased costs.

Globalisation is driven by specialisation in production and knowledge. It enables just-in-time manufacturing and inventory management processes, and it is made possible due to efficient cross border flows of people, goods and ideas. Globalisation is achieved by bridging global communication networks, establishing global logistics networks, enabling tradable global energy networks, and planting global brands. This resulted in unmatched prosperity in developed countries and lifted the poverty line for developing countries through a form of specialisation called 'outsourcing'.

Financialization is driven by financial motives of profits, carried out by privileged financial institutions, and often with products traded on regulated markets such as securities. Financialization is done through extractions of future profits accrued from financial channels other than trade and commodity. Mature financialization resulted in extreme wealth accumulation in concentrated hands, and brought with it wealth gaps, due to a process that relied on privileged financial institutions and regulated markets that are centralised and not open to all people. While this process may not be ideal, it still raised the overall prosperity of all countries over the decades.

Technology adoption brought down the costs of moving people, goods and ideas (i.e., the cost of communications, transportations, and knowledge.) As networks are formed, collaboration brings network effects and scales that reduce other economic costs such as friction. As a result, global economies expanded, prosperity rose, and service industries and capital markets dominated the share of economic activities and profits.

Technology is deflationary by nature as it raises productivity (e.g., through automation). Globalisation and to a large extent, financialization, are also deflationary. Imports and outsourced productions substituted costly inventories, infrastructure investments and labour. Financial products commoditised borrowing and lending, lowering friction and costs of capital. In fact, a lot of modern-day globalisations and financializations are made possible by various advancing technologies, with the Internet and the Web being the foundational technologies.

Components of Prosperity Engine

Source: Legatum Institute, 2016a, p. 4.

The pursuit of profit drives innovation and enhances productivity

Prosperity is a result of profit seeking behaviour, i.e., capitalism. Businesses can be profitable in economic systems regardless of the systems' competitiveness. However, profits tend to increase prosperity more *broadly* in competitive systems than non-competitive ones. Hence capitalism comes in two flavours: more competitive entrepreneurial capitalism and less competitive crony capitalism.

Competition is inherently deflationary. Economics teaches us that in a competitive market, price is determined by the intersection of aggregate supply and demand. This means that no one can arbitrarily raise prices in a competitive market. However, anyone can lower their prices if they can cut their costs. The best way to cut costs is to boost productivity with technological innovations.

Companies that can innovate on a regular basis ahead of their competitors can cut their prices, gain market share, and be consistently more profitable than their competitors. Such competitive advantage can bring higher profit margin, at least for a while. If their competitive advantage is sufficiently significant,

they may even be able to put competitors out of business.

New technologies disrupt traditional business models

Technology is inherently disruptive and deflationary since there is a tremendous incentive to use it to lower costs across a wide range of businesses, particularly in a competitive economic system. Technology-enabled disruption means that existing business models are being supplanted by new models that bring more efficiency to the production, distribution, and selling of goods and services through the adoption of technology. Indeed, the technology industry itself is prone to deflationary pressures because it is so competitive and this explains why technology companies splurge on research and development (R&D). Technology companies therefore must sell as many units of their new products as possible before the next "new, new thing" inevitably comes along from successful R&D. Technology destroys producers who fail to innovate and provide consumers with the best goods and services at the lowest prices on a regular basis. Entrepreneurial capitalism forms a process that naturally develops technological innovations that continuously benefit all of society, and eliminates over-production by putting unprofitable companies out of business.

Inventions are making the world better and smarter every year.

Source: Time Magazine, the Best Inventions

Political intervention slows down creative destruction by protecting the weaker market players

The economic restructuring described above is painful in practice, as there will be regular eliminations of unprofitable companies and therefore jobs. Hence politicians will intervene to reduce the pain by slowing down the pace of restructuring through policies aimed at *preserving jobs and protecting industries*. Such political intervention in the markets will likely result in excess capacity, structural deflation and economic stagnation.

For example, central bankers often respond to the sting of creative destruction by providing easy credit conditions to alleviate the pain. They hope that lower interest rates will revive demand enough to absorb all the excess supply and buy time for the losers to become competitive again. But such hope may not always come true. After the global financial crisis (GFC) of 2008, ultra-easy monetary policies might have propped up supply much more than they boosted demand. Credit crunches are nature's way of cleaning out insolvent borrowers from the economy. Easier credit will keep zombie companies in business, which is deflationary and reduces profitability for well-run competitors.

Entrepreneurs rather protect their business than the capitalist system that allowed them to succeed in the first place. They succeed by coming up with better goods and services that increase the well-being of their customers and attract more of them. And very often they do so through technological innovations. However, there is also a risk that successful entrepreneurial capitalists become crony capitalists when they pay off politicians and hire lobbyists to impose legal and regulatory barriers to bar new competitors from entry. Crony capitalists form associations and hire lobbyists and lawyers to protect their businesses from upstart competitors. Political power is an important part of their business model. Buying political influence matters more to them than winning the game in a competitive market with a level playing field.

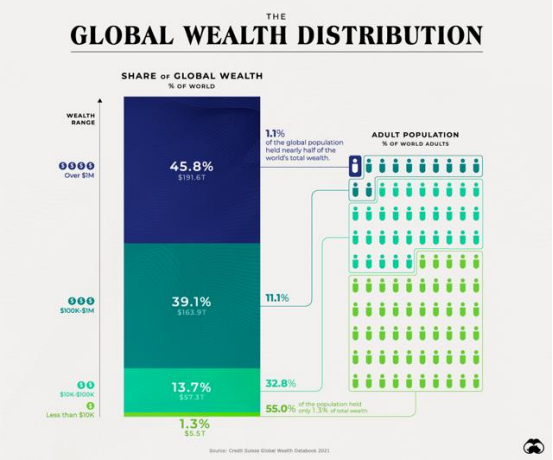
PRESENT: Rising Fragility

The world is approaching an inflection point as inherent risks unfold

While globalisation and financialization bring prosperity, they also bring vulnerability and inequality. The recovery from the GFC brought unprecedented prosperity but also the largest wealth gap in history. Outsourced manufacturing in China jeopardised jobs in many developed countries. The

COVID pandemic exposed the supply chain vulnerability that is very globalised. Russia's invasion of Ukraine revealed the danger of energy dependence globally. Financial sanctions on Russia reminded people of arbitrary rules on global trade and finance and security of wealth.

1.1% of the global population held nearly half of the world's total wealth



Source: Credit Suisse, Global Wealth Databook 2021

Globalisation will not provide the solutions for such insecurity in the decades to come. Global indebtedness also suggests that financialization has reached a point where most of the future profits have been extracted by all conceivable financial products. The only solution may be, once again, innovative technologies that can create values yet to be seen. In the coming mega investment cycle, besides profits, security should be added to the equation.

Rising economic and political divide stir up social discontent

The powerful forces driving the world economy today – globalisation, financialization (capitalism), technological innovation, plus demographic changes and exploitation of the environment – have generated huge material progress, but the social contract has failed to manage the adverse consequences.

Long term 'super-structural' policies in the past decades, or a lack thereof, bred today's unsustainable social pressure. They range from real estate to health care, education, monopolies, over-financialization, unfair trade and uncontrolled immigration. The burden piled because the cumulative choices made in these areas fell disproportionally on the lower and middle classes. This made the world less "fair," and its future more hopeless.

Faced with the growing pain, governments across the developed world have used fiscal policy to buy political relief. Inflated and unfinanced social spending brought temporary social peace and votes, but progressively rendered the countries indebted. With little fiscal room to manoeuvre, monetary policy eventually became the only game left in town. But propping up asset prices with interest rate cuts systematically enriched a few, promoted speculation and encouraged moral hazard. Eventually, even monetary policy became inadequate, and resulted in unprecedented and risky responses. During the last financial crisis, untried quantitative easing policies were used. In the process we became addicted to easy, seemingly costless money. But quantitative easing has arbitrarily inflated the assets of the wealthiest, breaching the social contract, and will someday detonate decades of accumulated social-economic discontent. The wave of popular dissent, apparent from Brexit to Trump to new populist governments across the world, may just be the tip of an iceberg.

This coming decade may also witness the biggest social disruption of all. The baby boomers longed for sustained peace; Gen X for economic prosperity and stability, while Gen Y/Millennials attempt to provoke change—whether through the Arab Spring, the Occupy movements, protests against police brutality or extrajudicial killings. Millennials, together with the Gen Z - the new citizens of the world, want positive progress through change using technological innovations. The desires for a world of stability and a world of change will very likely collide in the next decade when it comes to issues like climate change, energy, employment and education.

Augmented economy removes information asymmetry

The world is full of experts. Claims made by industry experts such as those in health care, financial services and technical areas in the past were largely based on information asymmetry when information was not made freely available. The information

economy has liberalised the distribution of information over the internet. A consequence is that it has become harder for governments and incumbents to claim that they are acting in the best interests of the public when the influence of special interest groups is blatantly obvious. But, the information economy does not stop there. Information technology will be infused into every aspect of our lives. In the future, technology will be so ubiquitous, so powerful and so integrated into our lives that it will be hard to define technology the way we do today. Technology shall be omnipresent and millions of times more powerful than the most powerful computers we have today. The future can be described as an augmented age that celebrates constant change wrought by technology, and those who resist that change will likely have the most to lose.

Deglobalisation calls for the need of self sufficiency

As the world order is changing, principally with a declining US and a rising China, the race to compete through self-sustainability will take centre stage. A new cycle of infrastructure spending will explode. One will build its own manufacturing plant, choose its suppliers carefully, stock up its reserves of resources and materials, restrict the access of capital markets, train only its own people, stop leasing its IP, and strengthen its defence of physical infrastructure and cyber data. Meanwhile, many countries are still haunted by financial indebtedness, political divide, and must brace for other big problems such as hyperinflation and social unrest. Policy priorities will have to change. Such change will lead to rebuilding domestic supply chains, reinforcing 'economic blocks and de-globalisation.' Self-sustainability is extremely important for survival in the next global mega cycle. The new supply chain will have to be technology driven, digital centric and proprietary in nature to be both productive and secure. Such economic priorities are inflationary by nature, unless they are offset by the deflationary technological innovations.

Fiat money may be entering its endgame, diversification is key

Under this new mega cycle, markets will diverge tremendously, and investors need to consider the inherent arbitrariness of regulators, risk of confiscation by governments, and risk of financial repression by central banks at the minimum. Polarisation of growth and inflation will be more of a norm than exception. Monetary and fiscal policies, the fiat tools, will be much less effective if not further worsen the trends of huge indebtedness. Under such scenario, protection of wealth takes priority over pure financial motive of profits. Diversifying into alternative asset classes such as cryptocurrencies is a must for all investors to consider.

"We will not allow inflation to rise above 2% or less … We could raise interest rates in 15 minutes if we had to."

-Ben Bernanke (December 2010)-

FUTURE: Next Economic State

A stack of advanced technologies will shape the future of economies under mega changes of world orders. The future world owners, namely the Millennials and Gen Z, will speed up such changes using technological innovations based on foundational and disruptive technologies. Such future is called Web 3.0 – a cyber-physical economy where technology lives inside us. The next state of the global economy may take many different shapes and forms, but will share the following common evolutionary advancements:

- Digital Presence: from Portals, to Mobile Internet, to the Metaverse;
- Computing Reach: from Client Server Computing, to Personal Computing, to Universal (Cloud) Computing;
- Virtual Experience: from Web 1.0 (Content/Read), to Web 2.0 (Commerce/Write), to Web 3.0 (Cyber-Physical/Own);
- Financial Experience: from Financialization, to Centralisation, to DeFi and Tokenisation (NFT);
- Data Ownership: from Servers, to Data Warehouse, to Distributed Ledger
- Gaming: from pay to play games, to free to play games, to P2E games (Play-to-Earn and GameFi)

Transition from Web 1.0 to Web 3

	WEB 1.0	WEB 2.0	WEB 3.0
INTERFACE	BROWSER	MOBILE	AR/VR/IOT
LOGIC	WEBSITE	APPS	A.I.
DATA	SERVERS	DATA WAREHOUSE	DISTRIBUTED LEDGER

Source: René G. & Mapes D. (2019). The Spatial Web: How Web 3.0 will Connect Humans, Machines, and AI to Transform the World.

Web 3.0 Innovations

The above is just a small list of disruptive changes enabled by the stack of advanced technologies, including blockchain. If AI, Cloud and 3D's are added, they will form the ABCD foundational pillars of the Web 3.0 economy. Among the Web 3.0 innovations, the most important ones are the ***Internet of Money***, the ***Internet of ID*** and the ***Internet of Trust***. They are innovations at the 'backend' that drive all economic, social and business activities. At the same time, Web 3.0 shall bring fundamental socioeconomic impacts that are best described as ***Digitalisation***, ***Decentralisation*** and ***Democratisation*** or the ***3D's***.

To complete the build out of the Web 3.0 economy, an additional stack of infrastructural technologies is required, which can be categorised as follows:

- Interface (IoT, AR/VR, wearables)
- Computing (AI, ML/Big Data, Blockchain, Cloud)
- Record Keeping (tokens, data centres, privacy, DLT)
- Physical infrastructure - energy and resources - focusing on mobile energy storage and distribution (Energy 3.0) such as next generation batteries and chips
- Community computing (in parallel to universal computing) - smart city, community blockchain, CBDC

But the most versatile and pervasive technologies remain to be AI, Blockchain and Cloud or the ABC of Web 3.0. The ABC shall represent the largest human infrastructure to be ever built in aggregate by all countries, but with a wide spectrum of standards and purposes.

Web 3.0 Economics

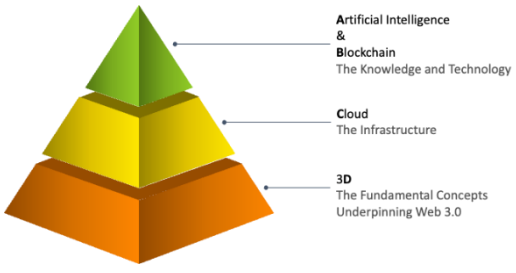
Contracts, transactions, and their records are among the defining structures in our economic, legal, and political systems. They protect assets and set organisational boundaries. They establish and verify identities and chronicle events. They govern interactions among nations, organisations, communities, and individuals. They guide managerial and social actions. Yet, these critical tools and the bureaucracies formed to manage them are not kept up with the economy's digital transformation. Under Web 3.0, the way we regulate and maintain administrative control and the way we make decisions are going to change.

PART 2: THE FUTURE LANDSCAPE

The ABCD Economy

We view Web 3.0 as a new economic construct represented by the ABCD pyramid, as shown below. We have written extensively on these topics in our previous research and blogs. In this report we shall focus more on the economic implications, rather than on the technical explanations that have been introduced in previous writeups.

The ABCD Model



Source: Heyokha Brothers

Augmented Age – Artificial Intelligence disrupts the application of information and intelligence

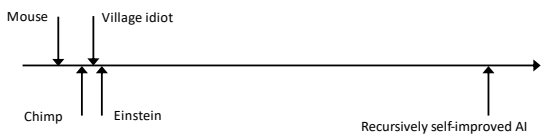
While Web 3.0 economy has not been completely defined, one can think in terms of the augmented age. Empowered by robotics, metamaterials and artificial intelligence, the augmented age will likely produce a resurgence in localised manufacturing. It turns out

that robots and AI labour are even cheaper than that of resources in China and India. As we automate driving, restaurants, grocery delivery, accounting, banking and other such activities, certain service industries will face decline. This makes de-globalisation and self-sufficiency possible while not reducing productivity and prosperity.

In today's digital or information age, there was an initial push towards process efficiency, such as the early mainframes, and further automation in the factory and production space. This was then extended to business processes and operations being automated at an enterprise level with enterprise-wide software solutions such as Enterprise Resources Planning (ERP). The Internet went further and disrupted distribution mechanics such as those we saw in the book and music industries.

While the Internet was mostly about disruption of distribution and availability of information or reducing information asymmetry, the augmented age will be about disruption of information, intelligence and the application of information and intelligence itself. It is not about information not distributed, but information not known!

The Scale of Intelligence



Source: René G. & Mapes D. (2019). The Spatial Web: How Web 3.0 will Connect Humans, Machines, and AI to Transform the World.

Blockchain is a Foundational Technological Change

Blockchain is the technology at the heart of bitcoin and other virtual currencies. Blockchain is an open, distributed ledger that can record transactions between two parties efficiently and in a verifiable and permanent way. The ledger itself can also be programmed to trigger transactions automatically.

With blockchain, we can visualise a world in which contracts are written in digital code and stored in transparent, shared databases, where they are protected from deletion, tampering, and revision. In this world every agreement, every process, every task, and every payment would have a digital record and signature that could be identified, validated, stored, and shared. Individuals, organisations, and algorithms would freely transact and interact with one another with little friction and without intermediaries like lawyers and brokers.

Rather than simply being another disruptive technology, which can offer a lower-cost solution to a traditional business model and overtake incumbent firms quickly. **Blockchain is a foundational technology: It has the potential to create new foundations for our economic and social systems.**

And despite our enthusiasm for the potential of blockchain, **many barriers — technological, governance, organisational, and even societal—will have to be overcome** before a true blockchain-led transformation of business and government can take place. It will take decades for blockchain to reshape the economic and social infrastructure alongside other technological and institutional changes that will speed up the process of adoption.

Foundational Technology Adoption – TCP/IP

Here we include an extract from an article written by Marco Iansiti and Karim R. Lakhani, *The Truth about Blockchain*, published on the Harvard Business Review where the writers detailed the adoption of TCP/IP (transmission control protocol/internet protocol), an example of the transformation process brought by a foundational technology, which laid the groundwork for the development of the internet.

"Introduced in 1972, TCP/IP first gained traction in a single-use case: as the basis for e-mail among the researchers on ARPANET, the U.S. Department of Defense precursor to the commercial internet. Before TCP/IP, telecommunications architecture was based on "circuit switching," in which connections between two parties or machines had to be preestablished and sustained throughout an exchange. To ensure that any two nodes could communicate, telecom service providers and equipment manufacturers had invested billions in building dedicated lines.

TCP/IP turned that model on its head. The new protocol transmitted information by digitizing it and breaking it up into very small packets, each including address information. Once released into the network, the packets could take any route to the recipient. Smart sending and receiving nodes at the network's edges could disassemble and reassemble the packets and interpret the encoded data. There was no need for dedicated private lines or massive infrastructure. *TCP/IP created an open, shared public network without any central authority or party responsible for its maintenance and improvement.*

Traditional telecommunications and computing sectors looked on TCP/IP with skepticism. Few imagined that robust data, messaging, voice, and video connections could be established on the new architecture or that the associated system could be secure and scale up. Only in late 1980s and early 1990s did a growing number of firms, such as Sun, NeXT, Hewlett-Packard, and Silicon Graphics, used TCP/IP, in part to create localised private networks within organisations. To do so, they developed building blocks and tools that broadened its use beyond e-mail, gradually replacing more-traditional local network technologies and standards. As organisations adopted these building blocks and tools, they saw dramatic gains in productivity.

TCP/IP burst into broad public use with the advent of the World Wide Web in the mid-1990s. New technology companies quickly emerged to provide the "plumbing"—the hardware, software, and services needed to connect to the now-public network and exchange information. Netscape commercialised browsers, web servers, and other tools and components that aided the development and adoption of internet services and applications. Sun drove the development of Java, the application-programming language. As information on the web grew exponentially, Infoseek, Excite, AltaVista, and Yahoo were born to guide users around it.

Once this basic infrastructure gained critical mass, a new generation of companies took advantage of low-cost connectivity by creating internet services that were compelling substitutes for existing businesses. CNET moved news online. Amazon offered more books for sale than any bookshop. Priceline and Expedia made it easier to buy airline tickets and brought unprecedented transparency to the process.

The ability of these newcomers to get extensive reach at relatively low cost put significant pressure on traditional businesses like newspapers and brick-and-mortar retailers.

Relying on broad internet connectivity, the next wave of companies created novel, transformative applications that fundamentally changed the way businesses created and captured value. These companies were built on a new peer-to-peer architecture and generated value by coordinating distributed networks of users. Think of how eBay changed online retail through auctions, Napster changed the music industry, Skype changed telecommunications, and Google, which exploited user-generated links to provide more relevant results, changed web search.

Ultimately, **it took more than 30 years for TCP/IP to move through all the phases—single use, localised use, substitution, and transformation**—and reshape the economy. Today more than half the world's most valuable public companies have internet-driven, platform-based business models. The very foundations of our economy have changed. Physical scale and unique intellectual property no longer confer unbeatable advantages; increasingly, the economic leaders are enterprises that act as "keystones," proactively organizing, influencing, and coordinating widespread networks of communities, users, and organisations."

Foundational Technology Re-adoption – Blockchain

One may be able to draw some parallels between blockchain and TCP/IP. Just as e-mail enabled bilateral messaging, bitcoin, the first application of the blockchain technology, enables bilateral financial transactions. Blockchain is an open and shared public ledger, as is the TCP/IP.

TCP/IP enabled low-cost connections. Similarly, blockchain could dramatically reduce the cost of transactions, cross-border payments for instance. But its potential goes beyond financial transactions, it can be used for the system of record for all transactions. As a result, blockchain may bring the birth of transformative business models.

In most businesses today, maintaining records of transactions is a core function. Those records track past actions and performance and guide planning for the future. They provide a view not only of how the organisation works internally but also of the organisation's external relationships. Every organisation keeps its own records, and they are private. When individuals from different companies need to work together, trust is rarely present, making collaboration difficult and inefficient.

In a blockchain system, the ledger is replicated in a large number of identical databases, each hosted and maintained by an interested party. When changes are made in one copy, all the other copies are simultaneously updated. The instantaneous exchange of value and information not only streamlines business processes but elevates the level of trust between parties and removes the need for third-party intermediaries to verify or transfer ownership.

This brings profound implications. Firms are built on contracts, from incorporation to buyer-supplier relationships to employee relations. If contracts are automated, the roles of managers, intermediaries such as lawyers and accountants would all change radically. However, as in the case of the last fundamental technological change, we may be decades away from the widespread adoption of smart contracts enabled by blockchain. A tremendous degree of coordination and clarity on how smart contracts are designed, verified, implemented, and enforced will be required, and all stakeholders would need to agree and trust, particularly institutional stakeholders.

Institutions, particularly financial institutions, should be interested in two areas where blockchain could have a profound impact: large-scale public identity systems for such functions as KYC, and algorithm-driven decision making in the prevention of money laundering and in complex financial transactions that involve many parties. Transformative applications will also find their ways to new platform-level players that will coordinate and govern the new ecosystems. These will be the Googles and Facebooks of the next generation and very likely to be decentralised.

Fortunately, TCP/IP has provided a good template for blockchain's adoption. Moreover TCP/IP has most likely smoothed the way for it. TCP/IP has become ubiquitous, and blockchain applications are being built on top of the digital data, communication, and computation infrastructure being built for TCP/IP. This should lower the cost of experimentation and allow new use cases to emerge rapidly. Of keen motives to replace TCP/IP are the mobile communication companies that define 5G and beyond, as they look to regain centralisation power. Such action may result in the delay in development of blockchain. Nevertheless, blockchain will affect every business on every aspect, by revolutionising how records are kept to start with, and much more in the end, when other advanced technologies are combined, notably AI and Cloud. The power of Web 3.0 shall unleash like a tsunami. The very big question is when.

Largest Human Infrastructure - Cloud

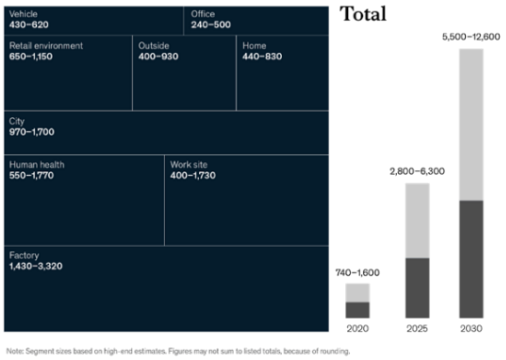
Cloud computing gave the necessary infrastructure and platforms to proliferate Web 2.0. It removes much of the friction of storing and managing data by making the infrastructure needed to handle data. Just as electricity powered the industrial revolution over a hundred years ago, data is powering today's most successful businesses and innovations. And just as electric power generation migrated to centralised power plants, the storage of data is moving from on-premise data servers to large centralised clouds run by expert cloud service providers.

Over the past decade, cloud computing has seen an explosive adoption both at consumer and enterprise levels. Legacy software providers such as Microsoft, Oracle and Adobe have all made immense efforts to encourage users of their on-premises software offerings to upgrade to their cloud equivalents, often on a subscription pay-as-you-go basis. At the same time, a cornucopia of cloud-native providers such as Zendesk, Workday and ServiceNow has emerged with Software as a Service (SaaS) offerings that are only available on the cloud. And it's not only SaaS that has emerged, Platform as a Service (PaaS), Infrastructure as a Service (IaaS), Backup as a Service (BaaS) and Disaster Recovery as a Service (DRaaS) as well. Pretty much Everything as a Service (or XaaS) is now available. And at the core of it all are the data centres.

According to Mark P. Mills, written in his book, *The Cloud Revolution: How the Convergence of New*

Technologies Will Unleash the Next Economic Boom and A Roaring 2020s, there are more than 5,000 enterprise-class data centres operating in the world, compared to 1,500 enterprise-class "office centres". And some $20 billion is spent each year on adding silicon servers inside the Cloud data centres today. That is twice the level of annual spending of just a decade ago. These data centres power the largest resources, energy and mobility human infrastructure.

Estimated 2030 economic value of Internet of Things adoption, by setting, $ billion



Source: McKinsey & Company

IoT devices collect a lot of data, but this data will be of no use until processed and analysed. Cloud provides the large and virtually unlimited storage space so that the tremendous amount of data can be stored and processed. And with the burst of data, the demand for real-time analysis could no longer be done by human beings and simple algorithms. This is where AI and machine learning come into place. Edge data centres enables the expansion of the silicon real estate footprint. Tens of thousands of these micro-data centres bring data processing and other computing needs as close to the sensor or other device as possible. This facilitates the speed required to deliver AI-driven intelligence to many types of real-time applications such as autonomous vehicles, automated manufacturing and servicing.

Entering the world of Web 3.0, the increasing use of mobile/IoT devices and data storages, as well as the integration of distributed ledger technology such as blockchain, aid the development of cloud computing, making it the biggest human infrastructure ever.

Token Economy – 3D's

The information age that dominated the last 25 years was shaped by the technological advancements and business innovations in 3C's: Communications, Content and Commerce and brought us Web 2.0 with platform as a business, shared economy, social media, mobile commerce and on-line education, among many others. The new paradigm, that can be phrased as the Token Economy, will be a cyber-physical economy characterised by the 3D's: Digitalisation, Decentralisation, and Democratisation. And the most important feature that defines the new paradigm is Decentralisation. **This is where the strong needs for change by Millennials and Gen Z, who are ready to shape the Web 3.0 economy, are met by technologies.**

The three defining elements, namely programmable blockchains (infrastructure), composable smart contracts (economy), and digital assets (incentives), make it possible for decentralised systems to achieve unprecedented levels of coordination and operational functionality. Decentralised governance, organisations, communities, networks, services, economies, and countless others will be made possible.

Being data centric and already digital by nature, as well as having high monetary value, decentralised finance ("DeFi") has already taken off. Realising the market potential, a lot of initiatives on core infrastructure projects have also taken off, and we will soon see decentralised versions of existing Web 2.0 categories like social media, video games, music, and marketplaces. Such decentralisation promises to bring **more equitable ownership among stakeholders, reduced censorship, and greater diversity**.

"Nothing is more obstinate than a fashionable consensus."

-Margaret Thatcher-

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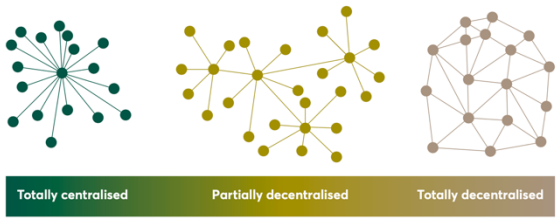
Decentralisation - Further Explained

Andreessen Horowitz (a16z), a venture capital fund in Silicon Valley, has recently published a paper written by Miles Jennings, *Decentralization for Web3 Builders: Principles, Models, How*, who shared his knowledge of decentralisation, its operation and challenges which we found extremely insightful. In the following section, we referenced and incorporated Jennings' models and principles when attempting to lay out our framework of decentralisation.

Dencentalised Networks



Source: Nesta, Introducing Decentralised Futures

Decentralisation can be thought of as a single design challenge that spans three different, but interrelated objectives: technical, economic, and legal. And tokenomics (i.e., token economics) using blockchain technologies try to address the three objectives in a single design, largely through mathematics.

Technical Decentralisation

The core innovation behind programmable blockchains is that they can support technical decentralisation by providing a permissionless, trust-less, and verifiable ecosystem in which value can be transferred — and, more importantly, upon which products and services can be built. This means that products and services can be deployed and run without requiring trusted, centralised intermediaries, opening a vast world of possibilities. This is also the foundation for economic decentralisation and legal decentralisation.

Economic Decentralisation

The advent of programmable blockchains (such as Ethereum, Solana, and Avalanche) and their respective digital assets (such as ETH, SOL, and AVAX) unlocked the ability of open source and decentralised systems. This is a paradigm shift.

The open source and decentralised protocols of previous generations of technology like Web 1.0 (such as http, smtp, ftp, etc.) stagnated because they lacked the ability to incentivise ongoing development and/or further investment of critical resources back into their systems. This left fertile ground for the centralised companies of Web 2.0 to emerge and succeed as they were able to leverage their efficiency and resources to build products and services that surpassed those of Web 1.0. But this centralisation also led to countless examples of user rights abuses, de-platforming, and aggressive take-rates (or rent extractions).

The Web 3.0 system, using programmable token incentives, can facilitate the formation of decentralised economies through accruing "value" — be it information, economic value, voting power, or other forms of value — from a broad array of sources, and distributing that value equitably among system stakeholders according to their contributions.

In order to achieve this, Web 3.0 vests meaningful power, control, and ownership to system stakeholders (via airdrops, other token distributions, decentralised governance, etc.). This in turn encourages stakeholders to contribute meaningful value, because they have skin in the game, a form of entrepreneurial capitalism. In other words: all the benefits of modern network effects are attained, but without the pitfalls of centralised control and captive economies.

Legal Decentralisation

Legal decentralisation addresses the issue of "level playing field". Information asymmetry has been one of the key issues that regulators try to address, by limiting the ability of those with more information from taking advantage of others with less information. Disclosure requirements are the answers but failed miserably as there are no incentives to do so.

If a Web 3.0 system can (a) eliminate the potential for significant information asymmetries to arise and (b) eliminate reliance on essential managerial efforts of others to drive the success or failure of that

enterprise, then the system may be "sufficiently decentralised". The implication is that the regulation on digital assets shouldn't be necessary. That is to say, it is legally decentralised.

In a broader context, the Web 3.0 economy looks for decentralisation of value, incentives, and trust made possible by the technical, economic and legal decentralisations mentioned above.

Value Decentralised – Internet of Value

Blockchain networks and smart contract protocols that enable technical decentralisation can also promote economic and legal decentralisation, such as:

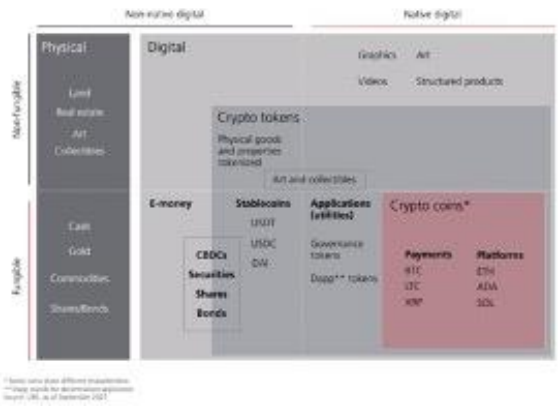
- by enabling transparency — e.g., how digital assets are distributed, and where most fees are being earned in DeFi ecosystem;
- by being open-source public good — anyone is free to use, test and upgrade its functionality to ensure safety and productivity;
- by enabling self-sovereignty in data — users retain control of their data, purchases, and content across Web 3.0 products and services that are built on different platforms;
- by prioritising composability — elements can be programmed to interact with each other, making these programs like building blocks that anyone can use and hence speeding up innovations.

Collectively, these features reduce the risk of information asymmetry, reduce the importance of any proprietary technology, and increase the importance of the network contributors and consumers relative to its developers. In other words: These features shift the system's value from its tech stack, to its network. As networks are more open and diffuse than proprietary (and centralised) systems, this shift highlights why Web 3.0 is better positioned than Web 2.0 to achieve decentralisation of value.

Incentives Decentralised – Digital/Virtual Assets

In our previous report, "Digital Assets and Web 3.0", written about a year ago, we first introduced this emerging asset class, its implications and the possible investment landscape. A lot has changed since then, but our thesis remains intact in that investors must embrace this new asset class and include them in their portfolio. For the current discussion, we introduce digital assets (or tokens) as the defining incentives to make any Web 3.0 system work.

An Overview of the Digital Asset Domain



Source: UBS, as of September 2021

Basically, the decentralised economies are driven by a combination of two types of incentives:

The first is intrinsic incentives, based on the system's underlying characteristics, such as user base, network effects, technology, etc. The second is extrinsic incentives, such as digital asset distributions, revenue sharing, etc. Of these, digital assets are the most critical tool Web 3.0 builders have to facilitate for the formation and ongoing functioning of their decentralised economies because they enable the balancing of incentives among developers, contributors, and consumers. When properly designed, digital asset distributions have the potential to drive a "flywheel" of network effects where the overall system becomes more valuable to more users as more people participate in the network. But unlike the locked-in network effects of Web 2.0 (being owned and centralised), Web 3.0 digital assets empower users to shape their own experience (through decentralised governance) and benefit from their contributions (voices being heard).

Ethereum's growth over the last two years is a prime example of this: From the start of 2020 to the start of 2022, the amount of digital assets deposited in

Ethereum's DeFi protocols grew from just over $600 million to just over $150 billion. But this isn't a narrative about the amount and their monetary value — rather, it shows how developer activity yielded products and services that attracted users, which then attracted more developers and additional products and services, which in turn led to further user growth.

The true value of Web 3.0 is in its network of stakeholders — not in its technology developer, not in a closed or proprietary system, and not in other classic moats.

Trust Decentralised - DAO

The vast majority of blockchain networks and smart contract-based protocols are run with decentralised governance administered by a decentralised autonomous organisation ("DAO"). Decentralised governance and DAOs provide many benefits, including:

- Enhancing security, by distributing technical control over Web 3.0 systems to decentralised groups — thereby avoiding any system's governance being controlled by any single party;
- Providing stakeholders with meaningful participations in decision-making and ensuring long-term incentive alignment among stakeholders - thereby contributing to the overall health and sustainability of the systems.
- Supporting legal decentralisation by reducing stakeholder reliance on the managerial efforts of any individual or group — thereby reducing the risk of information asymmetries.

To bridge the gap from existing economic systems, decentralised systems are experimenting with:

- SubDAOs. To streamline decision making, several DAOs empower subDAOs with tailored authority regarding certain categories of actions, such as legal, finance, development, etc.
- Governance minimisation. To increase the dependability of DeFi protocols, and to overcome challenges with DAO participation rates, some favour to minimise the ultimate number of decisions that DAOs are required to make, or to alternatively create a hierarchical structure in which more significant decisions require higher voting quorums.
- Incentivise participation. To ensure effective DAO governance, some DAOs incentivise active participation, including the compensation of delegates. Retroactive awards programs can be very effective because they defer the assessment and awarding of contributions until after the value has been delivered. They can also help spur competition and an open marketplace if designed well.
- Progressive decentralisation. To protect against malicious attacks, many DAOs use "progressive decentralisation", where greater control is handed from the developer company to the community as the safety of the protocol/ network increases.

Ultimately, DAO developers should be careful not to vest too much power in the hands of insiders. Instead, significant control should be given to the community. Where there are imbalances in power, one should look to delegate programs to help diffuse it.

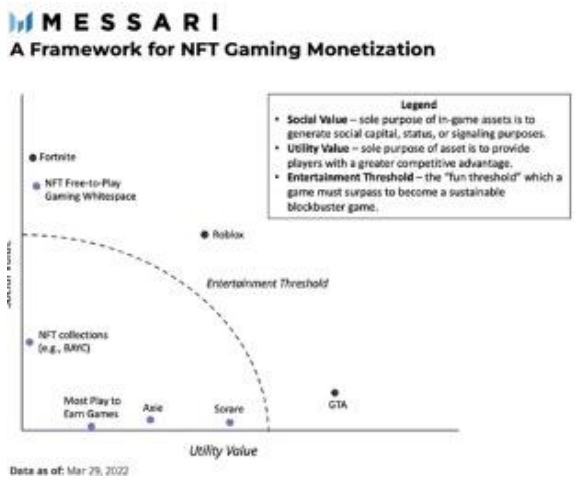
Economy Decentralised – Open Decentralisation

If the building blocks of an economy – value, incentive and trust – can be decentralised, then all economic activities can also be decentralised. But the complexity of economic activists shall require a form of open decentralisation where a common/shared infrastructure is used to build various economic activities. This means that Web 3.0 goes beyond merely disintermediating known features and applications, but open up to all other possibilities currently not available under Web 2.0. Early experiments have already happened in gaming, social media and marketplaces, the most favoured segments of Web 2.0 besides mobile finance. Let's take a brief look at each of them.

Web 3.0 gaming could entail a system with multiple games implementing a shared smart contract protocol and governance token; having separate in-game currencies and NFTs; and enabling both players and contributors to earn digital assets. These assets would also be portable across the ecosystem. The games driving the most use could then earn the greatest percentage of the governance tokens

distributed by the system's DAO, leading game creators to in turn fund additional development of their games.

A Framework for NFT Gaming Monetisation



Source: Messari.io

Web 3.0 social media could entail a system with multiple iterations of social media services and messaging services, each built as a separate client upon the same open-source smart contract protocol. Since the protocol would share a native governance token: consumers would earn tokens based on use, contributors would earn tokens based on the content they create, and clients would earn tokens based on various metrics established by the DAO.

Web 3.0 marketplaces could entail a system where a service provider offers a collection of collaborative smart contracts to their clients, providing them with facilitated interactions and scheduling capability with their customers. Developers could then build white-label versions of those services to offer many different levels of customised services or products. Clients and service providers would all earn the same governance token based on their contributions to the system.

Ultimately, open decentralisation, in simplicity means an open infrastructure — made up of blockchain networks and composable smart contract protocols — provides a rich environment for a variety of specialised products and services to be built on top of its layers. By utilising this shared infrastructure, builders can build Web 3.0 products and services at a fraction of the cost of building centralised Web 2.0 applications from scratch.

NFT projects and tokenisation protocols are two emerging elements of Web 3.0 system. If too much ownership is vested in the hands of a few, these two elements are no different to today's centralised systems. However, if they are decentralised well, NFT and tokens can become powerful tools to reaching the full potential of the cyber-physical regime of the Web 3.0 economy.

NFT Decentralised

Non-fungible token (NFT) projects and their communities are an emerging and increasingly popular type of Web 3.0 systems. The value of an NFT is largely intrinsic and not derived from the managerial efforts of others. But as NFT projects have grown in complexity, NFT projects now often involve additional content creation/ additional NFT drops, implementation of NFTs in video games, community-driven product development, and other activities — all of which potentially increase the reliance of NFT holders on the managerial efforts of others and therefore potentially being treated as 'securities' going forward.

NFT projects should therefore consider incorporating the principles of decentralisation into their Web 3.0 systems, particularly if they intend to couple the project with a fungible token.

The essential elements of an NFT project normally include:

1. an NFT collection minted on a blockchain and held by various users;
2. intellectual property contributed to the NFT community, most likely relating to the NFTs themselves (which could be "staked" to the community by the holders) and any lore created by the community;
3. digital assets distributions and incentivisation mechanisms;
4. the launching of DAO governance with respect to the community intellectual property and DAO treasury;
5. the initiation of derivative projects; and
6. the hosting of social gatherings and events.

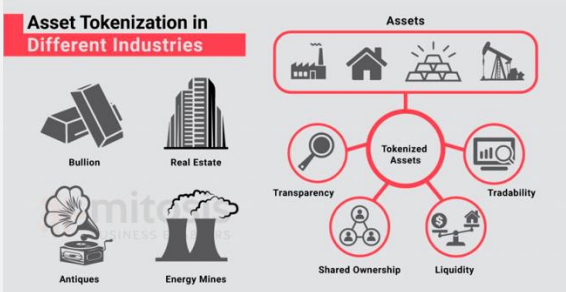
Decentralisation for such NFT projects can be achieved through the following ways:

1. the DAO could use its initial resources on community engagement (e.g., Twitter, Discord, etc.) and to fund social gatherings and other events — thereby boosting the implicit incentives of the community (i.e., its popularity);
2. those implicit incentives — along with explicit incentives (such as fungible token awards, access to NFT sales, etc.) — could then be used to incentivise the creation of derivative projects utilizing the community's intellectual property. Developers would receive rewards for developing such projects, and consumers would receive awards for using them. For example, the DAO could employ a third-party developer to create a play-to-earn game using the community's characters, with in-game tokenomics featuring the native digital asset of the community. In this regard, derivative projects act similarly to the clients described in the earlier open decentralisation models, making the overall system less dependent on any single source to drive value to NFT holders, which helps limit the risk of significant information asymmetries arising.
3. another significant tool that NFT projects have at their disposal are royalties on secondary sales of NFTs accruing to the DAO, which can fuel their decentralised economies. These royalties would provide the DAO with a decentralised revenue stream during periods in which derivative projects may not be producing sufficient returns for the system. Eventually, the combination of value accruing to the ecosystem from derivative projects and secondary sales could drive the creation of a healthy decentralised economy for the NFT project.

Tokenisation Protocols Decentralised

Tokenisation protocols are another type of emerging Web 3.0 system. In these systems, assets are onboarded to a blockchain, tokenised by a smart contract protocol, and then sold or used for other purposes. Types of tokenisation protocols include serial NFT-minting projects, digital asset marketplaces, and protocols that tokenise real-world assets.

Tokenisation of real assets



Source: Impact of Tokenized Assets in Business Environment

The open decentralisation model may include:

- assets brought on-chain from multiple providers through a shared smart contract protocol;
- the smart contract protocol tokenizing such assets;
- the sale or use of such tokenised assets through multiple clients;
- native digital asset distributions and incentivisation mechanisms; and
- the launching of DAO governance with respect to the community intellectual property and DAO treasury.

In the Web 3.0 decentralisation model for tokenisation protocols, economic decentralisation is achieved through sufficient diversity of inputs (asset providers) and outputs (asset acquirors), as well as the decentralisation of the layers through which the tokenised assets flow (the blockchain, the smart contracts, and the clients).

A protocol's DAO could also use explicit incentives (fungible token awards, commissions/ fees, etc.) to:

- incentivise asset providers to provide assets to the system;
- incentivise clients to make a market in the tokenised assets; and
- incentivise acquirors to acquire such assets or to consume them.

While the initial developer company may play a significant part in any of these roles (asset provider, client operator, asset acquiror) in the beginning,

once the system is decentralised, the developer company would eventually be just one of many actors in any given role. This would limit the risk of any significant information asymmetries accruing to it and reduce the reliance on its managerial efforts. In addition, many roles could be undertaken by the DAO and/ or subDAOs.

Over time, the explicit incentives could also be adjusted to account for potential shortfalls on either the supply side or the demand side. In a decentralised marketplace for instance, token incentives to sellers (the supply side) could be increased to bring more goods for sale onto the platform; and token incentives to buyers (the demand side) could be increased to encourage more purchases.

"And he that lives to live forever never fears dying."

-William Penn-

PART 3 - THE TRAYAH

Web 3.0 Investment Strategy

Trayah means Three in Sanskrit language. In most literature, a triangle represents perfectness, unity, and importance. It is the strongest unit. Triangle is also the Greek letter Delta, which is symbolic of a doorway, and is commonly used to represent change. Adding digital assets to public and private securities in an investment universe represents a change that also makes a complete investment triangle.

Web 3.0 is the third iteration of foundational economic change brought about by foundational technological innovations. Investing in Web 3.0 focuses on the investments in technologies of ABC with a central theme of 3D's. Together they define the Web 3.0 infrastructure upon which the new cyber-physical economy will be built. This is particularly needed as the new generations seek for change while the mega forces of de-globalisation and de-dollarisation are also forcing mega cycle changes. A new paradigm of secure and trusted economy has to be built, while at the same time answering the needs for more equality, more environmentally friendly, more freedom, more creativity and more competitive. We believe this is Web 3.0 economy.

Post-Modern Portfolio Construction

Crypto assets are becoming a key component of The Postmodern Portfolio by offering asset allocators a new category that extends the risk and return spectrum beyond traditional alternatives like real estate or private equity.

Crypto assets offer exposure to the Web 3.0 economies directly. While current Web 3.0 user adoption only roughly matches the internet in 1999, crypto market valuations have grown much faster and offer an investable universe of ~$2.7 trillion, or ~1.2% of global financial assets, and have recently become large enough to be included within institutional portfolios.

Limited investment alternatives for many cash-flushed investors with traditional asset mandates have driven stocks and bonds to historically elevated valuations, which in turn required investors to take on greater exposure to private market alternatives. Crypto assets, which have been the best performing asset class for eight of the last ten years, have offered a solution to the challenging macro environment by serving as a risk-on asset and hedge against inflation. Adding a small portion of crypto assets shall prove advantageous in future portfolio investments.

ABCD Value Chains

The overall investment approach for Web 3.0 should include both the infrastructure as well as decentralised business of the Web 3.0 economy such as the Metaverse. We believe Web 3.0 economies are cyber-physical in nature. As such, they are still subject to the macro forces of de-globalisation and de-dollarisation. However, we believe Web 3.0 will once again demonstrate the greatest human inventiveness driven by technological innovations to address the issues of over-financialisaton, over-exploitation and over-concentration.

For investment into Web 3.0, a portfolio that diversifies into listed equities, private equities as well as a small portion of cryptocurrencies and tokens should be well suited to capture this mega cycle of opportunities in the next decade.

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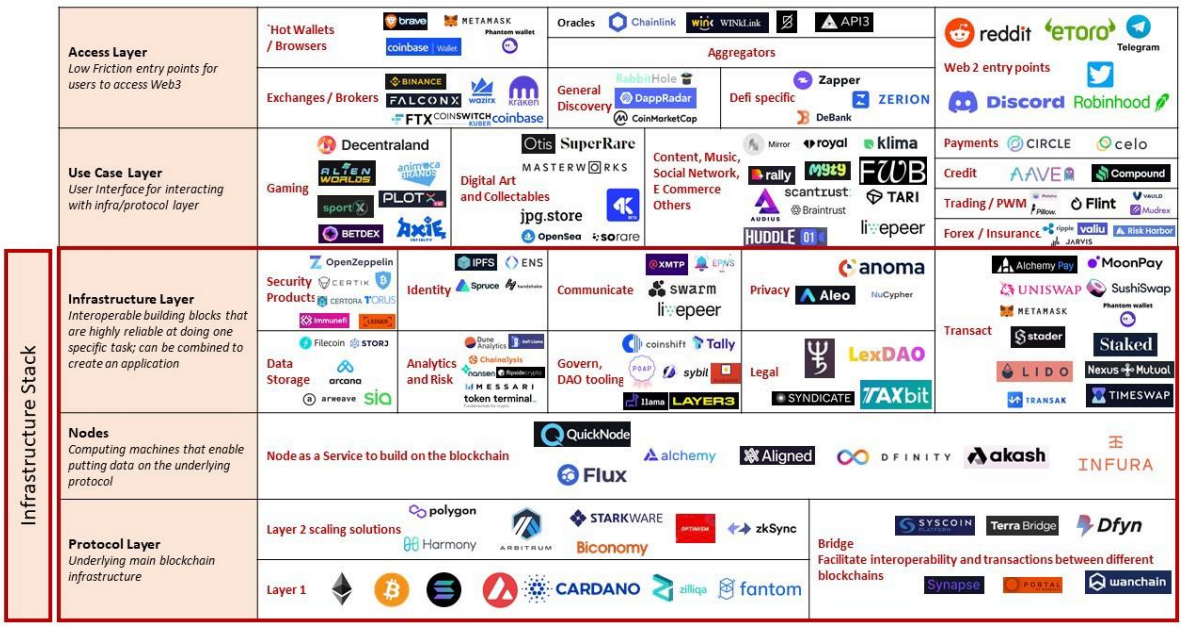
Such portfolio can be structured in two main parts. The first and majority part focuses on the infrastructure opportunities (i.e., AI infrastructure, Blockchain infrastructure, and Cloud infrastructure). Those are the companies that form and support AI, Blockchain and Cloud ecosystems. The value chains are very extensive as they include companies in basic industries such as software, hardware, semiconductors, batteries, sensors, networks, cybersecurity, content creation and streaming; to more Wed 3.0 focused industries such as VR/AR, IoT, wearables, XaaS, 5G, satellite, edge computing, 3D printing, gaming, neobank, and semantic Web. But we should also go down the value chains to the key materials and resources that are essential and relatively scarce for the physical infrastructure development. For example, nickel is key to lithium battery production, and copper and steel are essential for building data warehouse critical for large scale cloud infrastructure. This space is best covered by a combination of listed and private investment opportunities.

The second and smaller portion of the portfolio focuses on crypto native opportunities, with an initial focus on infrastructure Layer I blockchain protocols, Dapps such as DeFi, P2E, NFT minting, as well as utilities such as crypto security and insurance for DeFi. DAO's will also be one of the emerging class of investments that aims to decentralise a diverse set of business such as gaming, social media, and marketplace.

Web 3.0 and the underlying infrastructure stack

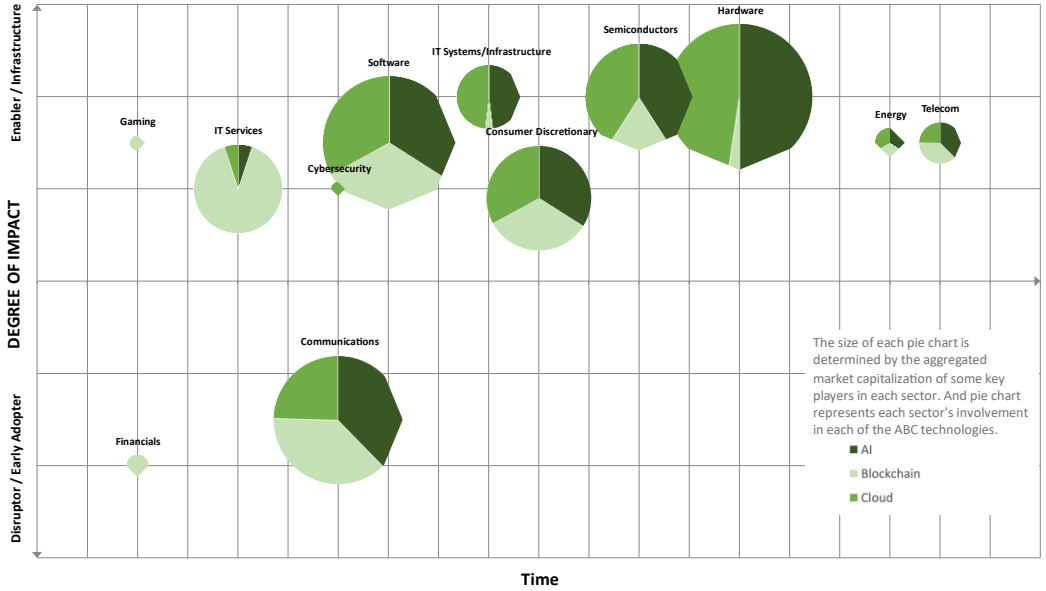


Source: Medium

Investment Universe

As Web 3.0 rides on the existing Internet infrastructure with the integration of new and advanced technologies, a Web 3.0 infrastructure investable universe with companies in diverse industries can be composed which we provide a brief introduction below.

The role of each sector and its impact as the economy embrace Web 3.0



Some Market Players in the Ecosystem

Sector	Company	Thematic Relevance	Key highlights	Others
Software	Microsoft Corp.	Infrastructure Cloud Computing	Microsoft has an ecosystem across cloud, PC segment, gaming and metaverse. One of the biggest global cloud service providers	VMWare Inc. VEEVA Systems Inc.
Financials	Block Inc.	Adopter Bitcoin for everyday transaction	Block has two powerful independent ecosystems serving customers (Cash App) and sellers (Square). The company takes a long term strategy in cryptocurrency and is a prominent contributor towards the development of bitcoin	Signature Bank Coinbase Global Inc.
	Silvergate Capital Corp.	Adopter Cryptocurrency	Silvergate is a leading crypto bank that serves the highest number of crypto customers in the US. The Silvergate Exchange Network (SEN), powers the payment network between crypto exchanges and institutional investors.	
Hardware	Apple Inc.	Adopter AR & VR / IoT	Apple has a track record of bringing tech to the mainstream. It is optimistic that they can bring AR and VR to the mainstream.	Keysight Technologies Inc. Goertek Inc.
	Samsung SDI Co., Ltd	Infrastructure Battery	Samsung is one of the world's largest supplier of lithium-ion batteries.	
IT Systems/ Infrastructure	Equinix Inc.	Infrastructure Data Centres	Equinix owns or has interests in 244 data centres across 30 countries on 6 continents. (As of April 2022)	Arista Networks Inc
Gaming	Unity Software Inc.	Enabler Metaverse	Unity offers a comprehensive end-to-end solutions for consumers to create, run and monetize real-time 3D games and applications. It is estimated that 71% of the top 1,000 games were made with Unity in Q4 2020.	NetEase Inc.
Telecom	AT&T Inc.	Infrastructure Mobile network	AT&T is one of the largest telecom titans in the U.S.. The company is in the early stage of transitioning to 5G networks	PT XL Axiata Tbk China Mobile Ltd.
Energy	Ganfeng Lithium Co., Ltd	Infrastructure Metal	As China's biggest lithium miner, Ganfeng handles lithium throughout the entire production cycle.	Merdeka Copper Gold Tbk Pt Vale SA
Semiconductors	Nvidia Corp.	Infrastructure Computing components	Nvidia is a pioneer in GPUs and DPUs, which are the key components for PC, as well as data centre architectures. Nvidia is also at the forefront of AI hardware and software technologies by continue to release more powerful and products for computing AI workloads.	Amkor Technology Inc Skyworks Solutions Inc

Source: Heyokha Brothers

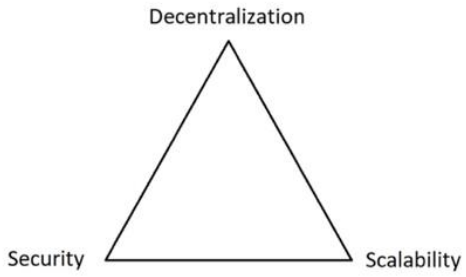
HEYÓKHA BROTHERS

PART 4 – ABCD EXPANDED

In the following section, we introduce in more detail the respective value chains with some representative organisations in the space. Some of the topics are more technical but are essential to understand the importance of the technologies. We shall only attempt to do 101 introductions as our focus in this report is the investment and risk implications in the coming decade. In the following section we shall introduce the basics, applications, markets and issues of Blockchain (with Crypto Market and Game Theory), DeFi, NFT, DAO, Ethereum 2.0, Blockchain 4.0, followed by AI and Cloud, before we introduce FinTech 2.0 starting with Banking and PayTech, and lastly, central bank digital currencies (CBDCs).

#1 Blockchain, Crypto Markets and Game Theory

The Blockchain Trilemma



Source: Heyokha Brothers

The blockchain trilemma addresses the challenges faced by developers in creating a blockchain that is scalable, decentralised and secure – without compromising any one of the facets.

Some argue that the blockchain data structure has the inherent limitations that prevent it from achieving all three properties, forcing developers to make trade-offs when building a blockchain project.

- Scalability: the chain can process more transactions than a single regular node can verify.
- Decentralisation: the chain can run without any trust dependencies on a small group of large, centralised actors.
- Security: the chain can resist a large percentage of participating nodes trying to attack it.

Tokenomics – Game Theory

Getting the tokenomics right is one of the fundamental steps to safeguard the long-term success of a blockchain protocol and its crypto assets. Tokenomics encompasses the concept of an economic system and optimisation designed to incentivise special behaviors in a community, using tokens to create a self-sustaining economy. Game theory occupies a critical role in tokenomics. Those who are unfamiliar with game theory may want to refer to the appendix but we provide an example of a failure game below:

The pricing decision of a company is highly influenced by the pricing decisions of rival companies. This is very commonly seen in the supermarket industry. One example was the price cut initiated by Asda on fuel in 2018. Asda, Morrisons, Sainsbury's and Tesco are competitors in racing to gain a larger share of the market. The price cut kicked off by Asda was quickly matched by the competitors. Although the companies may see an increase in sales of their products, this would result in a drop of their revenues and profits. Coordination failure is apparent in this example. The companies have the choice on whether to cooperate with each other and kept their prices higher, or they could engage in the mutual price cutting actions which are worse off for each of them in the long term.

Now we turn to look at how game theory plays out in blockchain. The transfer of crypto assets using DLT requires a verification process because electronic objects can be easily duplicated or changed. In a centralised network, a specific node, e.g., institutions such as banks for the transfer of money, is entrusted with the responsibility of verifications. But this comes with a cost, therefore these institutions charge users with fees. In contrast, in a decentralised network, verification tasks are not assigned to a specific node but to multiple nodes in the network (a consensus mechanism). This means that trust does not rely on one single node, but on the network and its protocol. As a result, the need of cooperation between participants emerges, displaying the characteristics of a coordination game.

Applying this to bitcoin, a utility function of a participant in the network would be dependent on the number of bitcoins in circulation, the demand of bitcoins, the network characteristics including its security, and the incentives to miners. Hence the participants' received value of bitcoins is tied to the long-term success of the network.

In order to maintain this robust network, the network is designed to have a game theoretic incentive mechanism. Miners who take part in verification tasks will be rewarded with bitcoins to compensate their cost of verifications (e.g., energy consumption cost). Naturally, when miners are able to capture utility from this process, more people would be incentivised to participate. This creates a network effect where higher number of participants drives the demand for bitcoins and since the supply of bitcoin is capped, its value will increase. This incentive mechanism boosts the bitcoin adoption as well as its security as its security increases when more bitcoins are mined.

Now you may question why participants all cooperate and follow the rules. It is natural to expect that there will be immoral people in a community such as miners who would try to "double spend" by creating a parallel chain and mine extra bitcoins. This can destroy the bitcoin system. Here is where the genius of blockchain comes in. The blockchain was designed in a way that it is a self-enforcing Nash Equilibrium. This is possible because mining has a recursive punishment system.

The blockchain protocol includes a rule that if any block that is mined on top of an invalid block becomes an invalid block. Using this rule, if a miner creates an invalid block on an alternative chain, other miners will simply ignore or reject this block and keep on mining on the original, honest chain. Thus, a coordination game can be applied here. A miner gains zero profit if his strategy is not consistent with those of the majority of miners, therefore, a miner will not spend and waste his computation power for a worthless outcome. The incentive mechanism encourages miners to behave in an honest manner.

Even though early miners would be able to achieve solid short-term gains if a majority of them act maliciously or a miner who have harness a majority of the mining power. In the long run, as the bitcoin network grows, the computing power and hardware required to "double spend" would be extremely expensive. Hence the benefit does not justify the high cost incurred. The malicious actors would be better off cooperating with the rest of the network.

Tokens are far more than the publicly perceived financial speculation instruments. Tokens, if well designed, can solve the common coordination failure problem found in traditional economy (such as the supermarket example). The introduction of a game theoretic incentive mechanism maintains the correct functioning of the network in the long run, making participants better off by cooperating and playing by the rules than undermining the system for their own wealth.

In short, tokenomics assures a long-term perspective to cooperative and competitive collaboration in the digital age.

Game Theory – Further Explained

Game theory is the study of strategic decision making consisting of 1) players, 2) strategies and 3) payoff.

In basic game theory, each player has a definite course of action, and the rules of the game are made known to the players. The players are assumed to be rational that they act to maximise their own payoffs. A player should capture his payoff (utility), for choosing a certain strategy (performing a certain action). They make decisions after evaluating the benefits and costs associated with their moves.

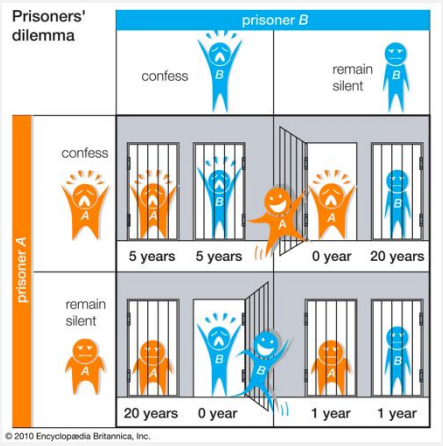
Let's look at the famous Prisoner's Dilemma as an example of game theory.

In this scenario, two prisoners are interrogated separately for a crime that they are equally guilty of.

Both prisoners are offered an opportunity to confess and receive a reduced sentence of five years each for partly responsible for the crime. If they both remain silent, the authorities can only convict them on a lesser charge resulting in one year in jail for each of them. If only of them testifies against the other one out by confessing, then the person who confessed will get zero year while the other gets twenty years. So there are four possible outcomes for this scenario, with both making one of the two possible decisions, confess or don't confess.

Below is the matrix for the years of prison time each of them will get based on their decision.

A Payoff Matric



Source: Encyclopædia Britannica, Inc.

The optimal solution with the least jail time for both prisoners is for both of them to remain silent and not confess. Confessing, however, is a dominant strategy for each prisoner as it yields a lower jail time regardless of the strategy of the other prisoner. Thus, it is rational for each prisoner to confess.

The outcome in which both prisoners confess is a Nash equilibrium which is the optimal strategy so that no player can gain by changing his strategy unilaterally, assuming that the other players keep their strategies unchanged.

A coordination game is when players benefit from coordinating their course of action by choosing the same strategy. If a minority of people in a group try to change to a new state while the majority of people are not changing their state, the minority will not have any incentive to stay in the new state.

The Prisoner's Dilemma is a coordination failure. The players would get a better payoff if they both cooperated. But since they cannot trust each other, each prisoner has an incentive to testify and confess.

#2 Decentralised Finance

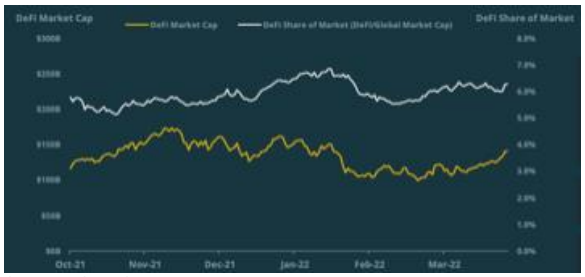
Introduction

Decentralised Finance (DeFi) is a collective term for financial products and services that are available on a public decentralised blockchain network, mostly built on Ethereum today. With products built using the same programming language, this means that different products can work together seamlessly.

Like traditional banks, crypto assets offer the same products but in a decentralised, non-custodial form. This includes lending, borrowing, trading, payment, etc.

According to CoinGecko, the DeFi market size stood above $141 billion at the end of Q1 2022, as measured by the amount of cryptocurrency locked in the market. The total value locked (TVL), a common metric for DeFi, which represents the total amount of assets locked in the various smart contracts is at $177 billion, compared to just $2 billion just more than two years ago.

DeFi Market Cap and DeFi Market Share of Overall Market (Oct 2021 – March 2022)



Source: CoinGecko

In traditional centralised financial world, financial institutions act as guarantors of transactions. In DeFi, a smart contract replaces the financial institutions' involvement in a transaction, thereby enabling peer-to- peer transactions and payments. The records of the transactions are stored permanently on the blockchain.

Smart Contract

Smart contract is a program that runs and stores on a blockchain. It's a collection of codes that represents different conditions that describe the possible scenarios of a future transaction. The code of the contract is replicated on the computers of the participants that are in the network. This ensures a more transparent and secured facilitation of the contractual terms.

Once the predetermined conditions have been met and are verified by the participants in the blockchain network, the relevant transaction will be executed

automatically. This means that smart contracts remove the need for intermediaries and the associated time delays and costs. The blockchain is then updated when the transaction is completed, so the agreement is executed and cannot be tempered.

DeFi Applications

Among the most common use cases of DeFi at the moment are lending and borrowing. Lending is a popular way to earn passive income in DeFi. DeFi loans enable users to lend their crypto assets to others and earn interest on the loan. In the world of DeFi, anyone can become a lender, the most common way is via a lending pool. Lenders pool their assets and distribute those assets to borrowers with the rules of the loan written into a smart contract.

Most loans made in DeFi are secured with collateral, borrowers typically need to be over-collateralised (e.g., MakerDAO requires borrowers to collateralise their loans at a minimum of 150% of the loan value) in order to reduce the risks for lenders against sudden drop in the collateral value.

In lending, the TVL metric is measured by the value of assets deposited into smart contracts by both the lenders and borrowers. A lot of users are depositing one asset, borrowing another, trading the borrowed asset for the deposited asset and then re-depositing. It can be considered as one form of leveraged trading in the crypto market.

The popular DeFi lending and borrowing protocols include:

- MakerDAO
- Aave
- Compound

The boom of DeFi since 2020 gave rise to yield farming. Yield farming is a network participation strategy that allows investors to provide liquidity to a liquidity pool. These pools power a marketplace where users can exchange, borrow, or lend multiple tokens. In return for locking up the funds in the pool, the investors will receive a reward from the specific pool to which they provided liquidity. The reward can be in the form of part of the transaction fee, interest from borrowers or a governance token. Yield farmers typically move their assets around frequently between different pools to maximise their returns. This came to prominence after Compound started issuing (airdrop) its governance token, COMP, to its platform users, which is known as liquidity mining.

Liquidity mining occurs when a yield farming participant earns token rewards as additional compensation. These token rewards may rapidly shoot up in value, increasing the profits for investors. The increase in TVL over the year is highly driven by investors betting on the promise of high yields from providing liquidity to the DeFi protocols. Currently, yield farming can provide more lucrative interest (e.g., ranging from around 3% to 20%) than a traditional bank, but keep in mind that there are much higher risks involved.

Other use cases of DeFi include:

- Decentralised exchanges (DEX)
- Peer-to-peer marketplaces where transactions occur directly between crypto traders.
- Derivatives (that allow asset deposits to power synthetic assets, futures contracts, and other options)
- Payment for transactions
- Insurance for DeFi

DeFi Limitations

With the unprecedented growth for the Defi market in the past two years, some of the inherent problems facing DeFi projects become apparent:

1. The scalability of the host blockchain

DeFi transactions require extended periods of time for confirmation due to the congestion of the Ethereum network. Ethereum at full capacity, can process about 30 transactions per second, while centralised counterparts can process thousands and thousands of transactions.

2. The rising transaction fees

Also known as gas fees, for crypto transaction including open lending protocols are rising, again due to the congestion. This makes low-value loans impractical. For example, for loan amounts below US$1000, these transactions fees would sum to more than the interest due, making it unreasonable to take out a low-value loan.

3. Lack of stickiness

Yield farming has also become a double-edged sword as liquidity mining could only attract new users and assets in the short term, this creates an unhealthy cash flow when the users have no intention of contributing to the projects' development, but only for the short-term gain.

4. Security

Routine upgrades and changes to software can often lead to outdated and redundant information. Most DeFi users still don't understand how to safely manage risk or objectively validate the security of a network as they stake (lock-up) large volumes of funds.

DeFi 2.0

The next evolution of DeFi is emerging with new projects exploring new ways to fix the existing limitations as well as to open more possibilities to capture users. New standards are required to provide a sustainable long-term solution which prevents users from withdrawing assets for new yield opportunities.

There have been protocols such as Olympus DAO which builds around the idea of protocol owned liquidity, so instead of liquidity mining, the protocol buys the liquidity outright, e.g., through a (crypto) bond, in exchange for its tokens. This essentially rewrites the incentive mechanism and ensure long term stickiness. Similar protocol called Fei which holds ETH to issue FEI, a stablecoin. Fei leverages protocol-controlled value (PCV) which outright owns the assets locked into the smart contracts. This gives the protocol more flexibility to engage in activities that are not profit-oriented. The PCV can be reallocated to other platforms in the future if the use case is clear, such as protocol development, Dapps creations etc.

Moreover, while Ethereum remains the most active and popular blockchain, other players are emerging. We anticipate a cross-chain future where each protocol will connect multiple blockchains, making the transfer of information between different blockchains more seamless. A multichain ecosystem can bring additional space for new protocols to enter, thus attracting more users to come onboard, expanding its scale and strengthens its security.

Advantages of DeFi 2.0

1. A wider level of flexibility for staked assets

DeFi 2.0 protocols add further layers of utility and incentives by using yield farm liquidity providers (LP) tokens as collateral for a loan, or to mint additional tokens. LP tokens can have their value unlocked for new opportunities while still generating APY.

2. Insurance covered smart contracts

DeFi 2.0 offers insurance on smart contracts for users, an insurance project can offer guarantees on a deposit with the yield farm for a fee. In the past, someone staking their LP tokens in a yield farm would previously assume risk as they could lose all their funds if said smart contracts were compromised.

3. Insurance for impermanent loss

With DeFi 2.0, a user works with the protocol to create token pairs, where one can add one token to a single- sided LP, with the protocol also adding their native token as the other side of the pair. Both the protocol and the user will then receive fees from swaps made in that respective pair. Over time, the protocol then uses fees generated to build up an insurance fund to safeguard deposits against the potential of impermanent loss. If the loss out values the number of fees built up in the insurance fund, the protocol can mint new tokens to cover the balance. The protocol can also burn excess to reduce supply or store them for later use.

4. Self-repaying loans

In a self-repaying loan structure, a lender can use the interest earned on the deposited collateral to pay off the loan over time. There is no risk of liquidation that would typically be faced by an ordinary loan.

DeFi Risks

Despite more desired incentives provided by DeFi 2.0, inherent risks remain to be managed. They include:

1. Compromised smart contracts

An audit cannot guarantee the security and safety of a smart contract, so it is key that users do due diligence and research before investing in a protocol.

2. Changing regulations

Protocols may need to adjust rules often to accommodate updated mandates and industry standards. This may change the level of support and compromise the amount of decentralisation involved.

3. Rigid user experience

If the website of a DeFi project goes down, users will not be able to recover their staked assets unless they possess the technical expertise to interact directly with the smart contract.

TLDR: DeFi stands for the financial products and services that are available on a public decentralised blockchain network. Trusted intermediaries are replaced by smart contracts which are codes that are used to automate the execution of agreements when predetermined conditions are met. There is a vast range of DeFi applications such as lending & borrowing, decentralised exchanges, derivatives and insurance. Nonetheless, it is important to keep in mind that DeFi is highly risky and has its limitations. DeFi is moving on to its next generation, DeFi 2.0, in order to develop solutions for the realised limitations of the first-generation including issues of scalability and sustainability of existing yield farming mechanism.

#3 Non-Fungible Tokens (NFT)

Introduction

NFT is a digital asset that can be purely digitally created or can represent real world objects such as art, music, in-game items, video and collectibles that sit on a blockchain.

Fungible tokens such as Bitcoin can be traded or exchanged for one another, one Bitcoin is always equal to another Bitcoin. Whereas each NFT has its unique digital signature that is directly linked to a blockchain address, this makes it impossible to be substituted or exchanged for another asset of the same type. NFTs can have only one owner at a time and a private key is used to serve as the proof of ownership.

The NFT industry's popularity began with gaming and has expanded far beyond it afterwards. In 2020, gaming sector had the highest sales count of over 629K among other key NFT sectors including sports, art, collectibles, metaverse and utility. In 2021, according to the data from market tracker DappRader, the sales volume of NFTs surged to $10.7 billion in the third quarter alone, up more than 8X from the previous quarter. The total 2021 sales volume stood at $13.2 billion up to Q3 2021. These numbers include sales from multiple blockchains and "off-chain" transactions such as NFT art sales at auction houses.

NFTs are typically held on the Ethereum blockchain and the process of creating an NFT on the blockchain is called minting. The process of minting involves the below steps:

1. Open a crypto exchange account
2. Purchase cryptocurrency e.g., Ether (Minting an NFT requires to perform a transaction, therefore you will need to pay gas fee)
3. Create a crypto wallet, e.g., on Metamask
4. Send Ether to the crypto wallet
5. Set up a wallet on an NFT platform and connect the crypto wallet to it
6. You can now create and list your NFT by uploading the digital art to the platform

Popular NFT marketplaces include:

- OpenSea
- Rarible
- SuperRare
- Foundation

Values of NFTs

Currently, creators often need to handover the ownership of their content to platforms that they use to publicise it, and these platforms can reap profits from the creators. NFTs create a new marketplace for them to directly sell their artworks to consumers. Removing the middlemen allows creators to keep more of the profits. They can also program royalties in the NFT (smart contract) so that they can receive a percentage of secondary sales, which generates perpetual returns for these creators. NFT creators can also create fractional ownership of NFT and these fractionalised NFTs can be traded on DEX. NFTs can also play a role in DeFi. NFTs representing valuable assets like cars and real estate on blockchain that can be used as collaterals

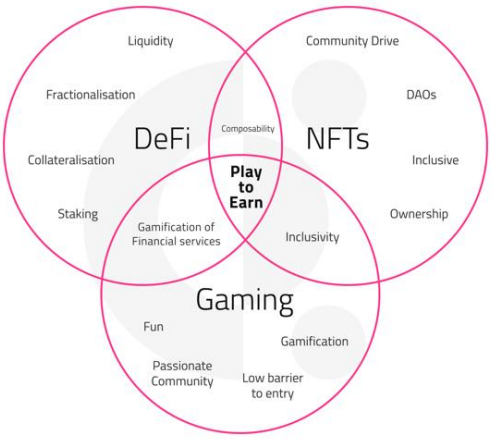
in decentralised loans (or even traditional loans offered by some banks!).

Crypto-wallets have also begun incorporating NFT-related services to make them more approachable to users. Wallets such as Metamask and Pillar are among those that have made it easier to trade and keep track of purchased (and minted) NFTs alongside other crypto assets such as bitcoin. With the explosion of the NFT market, multinational corporations also began embracing NFTs. eBay, for example, is now allowing the sales of NFTs on its platform. However, it has yet to accept cryptocurrency as a form of payments.

NFT Games

The introduction of NFTs has also begun to reshape the gaming industry. "Play to Earn" (P2E) games allow users to farm or collect crypto and NFTs which can then be sold in the market. This type of games creates in-game economies and business models where players can play for an income. Simple ways of earning would include completing daily quests and trading in-game NFTs. Alternative ways to earn would be by staking, where these games allow players to lock up NFTs in smart contracts in return for reward tokens (GameFi). This development, if successful, can form the foundation for metaverse where gaming is expected to be a key component.

P2E is the Combination of DeFi, NFTs and Gaming



Source: Covalent, Understanding the metrics that matter for P2E Gaming

NFT Music

Music NFTs can range from a song, an album, to a bundle including extras such as gig tickets and exclusive bonus tracks. The demise of CD and the usage of online music streaming platforms such as Spotify and Apple Music have significantly strangled profits for the musicians themselves. With NFTs, musicians can bypass label, distributor and publisher rights. They can set the terms and embed royalty program in the smart contract to ensure a slice of any resale value. This essentially gives the musicians a larger share of profit.

One current downside of the introduction of NFT is that the technology has shifted the focus of the art from the value of the music itself to its financial ownership. The high ticket price and gas fee involved have hindered a majority of fans from entering this new marketplace.

Opulous – an online platform to be launched this year that aims to enable musicians to embed a share of their future music royalties in Opulous Music NFTs. The NFTs can be purchased and traded on the Opulous NFT Exchange. These NFTs will generate monthly royalty revenue, allowing owners to earn money from music copyright alongside the musicians. In addition, musicians are able to fund new projects via the platform by either selling their music copyright as NFTs or with DeFi loans up to the value of the royalties they generate over 12 months.

NFT Collectables - Wine

In the wine industry, NFTs are sold not only for the physical bottles, but also for artwork, such as the digital images of wine bottles, labels and wine storage. It provides ways to monetise wine beyond what is actually contained in the bottle.

For winery owners, one key advantage of NFTs is the ability to introduce the wine into multiple channels and attract non-traditional market and new customers. Another benefit is to combat fraud in wine selling. Back in 2016, a report from the European Union Intellectual Property Office estimated that the production of fake spirits and wine was costing EU businesses €1.3bn a year. With the transparency brought by NFT which can essentially capture the chain of evidence going from seller to buyer and reseller, it provides a stamp of

authenticity and makes the wine safe from tampering.

Consider Hellofam.wine – the world's first all NFT wine brand. Customers can purchase Grape Fam NFT to own 1 case of Genesis Vintage 2021 or obtain fractional ownership by purchasing Seedling NFTs which are each backed by a bottle of Genesis Vintage 2021. The wine will be stored indefinitely in an insured, temperature-controlled facility and never sold outside of the NFT. Customers may choose to redeem a case of wine by burning a Grape Fam NFT or 6 Seedling NFTs and paying a processing fee.

NFT Assets - Real Estate

Physical real estate can be tokenised in a way which the token represents the ownership information of the asset, recorded on blockchain. All details including ownership, construction plans, the location and the investor's rights are recorded in the smart contract. The value of the property is then distributed among a fixed number of tokens and issued to investors.

The tokenisation enables the illiquid asset to be made accessible to a broader investor base. Illegal activities such as tax evasion and money laundering can be prevented by the blockchain technology.

Other than physical real estate, digital real estate can also be sold as an NFT. After sale, creators of digital real estate can integrate the NFTs on metaverse platform for the owners to experience the property in virtual reality or augmented reality environment in applications.

The first digital house – Mars House by Krista Kim – was sold for over $500,000 (288 ETH) during a Sotheby's auction. The new owner will receive the 3D files for the NFT which can be integrated on metaverse. However, this sale does not come with the copyright, Krista Kim Studio Inc. retains ownership of the Mars House copyright, meaning that any digital or physical reproduction of the home are restricted. If the owner later resells the house, he/she must delete the 3D files from his/her metaverse. The Mars House was even opened to public via virtual self-guided tours, on Spartial, a virtual reality platform. There is also an option for people to rent the house for weddings and other virtual private events.

#4 Decentralised Autonomous Organisation

Introduction

Decentralised Autonomous Organisation (DAO) is an internet native community that runs on a blockchain protocol. It is where a group of people pull capital together to fund a collective mission.

In traditional organisations, there are usually a hierarchy with a formal board of directors that makes the call from top-down. For DAOs, there are no hierarchy, no board of directors and no central authority. Decision making is based on a bottom-up community where consensus is achieved through voting. The backbone of a DAO is its smart contracts where all the rules and governance are written. These rules can only be altered by a vote.

The DAO framework is typically used for passing votes that are ultimately responsible for the changes made to the protocol over time. This can range from deciding the interest rate for a lending protocol, the issuance of governance token, and investment with the protocol's treasury. The weight of your vote is defined by your ownership of tokens.

Many NFT projects are DAO-governed. The combination of DAO and NFT creates a new form of decentralised media and investment available on the internet which would be owned by NFT creators and operated by DAO token holders.

There are different types of DAOs, all of which serve as a governance mechanism aiming to offer a trust-less system accessible to all. Usually, only token holders can participate in the governance of a network protocol.

Governance-token based DAOs

Voting is based on the ownership of assets which are represented by tokens. DAOs typically issue governance tokens tied to a certain project. These tokens tend to provide holders with voting rights. During the early establishment of a DAO, the founding members are usually given the newly mined tokens when these tokens are yet to have any market value. These tokens can then be traded permissionless on a decentralised exchange. It is also important to keep in mind that although the upside potential of these governance tokens might be

significant as they often have a secondary market value. There lies the possibility that the value of governance token for a DAO may hit zero.

Examples:

- Maker
- Aragon
- Uniswap

Case Study: The Maker DAO

The Maker Protocol allows users to generate DAI, its stablecoin, by leveraging collateral assets approved by the Maker Governance. It is basically a credit facility that issues loans with a certain interest rate, charged in the form of a stability fee. When a user wants to retrieve the collateralised crypto from the smart contract, they must first pay back the Dai they generated along with a stability fee.

The protocol is managed by people who hold its governance token, MKR. They decide on key parameters including stability fees, collateral types/rates through their voting power.

The stability fee is a fee that is paid by each borrower when debt is paid down or completely paid off. It is an annual percentage yield that is calculated on top of the existing debt. Stability fees must be paid in Dai only.

Security measure

Not only the MKR holders, but anyone can submit proposals for an MKR votes. After a loophole was flagged in 2018, the Maker Foundation introduced a security measure which set a 24-hour governance delay to the execution of changes after a governance variable has been approved. This gives the voters an opportunity to protect the system, against a malicious governance proposal if any, by triggering a shutdown.

Incentive mechanism

The Maker system is designed in a way such that the MKR token should accrue value as the use of the Maker Protocol increases, because the supply of MKR is reduced when the system is working well and increased when it is governed poorly through auctions. Once the collected fees exceed a certain amount, the Maker system holds an auction to sell the extra Dai which must be bought with MKR. The MKR will be destroyed subsequently, thus reducing its supply. On the other hand, MKR tokens will be created to auction for Dai if there is insufficient Dai raised to cover outstanding obligation, this will lead to an increase in supply of MKR. Therefore, MKR holders are incentivised to ensure the Maker system is running smoothly so that it can generate more fees from users, thus reducing the supply of MKR.

Share-based DAOs

Unlike governance-token based DAOs, share-based DAOs are less accessible. Those who wish to participate would need to submit a proposal to join together by offering tribute of value in the form of work or tokens such as ETH. Share-based DAOs issue one token that represents the voting power and ownership of the capital reserve.

These tokens are generally redeemable for the underlying capital at any time. In contrast, there is usually no capital reserve for governance-token holders to trade against.

Examples:

- Moloch
- MetaCartel

Case Study: Moloch DAO

Moloch DAO focuses on funding the development of public infrastructure related to Eth 2.0. As Ethereum is considered a digital public good, its development has been rather slow as there is no incentive for stakeholders to bear the cost in return for the benefit that is split between the ecosystem. The Moloch DAO seeks to realign the incentives to solve this issue where stakeholders pool funds and vote on the fund allocation and share the costs together through the DAO structure.

Limited access

Access to the DAO is restricted and it cannot be purchased on the open market. Membership proposals may only be submitted by an existing member. Existing members then vote on new entrants so that existing members are incentivised to only admit new entrants with aligned interests. New entrants fund in ETH and it is locked up in a contract called the Guild Bank. Contributors then request a

certain number of Shares in return, which represents their voting rights.

Skin in the game

Similar to the mechanism used for membership proposals, funding proposals can only be submitted by a member. The proposal would contain work to be delivered in exchange for a requested number of Shares. Once a proposal is passed, new Shares are minted and members will bear the cost of dilution.

These contributors are able to liquidate their votes to retrieve the proportional share of the funds from the guild if they did not agree with the result of a vote by Ragequitting. Ragequitting means that the member needs to liquidate the entirety of their shares and it is restricted for those who voted "No" in a given proposal if the proposal passes, this ensures that the "Yes" voters have to bear the cost of a malicious proposals. These two mechanisms effectively minimise the attempts of 51% attack.

Tokenomics - Token Burning

Token burning is a strategy used by blockchain protocols and cryptocurrency projects to influence the price of a token or coin. The main idea is to reduce the number of tokens permanently from the circulation. In fact, this process is very much like the idea of a publicly traded company buying back its stocks.

A common way for a protocol to do so is by buying tokens from the market and remove them from the supply. These tokens will then be transferred to an "eater address". This is a one-way address with no private key, meaning the transaction cannot be reversed and the tokens cannot be recovered using a private key (because there is none!).

Another alternative would be charging gas fees for each transaction to reduce the supply of tokens from circulation. Again, these fees will be burnt by sending them to an eater address once a transaction completes.

Token burning is often used for deflationary purposes, the decrease in supply tends to boost the asset's value. Together with minting new tokens, token burning can also be used to maintain the price peg of stablecoins.

DAO Examples

1. Nexus Mutual – DAO in DeFi

Nexus Mutual, is a mutual insurance platform, i.e., an insurance company owned by its policyholders. In the very beginning, the insurance industry took the form of a (decentralised) community-based model in which members in the community would pull resources together to protect individuals from risks they faced. Overtime it developed into an industry dominated (centralised) by institutions. Although this brought benefits from product diversification and economies of scale, it also created inefficiencies into the market due to the lack of trust between institutions (who insure) and agents (who sell), which resulted in extra costs (accounted for roughly 35% of insurance premiums) being borne by customers. Nexus is utilizing blockchain technology to bring back the past (community) model which could solve the trust issue and thus cutting half of the extra costs (i.e., reduced premium). Its products include:

(1) Protocol cover, the cover would pay out if the insured suffered a financial loss on a designated protocol.
(2) Yield Token cover, cover up to 90% of loss if a yield bearing token de-pegs in value by more than 10%.
(3) Custody cover, protect against hacks and halted withdrawals on exchanges or custodial wallets.

The generation and acquisition of NXM tokens require a specific contribution to the mutual made through either funds or services. Membership tokens can be used in:

(1) Purchasing cover – member tokens can be burned to purchase cover
(2) Claims assessment stake – to participate in claims assessment and earn the resulting income (if voting with the consensus outcome)
(3) Risk assessment stake – to participate in assessing risks and earning commissions
(4) Redemption – if the capital pool has sufficient funds, redemption of tokens in exchange for Ether is permitted

Staking in #2 and #3 are to ensure individuals have skin in the game to prevent dishonest actions.

For #2, voting against the consensus outcome will also result in locking of the bond for a longer period. For #3, risk assessor will earn commission in the form of tokens for cover sold. But if there is an early claim then part or all of the stakes will be lost.

Currently, the DAO requires all members of the mutual to be identified as required by the company law in the UK. As each member becomes a guarantor of the company. KYC will be conducted when an individual first signs up as a member.

In terms of governance, there is an advisory board, set up to ensure the sustainability and growth of the company as well as to facilitate decisions requiring interactions with the non-blockchain world. Each member can submit proposal to join the board. It will then be voted upon through a full member vote. This ensures the members remain to have full control of the mutual.

2. The DAO

In 2016, a project called 'The DAO' which was an investor-directed venture capital fund, made a fundraising record of 12 million ETH, worth around $150 million USD at the time, over a four-week period. What was essentially thought of as a prosperous project fell victim to a major breach which led to its ultimate end in less than 3 months after its launch.

A loophole was discovered which enabled hackers to retrieve Ether before the smart contract update the balance. The smart contract was created without taking into account the possibility of a recursive call and the bug that the smart contract first sends ETH funds before updating the internal token balance.

A hacker stole 3.6 million ETH. However, the stolen funds were not lost immediately as they were frozen as part of a 28-day holding period. This gave time to the community to decide how to proceed. Among the options, some were calling for the stolen funds to be returned, and others argued that interfering with the transaction was against Ethereum's decentralised principle.

Ultimately, a hard fork was done to restore the funds. It resulted in the Ethereum network split into two, with the version of Ethereum that exists today undoing the ramifications of the breach. Those that were not in favour of this action opted to use the original Ethereum blockchain, which is known as Ethereum Classic.

The DAO teaches a valuable lesson about the importance of security. One failure could cause serious repercussions for the blockchain network, damaging its creditability. Thus, a lot of effort is required to ensure the consensus protocol is well designed with no loophole for exploitation. But it is also fair to predict that the growing popularity of DAOs will bring disruptions to the traditional structure of businesses through different experiments. We could anticipate DAOs and tokens to replace organisations and shares. While this might not be suitable for all businesses, it should nonetheless streamline certain processes and improve efficiency for any organisations. Such implications cannot be underestimated!

#5 Ethereum and Ethereum 2.0

Introduction

Ethereum is the second most popular cryptocurrency, after Bitcoin.

Bitcoin established the foundation for decentralised blockchain technology. Bitcoin is designed to work in peer-to-peer transactions as a currency; created to solve "the root problem with conventional currencies is all the trust that's required to make it work", this is seen as somewhat limited.

Vitalik Buterin, the prominent co-founder of Ethereum, envisioned blockchain as more than just a payment system, he wanted to expand blockchain's functionality to programmable apps.

"I thought [those in the Bitcoin community] weren't approaching the problem in the right way. I thought they were going after individual applications; they were trying to kind of explicitly support each [use case] in a sort of Swiss Army knife protocol."

- Vitalik Buterin-

Ethereum is sometimes referred to as "the world's computer", the idea behind is that it is the common global platform that allows anyone with access to the internet to write distributed applications upon it.

Originally, he wanted to achieve this by adding a more advanced scripting language on top of Bitcoin to allow smart contracts processing, but this idea was not welcomed by the Bitcoin community. Therefore, he decided to create a completely new blockchain. He published his white paper outlining the idea of Ethereum in late 2013, hoping Ethereum will be the solution for all use cases of blockchain that don't have a specialised system to turn to. And these different applications can talk to each other within the platform.

Key Concepts

Ether

Ethereum's cryptocurrency. It is used to pay for the computational resources and gas fees.

Consensus algorithm

- Proof of work (PoW)
  - Every node in the network has the history of the entire chain.
  - The blockchains are secured and verified by miners racing to be the first to solve a math puzzle. The winner gets to update the blockchain with the latest verified transactions and is rewarded in the form of coins.
  - Requires phenomenal amounts of computing power

To address the scalability and environmental sustainability concerns surrounding PoW protocol, a new algorithm appeared:

- Proof of stake (PoS)
  - Secures the blockchain through verifying transactions according to coin holders' stake in the token
  - The network selects a winner based on the holding each validator has in the pool and the length of time they've had it there — literally rewarding the most invested participants.
  - Once the winner has validated the latest block of transactions, other validators can attest that the block is accurate. When a threshold number of attestations have been made, the network updates the blockchain. All participating validators receive a reward, which is generally distributed by the network in proportion to each validator's stake.
  - Requires less computing power because it does not require miners racing to complete the same puzzle. This could potentially reduce the energy use by up to 99.95%

Smart contract

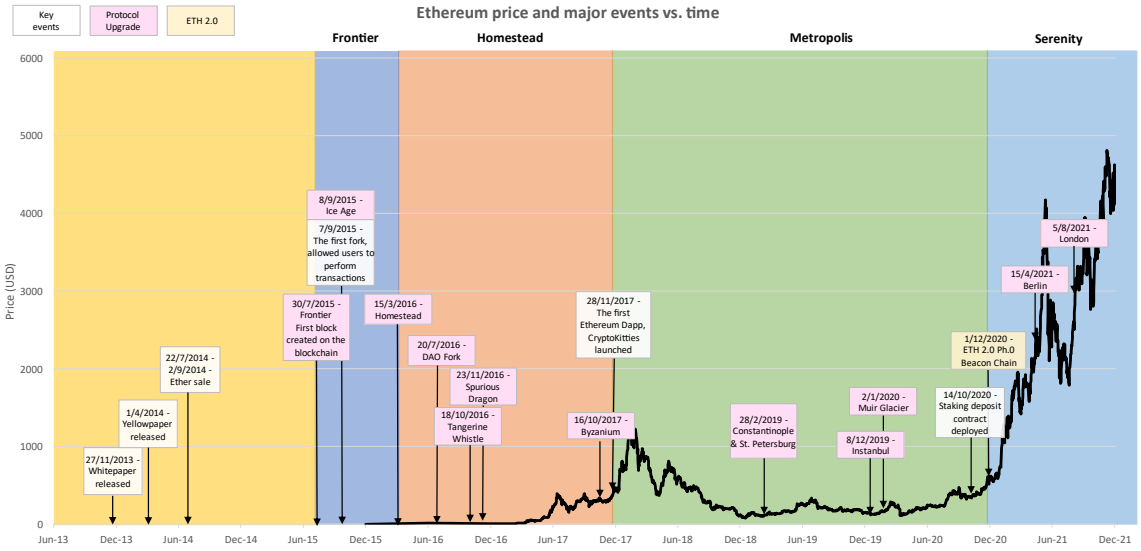
A smart contract is a program that runs on blockchain. It works by following "if/when…then" statements written into codes.

Smart contracts are:

- A type of account, meaning they have a balance and can send transactions over the network.
- Not controlled by any user, instead, they are deployed and run automatically as programmed. User accounts can interact with a smart contract by submitting a transaction that execute a function defined on the smart contract.
- Not able to be deleted by default, and interactions with them are irreversible.

Anyone can write a smart contract and deploy it to the network as long as you know how to code in a smart contract language and have enough ETH to pay the gas fee for deployment. Smart contracts allow multiple parties to come to a shared result in an accurate, timely, and tamper-proof manner.

Etherum development over time



Source: Ethereum.org, Heyokha Brothers

But Ethereum is not yet mature and has its own problems to solve.

Problems:

- Inefficient consensus protocol

Ethereum is still using PoW protocol, although it is more secure, its speed is holding its back. The current architecture is able to process a maximum of 15 transactions per second.

- High gas fee

While Ethereum network fees have dropped significantly in recent times, the average gas fee is around $20-30 per transaction which is significantly higher compared to other layer 1 protocols.

- Excessive workload

With Ethereum being the foundation on which NFTs and DeFi are build, the number of users soars and the workload on the layer 1 blockchain increases. Therefore, the processing need and capacity have dipped. This would lead to the appearance of the blockchain trilemma which is a set of three main issues that developers encounter when building blockchains.

Comparison of Layer 1 blockchain's average transaction fee

Metric	Bitcoin	Ethereum	Solana	Polkadot	Algorand
Price	$47k – $58k (7d)	$3,800 – $4,200 (7d)	$250 – $225 (7d)	$38.68 – $43.31	$1.5 – $1.8
Market Cap	$1tn	$446bn	$68bn	$42bn	$10.2bn
Unique Active Addresses	950k active	520,000	1m	27,134	64,300
Total Value Locked in DeFi	$1.6bn (DFI)	$156bn	$11.2bn	$2.5bn	$100mln
Average Transaction Fee	$1	$28	$0.00025	$3.8	$0.0015
Actual TPS	2.5	13	2,300	166.6	1,200
Theoretical TPS	7	35	65,000	1,000,000	3,000
Time to Finality	30 min – 6 days	42–90 sec	21–46 sec	12–60 sec	4.4 sec
Protocol Revenue	$450m tx fees. $14bn mined (328k BTC)	$2.2bn tx fees $19bn block rewards	2.2m	7mln (annualized)	$498mln
P/S Ratio	70x when considering block rewards. 2,200x without.	22.2x w/block rewards 215x w/out	30,909x	4,715.76x	22.2x
Staking Returns	8% or less	5–7%	8.20%	14.60%	4–6%

Source: Cointelegraph Research

Solutions:

Ethereum 2.0 is currently in development, which aims at addressing the network's tech issues on speed, efficiency and scalability. The upgrade includes introducing PoS, as well as employing sharding to Ethereum.

Sharding splits the job of validating and authenticating transactions into small and manageable bits. Shard chains will spread the network's load across 64 new chains. Therefore, the workload can be spread across the network to harness computing power through more nodes. Since the network processes these shards simultaneously in parallel, sequential processing on multiple transactions can occur at the same time. Also, PoS validators will only need to store and process the transactions on the shard they're validating, not the entire network.

This upgrade would increase the transaction throughput for the network to tens of thousands of transactions per second, also lowering the gas fees on the network.

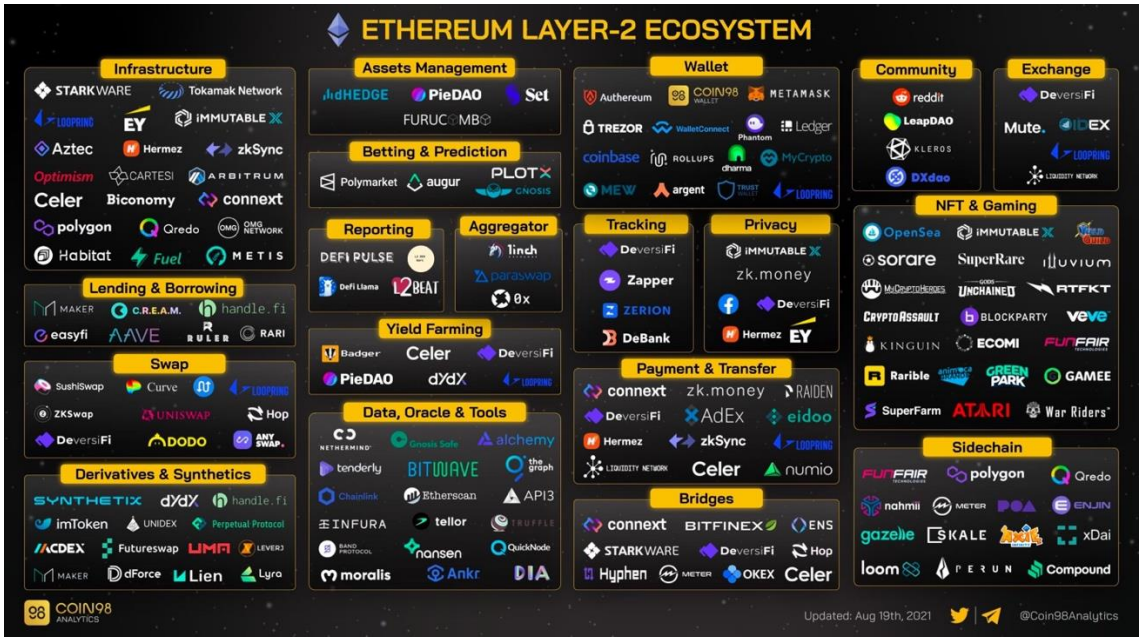
The upgrade is designed to be launched in three phases:

1. "Phase 0" also known as "The Beacon Chain" was launched on 1 December 2020 and created the Beacon Chain, a proof-of-stake (PoS) blockchain that will act as the central coordination and consensus hub of Ethereum 2.0.
2. "Phase 1" also known as "The Merge" will merge the Beacon Chain with the current Ethereum network, transitioning its consensus mechanism from proof-of-work to proof-of-stake. As of 31 May 2022, Buterin said The Merge is expected to be released in August 2022.
3. "Phase 2" also known as "Shard chains" will implement state execution in the shard chains with the current Ethereum 1.0 chain expected to become one of the shards of Ethereum 2.0. As of 31 May 2022, it is expected to be released in 2023.

Ethereum Ecosystem

Using Ethereum as the Layer 1 infrastructure, there already exists a well-developed Layer 2 ecosystem that builds on its top. The below chart is a good overview of such ecosystem that is still growing rapidly.

Etherum Layer 2 Ecosystem

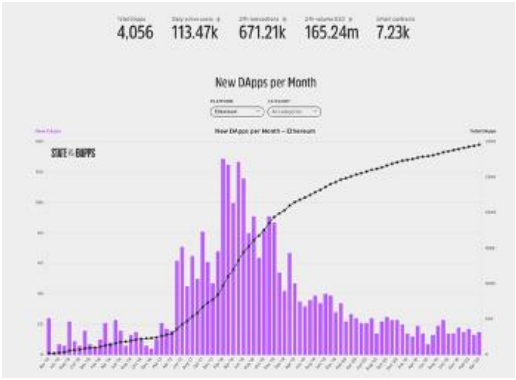


Source: Coin98 Analytics

From State of the DApps, we can also observe how active the ecosystem is and the stakes involved. While reaching USD hundreds of millions in a typical day, Etherum ecosystem is still at its early days of

development. But we believe its growth may further explode after the complete upgrade to Ethereum 2.0.

Etherum DApp Statistics



Source: State of Dapps

Alternatives to Ethereum

While dominating at the moment, there are (and continue will be) alternatives for other Layer 1 protocols. We briefly mention a few here that look promising:

- Cardano
  Created by one of the Ethereum co-founders, it shares many similarities with Ethereum which allows users to create dApps on its network. But unlike Ethereum, Cardano already employed the PoS mechanism.
- Solana
  It uses the Proof-of-History mechanism of which a historical record is created that proves that an event has occurred at a specific moment in time. Solana has a 'stateless' architecture so that the entire state of the network does not need to be updated for each transaction, making it highly scalable. A crucial selling point for Solana is that it is able to process 60k transactions per second, making it one of the fastest performing Layer 1 blockchains.
- Polkadot
  Scalability is a key aspect of Polkadot. It is already using sharding which is called parachain,, supporting 100 chains linked to the network, this allows it to process 100K transactions per second.
- Avalanche
  Avalanche is "designed to be faster and cheaper to use than Ethereum, processing more transactions per second at a lower cost." It uses PoS mechanism. According to Ava Labs, Avalanche can process over 4,500 transactions per second.
- Algorand
  It is intended to be a "fast, scalable system for decentralised applications and DeFi protocols," it uses PoS mechanism.

#6 Blockchain and Blockchain 4.0

Introduction

Since the invention of Bitcoin in 2008, which is the first application using blockchain technology, blockchain has gone through more than 13 years of development and we believe it is now in its fourth iteration.

Our Vision of Blockchain 4.0 can be summarised in the following table:

	Blockchain 1.0	Blockchain 2.0	Blockchain 3.0	Blockchain 4.0
Concepts	· Peer -to-peer network without the needs for intermediaries · Removal of central authority	· Extending the use cases of blockchain	· Tradeoff between the components of the trilemma · The takeoff of token economics e.g., DeFi, NFTs, Dapps · The use of sidechains and relays to bridge blockchains	· Extending beyond virtual, the beginning of the creation of a cyber-physical world · The storage of multiple digital assets and transfer of tokens from the convenience of just one wallet
Defining features	Proof of Work	Smart Contracts	Proof of Stake	True Interoperability
Applications	Bitcoin	Ethereum	Solana, Cardano	Metaverse

Source: Heyokha Brothers

We envision Blockchain 4.0 to be the phase which metaverse truly takes off, providing an entrance to the cyber-physical world. Blockchain technology, together with other enablers, namely AI, AR/VR, IoT and big data, will underpin the metaverse and help create a cyber-physical ecosystem for all players. Its impact on our society and human interactions will be profound.

Interoperability technology – the ability to see, access, share information and transact across different blockchains and blockchain networks without the need of intermediaries, will be a key to Blockchain 4.0's ascent. This includes not only tokens, but also NFTs. How fast such a cyber-physical ecosystem comes about depends highly on how easy it is for people to transact. The ability to bring digital ownership from one context to another is a prerequisite for bringing the idea of one single identity live, where internet of money, internet of trust and internet of identity will emerge.

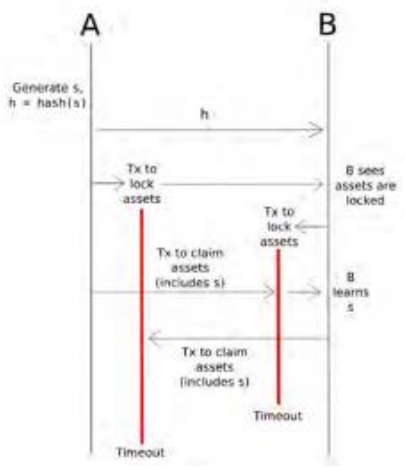
One blockchain network is simply unable to provide all the needs for any given transaction. Interoperability promotes blockchain scalability. Only multiple networks, each providing specific value, can enable data from separate networks to be routed to other relevant networks for transactions, without the need for asset swaps.

The Current Development of Interoperability Technologies

Public Connectors / Cross-authentication

1. Notary Schemes
   Transactions are executed by trusted parties (notaries) that help participants on blockchain A confirm that some event occurred on blockchain B and vice versa.
2. Relays
   Systems inside one blockchain platform that can validate and read events and/or states in other blockchain platforms. More specifically, a relay is a contract on blockchain platform A that functions as a light client of blockchain platform B, using blockchain platform B's standard verification procedure to verify block headers fed into the contract.
3. Hashed time-lock contract (HTLC)
   A transactional agreement wherein the receiver of a payment either acknowledges receiving the payment prior to a deadline by generating a cryptographic proof of payment or forfeits the ability to claim the payment, returning it to the payer. Many solutions are hybrid, sharing characteristics of HTLCs and relays. HTLC is the most trust-less and practical approach of the three.

A Simplified Example of the HTLC Mechanism



Source: R3 Reports

API Gateway

An API gateway organises several APIs. An API is a piece of code that governs the access point to a server and the rules developers must follow to interact with a database, library, software tool or programming language. APIs are used in an additional external layer on top of the blockchain platform.

API solutions are common in the market, all blockchain platforms today have APIS for integration with non-blockchain applications and are working on solutions that allow interoperability with other blockchain platforms.

Oracles

An oracle is an agent that enables the transfer of external data to the blockchain for on-chain use. This is done using smart contracts that add information about real-world events to the blockchain. Once entered on the blockchain, the data can be used to automate processes based on real-world events.

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An Overview of the Types of Interoperability

	Notary Schemes	Relays	HTLC	API Gateway	Oracles
Pros	· Simple · Flexibility at run rime	· Does not require using a central trusted party	· Reduces counterparty risk in smart contracts by effectively creating a time-based escrow	· Easy to implement	· Easy to implement
Cons	· Centralize trust · Single point of failure · Trade-off between comfort and speed with security · Over-collateralization required which transfers to higher handling fees	· Very difficult to connect blockchain platforms what do not have similar characteristics · Compromising the main chain would invalidate the relay logic, i.e., a hard fork of one chain can potentially lead to relays tracking that chain breaking.	· Most limited in terms of functionality, supporting only digital asset exchange · Not useful for asset portability or crosschain oracle use cases.	· May not guarantee eventual data consistency · Trust is centralized to the API operators · APIs may not speak the language of the underlying blockchain.	· Applications are only as reliable and trusted as their oracles are · Require the operation by a trusted third party
Examples	Notaries are instantiated as crypto exchanges **Centralized exchanges:** Binance and Coinbase **Decentralized exchanges:** 0x and Uniswap	Polkadot, Cosmos, POA, AION, ICON, ARK	XClaim, the Lightning Network	**Blockchain to Non-blockchain:** JSON.RPC.API, Hyperledger Composer API **Blockchain to blockchain:** Open standards-based framework, Hyperledger Quilt	Chainlink, Augur

Source: Heyokha Brothers

Challenges of Blockchain 4.0

1. There are many blockchain protocols, but all of them have different characteristics – such as the type of transactions, hashing algorithms, or consensus models. This does not only create technological barriers, but also concerns on governance, privacy and security aspects.
2. The blockchain development has been done in silos since its inception and solutions for blockchain interoperability emerged in a later stage which are also done in silos. Well-defined (economic) incentives are required to motivate stakeholders in the ecosystem to collaborate with each other.
3. Composability of a smart contract, where sending a token across one bridge will not have the same contract address if it crosses another bridge. This means that anyone else sending a token across another bridge will not be able to interact with the original tokens sent from the main bridge.
4. The path for developers and publishers to pursue the vision of the interoperability for NFTs and digital ownerships is unclear. Using gaming industry as an example, the incentives are not straightforward. Incumbents are more likely to protect their own interests, rather than opening up their ecosystems to external influence or allow their intellectual property to be used elsewhere.
5. An industry standard might need to be established in order to align technical requirements for interoperability to be possible at scale. Cooperation alone may be one of the biggest obstacles.

#7 Artificial Intelligence and Machine Learning

Definitions

Britannia defines AI as:

"The ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings."

Wikipedia defines AI as:

*"Intelligence demonstrated by machines, as opposed to natural intelligence displayed by animals including humans.***History of AI**

1950 – Turing's test

Alan Turing's landmark paper in which he speculated about the possibility of creating machines that think. He noted that "thinking" is difficult to define and devised his famous Turing Test. If a machine could carry on a conversation (over a teleprinter) that was indistinguishable from a conversation with a human being, then it was reasonable to say that the machine was "thinking". The Turing Test was the first serious proposal in the philosophy of artificial intelligence.

1955 – AI named

The term artificial intelligence was coined by John McCarthy, a math professor at Dartmouth.

1956 - Dartmouth Workshop

The conference was organised by Marvin Minsky, John McCarthy and two senior scientists of IBM. The proposal for the conference included this assertion: "every aspect of learning or any other feature of intelligence can be so precisely described that a machine can be made to simulate it". The participants included those that later created important programs during the first decades of AI research. The 1956 Dartmouth conference was the moment that AI gained its name, its mission, its first success and its major players, and is widely considered the birth of AI.

1957 to 1993 - The roller coaster of Success and Setbacks for AI.

1990s to 2000s - Landmarks achieved.

- In 1997, reigning world chess champion and grand master Gary Kasparov was defeated by IBM's Deep Blue, a chess playing computer program. In the same year, speech recognition software developed by Dragon Systems was implemented on Windows.
- The observation of the Moore's Law came about which predicts that the speed and memory capacity of computers doubles every two years.

From 2011 to present – Big Data

Big data and advanced machine learning techniques were successfully applied to different industries, leading to major breakthroughs in the field.

Types of AI

Weak AI	Strong AI
• Aka **artificial narrow intelligence** • Involves applying AI to specific tasks • Relies on human interference to define the parameters of its learning algorithms and to provide the relevant training data to ensure accuracy.	• Aka **artificial general intelligence** • Involves machines that possess the ability to perform any intellectual task that a human being can. • The machine would have a self-aware consciousness that has the ability to solve problems, learn and plan ahead for the future.
Examples: • Voice recognition: Amazon Alexa, Siri, Google Assistant They operate within a limited predefined range of functions, it has no genuine intelligence or no self-awareness • Face recognition: iPhone face verification • Tesla Autopilot feature • Finding the optimal route on Google Maps • Hanson Robotics' social humanoid, Sophia	Strong AI still exists as a theoretical concept today. Examples of Strong AI in movies: • The Machine (2013) • I, Robot (2004)

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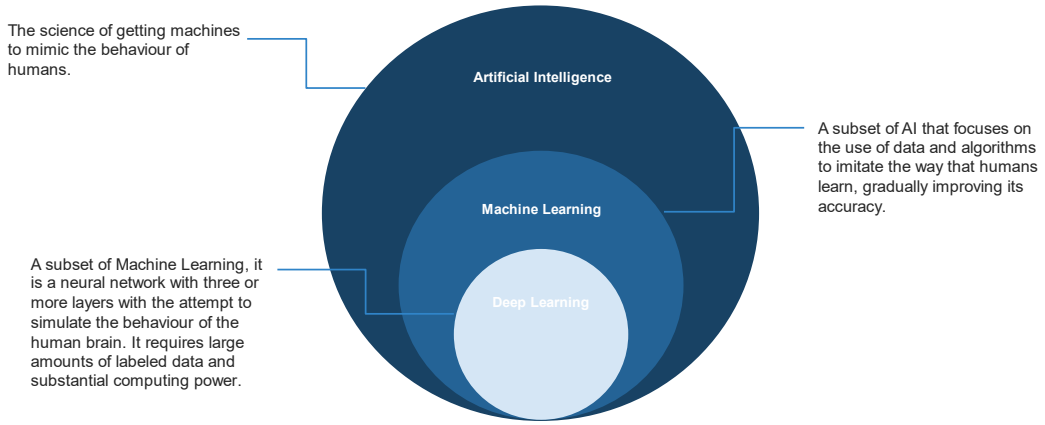
Artificial Intelligence vs. Machine Learning



Types of Machine Learning

Unsupervised Learning	Supervised Learning	Semi-supervised Learning	Reinforcement Learning
• The datasets are unlabeled. • The algorithms discover hidden patterns or data grouping without the need for human intervention. • Ideal for exploratory data analysis, cross-selling strategies, customer segmentation, image and pattern recognition.	• Use of labeled datasets to train algorithms to classify data or predict outcomes accurately. • As input data is fed into the model, it adjusts its weight until the model has been fitted appropriately.	• A medium between supervised and unsupervised learning. • Uses a smaller labeled data set to guide classification and feature extraction from a larger, unlabeled data set. • Suitable when there is not enough labeled data to train a supervised learning algorithm.	• A behavioral machine learning model • The algorithm isn't trained using sample data, the model learns as it goes by using trial and error. • A sequence of successful outcomes will be reinforced to develop the best recommendation or policy for a given problem
• Retail loyalty card – once the card is scanned, there is collected data on the customer's shopping behaviour. Clustering could be used to identify groups with similar preferences.	• Agricultural products – For the model, input would be images of tomatoes with corresponding labels (e.g., end-user, intermediate producer, fertilizer). The output would be the probability measuring the model's certainty. Each tomato is scanned by a sensor and evaluated by a model which assigns each tomato to a specific group.	• Sentiment analysis - classify customers' views based on tweets, blog comments, etc. The model is pretrained on text documents from e.g. books. The model's task is to predict the next word in a sentence. The objective is to learn the structure of a language in a first step before specializing in a particular task.	• Personalized Ad content and recommendations

Source: Heyokha Brothers

#8 Cloud Computing

Definitions

Wikipedia defines cloud computing as:

"The on-demand availability of computer system resources, especially data storage (cloud storage) and computing power, without direct active management by the user."

Investopedia defines cloud computing as:

"The delivery of different services through the Internet. These resources include tools and applications like data storage, servers, databases, networking, and software."

Three Fundamental Concepts that Define the Cloud

1. Delivering a service, e.g., computing or storage as a utility
2. Multiple people sharing the same computer resource
3. Accessing services via networking

History of Cloud Computing

- References to the phrase "cloud computing" appeared as early as 1996, with the first known mention in a Compaq internal document.
- The cloud symbol was used to represent networks of computing equipment in the original ARPANET by as early as 1977, a predecessor to the Internet itself.
- The term cloud was used to refer to platforms for distributed computing as early as 1993, when Apple spin-off General Magic and AT&T used it in describing their (paired) Telescript and PersonaLink technologies.
- The first generation of cloud in 2005 is defined as - centralised infrastructure in data centres that host a lot of compute and storage resources.

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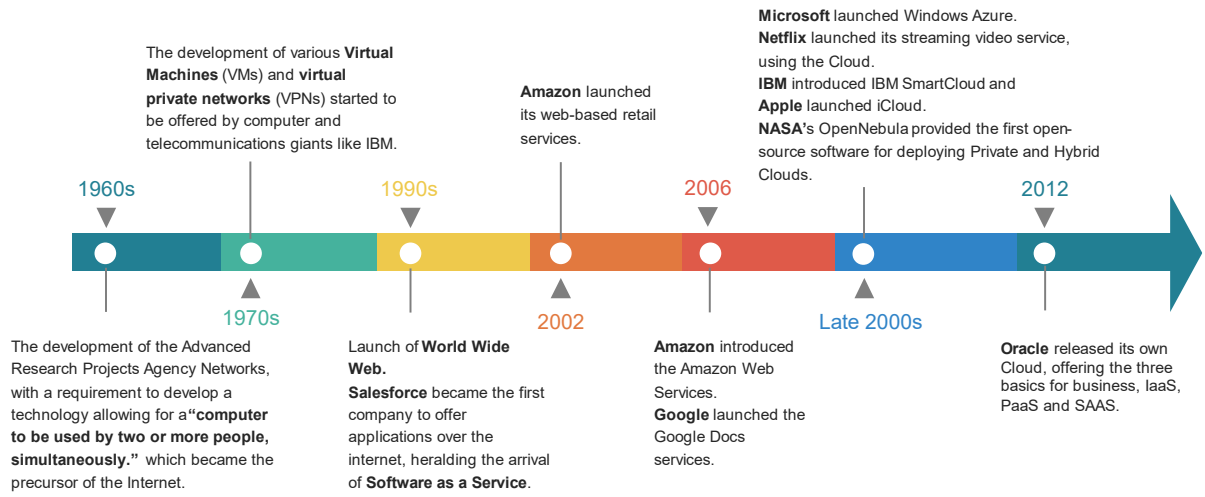
A Brief History of Cloud Computing



Source: Heyokha Brothers

Enabling Technologies for Cloud

- Broadband Networks and Internet Architecture
- Data Centre Technology
- Virtualisation Technology
  - The technology to generate virtual instances of computer resources for multiple uses of the same physical resource.
- Web Technology
- Multitenant Technology
  - A shared software that enables multiple users to access the same application logic simultaneously. Each tenant has its own view of the application that it uses while remaining unaware of other tenants that are using the same application.

Cloud Incentives

1. Cost effective
   a. Saves time and investment in the early phase, minimises up-front IT infrastructure costs
   b. "Pay as you go" model for storage that you have installed
   c. Allow users to take benefit from the technologies without the need for the expertise with each of them
2. Enhance efficiency
   a. Greater mobility and connectivity to connect with people and information. It allows to access data from anywhere, anyplace and anytime
   b. Users can focus on their core business instead of being impeded by IT obstacles
   c. Improved manageability and less maintenance
3. Data security
   a. Cloud offers many advanced features related to security and ensures that data is securely stored and handled.
   b. Once the data is stored on the cloud, it is easier to back-up and restore data.
4. Scalability
   a. Ability to increase or decrease IT resources as needed to meet changing demand with minimal disruption.

Cloud Computing Model

IaaS

- Offers the most in-house control, allowing access and direct maintenance to most cloud resources
- Clients can buy resources as needed without relying on in-house hardware
- The cloud services are mostly managed by a company

PaaS

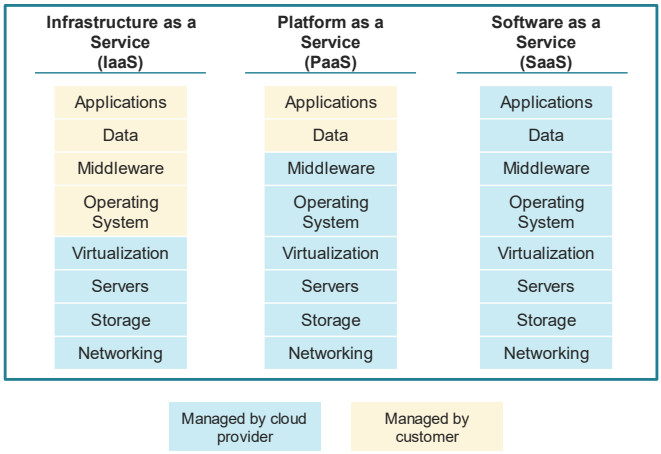
- Offers a platform to create software

- Delivered via the internet, giving IT teams the ability to design software without bothering with other aspects
- The cloud vendor shoulders a majority of the service.

Saas

- The most widely used type of cloud service
- Employs internet to provide distributed applications and services, eliminate the need for clients to download any software
- A cloud vendor fully manages the entire offering

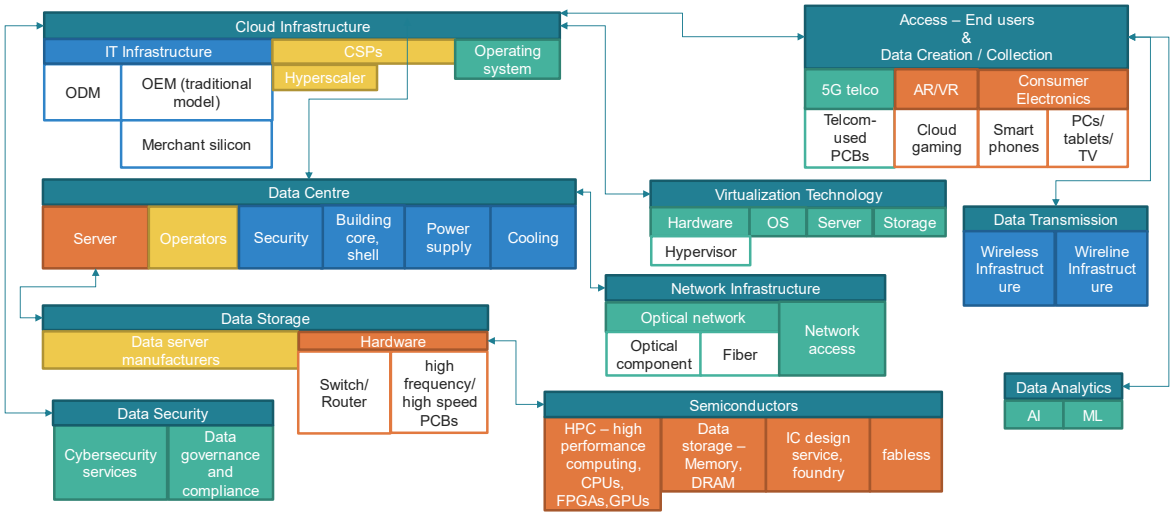
Cloud Computing Models



Cloud Deployment Models

Public Cloud	Private Cloud	Hybrid Cloud
- Owned and operated by cloud providers - Maintained off-site via internet - Help streamline workflows and collaboration on applications with many users, making sharing resources more efficient - Include SaaS, PaaS and IaaS	- Can be owned / operated by customer or a third party - The service is done in-house or "co-locate" - Resources are shared internally among gated users for a high-level of control and security for sensitive data - Often used when a company is big enough to effectively operate its own cloud data center	- A combination of private and public cloud offerings - Provides efficiency with a public cloud and security with a private cloud

Cloud Ecosystem



Source: Heyokha Brothers

#9 The Banking and Paytech Landscape

Introduction

For the past decades, payment is shaped as part of banking services. Debit cards, credit cards, fund transfers are all examples of payment services.

The 3 core utilities of banking include:

- Deposits
- Payments
- Lending

And the rise of fintech has led to competitions faced by the incumbent banks in all these three areas of utilities:

- Digital banks challenge deposits
- PayTech challenges payments
- P2P challenges lending

Due to the regulatory framework established in the society, payment services used to be monopolised by banks. But is a bank account necessary for making payments?

The answer clearly is a no. The advance in technology means that these utilities are no longer necessarily provided by banks. In fact, most of the time, traditional banks are bounded by their legacy system as well as strict regulatory framework which hinder innovation.

Therefore, they are gradually being displaced by new paytech solutions which are simple and convenient. Mobile wallets such as Venmo, WeChat Pay and Paytm, enable us to fulfil the same utility without a bank account such as via top-ups. This phenomenon is particularly prominent in emerging markets where a large portion of the population are unbankable and access to branches are limited.

What's interesting to note is that providing payment services was never the primary goal of a lot of these digital banks / mobile wallet platforms creators, they merely serve as a complementary service offered to consumers. A lot of them are created by e-commerce players or telecommunications service providers who see payment capability as an obstacle for their own expansion, examples include Alibaba and Gojek. Therefore, they launched their own payment platforms Alipay and GoPay, respectively. These applications are then extended to other services, covering deposits and lending utilities.

Case Studies

Alibaba

Alibaba was formed in 1999, with an original idea to create the Chinese Amazon. The team subsequently launched Taobao in 2003 which connects small Chinese businesses and sole traders to local citizens. One of the challenges the platform faced in the early e-commerce market was the lack of trust in online transactions between strangers. To resolve the issue and to boost transaction volume on the platform, the company introduced Alipay in 2004, where Alibaba held the money until the buyer signed off on receiving the goods. In 2008, Alipay introduced its mobile e-wallet and marked the beginning of the super-app's meteoric growth. While it took Alipay five years to reach 100 million customers prior to 2008, it added 20 million new users in the first two months of 2009. Today, it has over 1.3 billion users worldwide.

Tencent

Tencent, founded in 1998, entered the payment space from a different angle. The company pivoted towards online gaming after becoming China's leading player in online messaging through QQ. To support its gaming and social media business, it introduced a virtual currency "Q coin" for QQ users to complete purchases in the QQ ecosystem. This had led to the foundation for the subsequent launch of its first online third-party payment platform, Tenpay in 2005. In 2011, Tencent launched WeChat, a smartphone-based social messaging application, the company then integrated Tenpay into WeChat, creating WeChat Pay, a payment product embedded in WeChat that enables peer-to-peer money transfer directly through the messaging platform. The application has over 1.2 billion users today.

FinTech 2.0

Under FinTech 1.0, where banks are no longer the only provider of financial products and services, FinTech solutions share some common features:

- Identification
- Providing a form of payment

- Supportive of P2P

While regulators are still experimenting ways to regulate FinTech 1.0, another wake-up call happened. The collision between technology and society has led to the emergence of Bitcoin in 2009, which could be seen as an alarm call to the regulators. The fact that the token is primarily designed to break free from the control of central authority presents a significant problem to governments and central banks.

In 2021, we observed most major players in the global economy have taken sides on crypto acceptance and have released certain guidance on the regulatory framework in one way or another.

Under our Web 3.0 framework, blockchain technology provides:

- Internet of ID
- Internet of Money
- Internet of Trust (creditworthiness in the case of banking equivalent)

These features of blockchain technology fulfil the elements required to facilitate a payment transaction.

The merging of fintech and cryptocurrencies in the financial system is presenting new challenges for both regulators and incumbent banks. And incumbent banks are desperate to find a way out to defend their market share.

The challenges that these incumbents are facing include:

- The obligation to follow anti-money laundering (AML) policies;
- The demand of real-time transactions from customers (low-friction, low latency); and
- The need to provide frictionless cross-border transactions

A Regulatory Rethink

The primary mission of regulators is to detect and address risks posed to the financial system and its customers, and to promote a healthy financial system. Goals such as financial inclusion and literacy come only second.

The financial system and its regulatory framework have worked well in the past and are perceived to be working well enough today, making them almost impossible or unreasonable to be rebuilt from scratch or abandoned. Nonetheless, regulators have noticed their vulnerability to disruptive technologies from first FinTech and then cryptos.

Having said that, we acknowledge that regulatory change is extremely complicated and expensive, not to mention the role political interests play in policymaking (the crony capitalism scenario discussed in Part 1).

Over the past decade, we have observed two routes that banks and regulators are taking, in order to catch up in the race, and they are:

1. Open Banking, and
2. Central Bank Digital Currency (CBDC)

Both initiatives require the regulators to take the lead to push the development. Both approaches aim to enable a faster flow of funds and more transparent record-keeping of each and every transaction, solving the painful AML challenge.

Despite some fintech companies have successfully taken advantage of and filled the wide gap between traditional banks and technologies, they are no different to the incumbent banks when being disrupted by blockchain technology. Therefore, incumbent banks and fintech companies must join forces to avoid getting dropped out of the race.

An Overview of Key Players in the Financial Industry

Players	Motives	Values	Examples
Incumbent banks / Regulators	· Provide services with a healthy structure (identity, trust, financial needs) · Reduce risks and provide stability · Anti-money laundering	· Provide all financial services under one roof · Security · Human Interaction	
Digital banks	· Provide financial services to those who were previously seen as unbankable · Lower the barrier of entry	· Financial Inclusion · Lower friction and provide convenience · Lower fees	
Mobile / Online payment platforms	· Provide a seamless experience by bridging with other applications and services · Lower the barrier of entry	· Lower cost (better margin) · Better customer satisfaction · Engendered trust	Alipay, WeChat Pay, GoPay, Venmo
Payment service providers	· Provide financial services to those who were previously seen as unbankable · Embedded in other services such as e-commerce to provide a one-stop shop solution	· Convenience	Adyen, Paypal, Stripe
Crypto wallets	· Generate trust without the need for a trusted third party · Remove the need for a central authority	· Lower cost by eliminating intermediaries	Coinbase, Crypto.com
Traditional credit scoring systems	· Solving the trust issue between banks and consumers	· Provide a fair measure of creditworthiness	Transunion
Alternative credit scoring system	· Solving the trust issue between banks and consumers · Provide quantifiable credit scoring that can be utilized real-time	· Provide a fair measure of creditworthiness · Improve social governance	Zhima Credit

Source: Heyokha Brothers

The Future of Banking and Payment

- Banking utility will be incorporated into everyday commerce, the core banking system will disappear, and it will become a part of the larger technology-experiences delivery architecture.
- Banking will be about the experience, not products, it will be built around delivery.
- Payments from one value store to another will be real-time and frictionless, independent of a physical payment artefact, and with the greatest network effect.
- Payments will be automated by AI assistant/robots.
- Credit scores will no longer be measured based solely on your financial habits at the financial institutions. Cameras in restaurants, subways and airports will automatically identify your credit status.

For this scenario to play out, a digital identity infrastructure needs to be built. And this will rely on the development of decentralised identity, open banking and biometric technology.

Biometrics will play a dominant role in identification, your face can be used as the authentication system, so people no longer need to bring a mobile phone, cash or even ID card. Decentralised identity and open banking enable banks or other trusted authorities to act as an identify verifier without disclosing any personally identifiable information. With self-sovereign identity technology, users are always in control of what to be shared and with whom.

Web 3.0 Financial Services

How does the ABCD play a role in this evolution?

- With cloud computing, machine learning and big data, creditworthiness becomes direct and

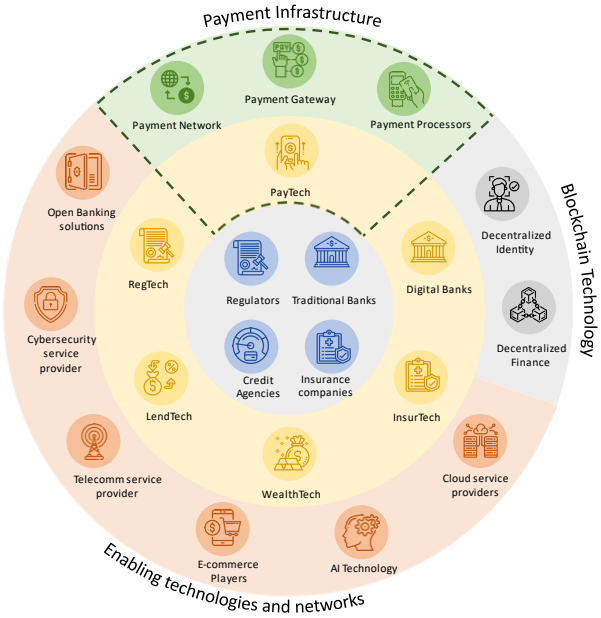
quantitative. It can be analysed and utilised in real-time.
- Server rooms will be replaced by cloud, enhancing the security of data storage.
- eKYC removes the barriers brought by the requirement of identification documents and access to branches, thus driving financial inclusion.
- Applications of DLT on trade finance and cross-border transactions etc.
- Ripple effects: mobile technology, mobile energy and IoT abundance.

Ultimately, we expect to see a transformation of the banking and payment landscape which involves:

- The functions of the business to be built as utility-or-experience based, and not product-based. The utilities will be incorporated into everyday commerce.
- A cashless society: money will become fully digital rather than physical, the structures that engender trust in money will be distributed rather than centralised.
- A decentralised identity infrastructure to be built.
- Network effect is the key to success for businesses.
- New regulations will move in the direction of open banking.
- Partnerships or consolidations between banks and fintechs.
- The ABCD technologies will play essential roles in the new business models and compliance to regulations.
- RegTech will need to be developed separately for FinTech 2.0 which is crypto ready.

Investment opportunities for FinTech 2.0 businesses currently lie within the players in the two outer rings of the below ecosystem chart.

The Proposed Fintech 2.0 Ecosystem



Source: Heyokha Brothers

CBDC: Self-Sovereignty Wake Up Call

One of the wake-up calls during the still on-going Russia's invasion of Ukraine is how the market witnessed the US and EU utilizing the powerful tool of economic warfare by barring Russia from accessing its billions of foreign reserves (except using the reserves for energy payments.) As a result of this sanction imposed against Russia, calls have been raised for the need for alternative holdings.

Being the top holder of foreign currency reserves with $3.22 trillion as of January 2022, with over two and a half times more than the second-largest

reserve holder, as well as a friend of Russia, it will come as no surprise if China decides to unshackle itself from the dollar-dominated system in order to reduce their reliance on US dollar.

De-dollarisation is not only limited to China, it is reported by The Wall Street Journal that "Saudi Arabia is in active talks with Beijing to price some of its oil sales to China in yuan," a move that could further erode US dollar reserve currency's status. And one should also notice that the Middle East, led by Bahrain and the UAE, is setting up some of the world's largest crypto exchanges spearheaded by FTX (who have decided to leave HK) and Binance.

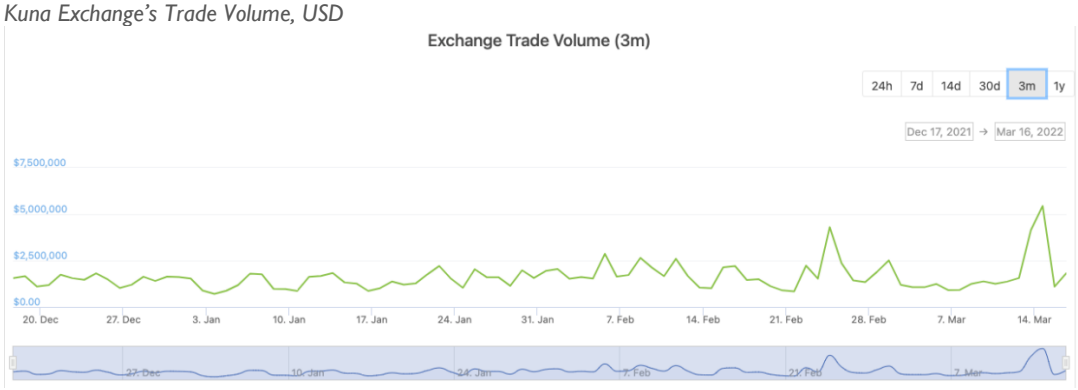
No matter how the war of tragedy unfolds, it has signalled to some countries the need to reduce their reliance on SWIFT - the global messaging system between banks to ensure financial security. In fact, Russia's central bank has developed its own alternative to Swift called the System for Transfer of Financial Messages since 2014, when the US government threatened to disconnect Russia from SWIFT. But it is nowhere near as big as the former.

Having said that, with cryptocurrencies becoming more mainstream, the long race to catch up may not be necessarily if blockchain technology is here to provide a powerful alternative to the legacy global messaging system in the coming years.

Blockchain as a backbone for global finance may still be remote, but we have witnessed how crypto has marked its place in the war.

With Ukraine's central bank limiting its citizens from withdrawing foreign currency, some Ukrainians have turned to crypto as an alternative. Crypto trading volume on Ukraine's Kuna Exchange had surged 200% in the last week of February, reaching its highest level since May 2021. The country has also raised over $50 million in crypto donation, as indicated on its official donation website.

Kuna Exchange's Trade Volume, USD



Source: CoinGecko

On the other hand, crypto could also be used as an escape route for Russia.

The fact that cryptocurrencies cannot be frozen (let's rule out centralised crypto wallets for now), has made these tokens an extremely important tool. The Bank of Russia has been developing the digital roubles and has already started the pilot stage of its CBDC before the war began. The call to ban selective Russian banks from the international payment system may have motivated the Russian government to speed up the progress.

Despite no clear evidence of Russians rushing to crypto for a safe haven as information is limited about the country lately, we are witnessing regulators around the world ramping up their efforts in the cryptocurrencies space. Perhaps one of the motives behind this could also be the attempt to close any potential loopholes in the sanctions. While we hope that the conflict can be quickly resolved, if sanctions have become a norm rather than exception, we should all think about what self-sovereignty means to our wealth.

On 9th March 2022, US President Joe Biden signed an executive order on digital assets, including cryptocurrencies. While the order did not specifically launch any new policies, but only guidelines for the upcoming steps, it marked the first official strategy on digital assets set forth by the US

government and has given the crypto industry the regulatory clarity that has been long sought after.

The executive order outlined a number of policy priorities and risks related to the implications brought by digital assets, first and foremost is customer and investor protection, followed by financial stability and systematic risk, national security, energy demand and climate change, etc. The executive order contains a well balance of discussion on both the opportunities and risks.

No commitments were made to a US Central Bank Digital Currency (CBDC), but the executive order specifically called for the "urgency" for the Fed to double down their research on CBDC. We see this as a pursuit to put the US on a level playing field with China who has launched its CBDC pilot last month.

Just days after the executive order was signed, the European Parliament voted to advance a draft of the Markets in Crypto Assets bill, or MiCA, which is a regulatory framework for crypto assets that has been in development since 2018. A lot of similarities could be found between the executive order and the MiCA.

The uniform framework for the EU's 27 member states also covers rules on supervision, consumer protection and environmental sustainability of crypto assets. An earlier addition to the bill that aimed to limit the use of cryptocurrencies powered by the energy-intensive consensus mechanism known as proof-of-work, which essentially means banning crypto such as Bitcoin and Ethereum in the EU, was voted down by the committee.

Alternatively, the committee voted in favour of a proposal to include crypto-assets mining in EU taxonomy for sustainable activities by 2025 to reduce carbon footprint. The EU has begun its digital euro project since July 2021 and the current investigation phase is expected to take two years. One thing to note is that the MiCA will not be applied to CBDCs.

While the US and the EU have just started with the entrée, China is enjoying the dessert. After eight years in development, China has debuted the digital yuan, its version of CBDC, during the Beijing Winter Olympic Games last month, subsequent to its trial launched in late 2019. According to the data released by the Chinese government, the digital yuan was accepted by more than 8 million merchants and over RMB 87 billion in transaction value was reached as of the end of last year. The next step for China would be to follow its plan outlined in the 14th Five-Year Plan, further expanding the development of the digital currency alongside its digital economy.

Digital Yuan

Image Source: Kyodo

Last but not least, the Hong Kong Secretary for Financial Services and the Treasury released a letter through his blog yesterday, announcing the government's latest development in regulating the virtual asset industry. Although there is no explicit timeline for the next steps, the letter highlighted the government's consideration to introduce a new licensing regime for virtual assets service providers in accordance with the requirement imposed by the Financial Action Task Force which requires all virtual assets exchanges to apply for a license from the Securities and Futures Commission.

If 2021 was marked as the year that made crypto and NFT broke out of their niche, 2022 would be the year of crypto regulation. And with over 80 countries currently exploring a CBDC, we think digital currencies are here to stay and disrupt the traditional financial system. These are still early days for CBDCs and we do not know how fast and far they will go.

But we are excited.

Enjoy reading our reports?

Checkout our website for more!

- The End-

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Our previous special report

- **Q1 2021: Into the Matrix** (link)

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