Circles of Trust

A Compelling Use-case Model
for Enterprise Blockchain
Adoption

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Blockchain by Perception: Arriving at a Consensus

Probably one of the major roadblocks to blockchains moving mainstream rests in its popular perception. What do blockchains mean to the public? Because up until a few years ago, when people meant blockchains, they really would have meant Bitcoin. And, while bitcoins are supposedly a breakthrough invention in the line of digital assets, it was largely perceived as a rebellious currency that made its way out without the involvement of banks. While the common lot may not have bothered about the workings of the bitcoin, the very term "bitcoin" helped them understand that it is some sort of a currency, existing only digitally of which anyone can buy, sell, or make. And even when the mysterious technology underpinning it came to be seen as equally rebellious, the public soon learned to differentiate blockchains from bitcoins. It is just that it wasn't still easy for them to understand blockchains similar to the many cryptocurrencies running by it.

Even among businesses who are tech-savvy, would their leaders or managers understand how a blockchain works? They know sooner or later it is going to come, solving their problems, and redefining their businesses. But, it is important to know how they connect blockchain with what they know already or are acquainted with. They might simplify the concept of blockchains to a shared spreadsheet where new data can only be added, while past entries cannot be edited or erased. For some, blockchains might closely resemble a distributed ledger whose records are impossible to hack, cheat, or forge with. If one tends to get curious about how a blockchain functions, they imagine a network of connected computers performing transactions on their own, abided by smart contracts. At a higher level, blockchains were bought, believed, and agreed to be a foundational technology that helps track, manage, and trade assets over a secured network without the need for intermediaries.

If blockchains are a foundational tech, then how does it stand relative to other foundational technologies that dominate the commercial economy.

Blockchain was often thought to be cloud 2.0. While the cloud replaced the servers in enterprise campuses and centralized the processing power elsewhere, blockchains slice up the processing power and scatter it all over the globe.

Blockchain offers a way to decentralize the cloud. A decentralized cloud was what the cloud was supposed to be in the first place–offering a truly transparent network that eliminates the need for a central governing authority, solving some of the most troubling security challenges that came with the cloud. But if it is a transparent network, how does it enable security for its users? A transparent network that allows the participants to view any transactions made on the network. But its encryption mechanisms ensure

the data transacted is protected and immutable, meaning it cannot be edited or erased. This feature of unmatched transparency coupled with security on interconnected networks has made blockchains to be even seen as internet 2.0.

Unlike the internet 1.0, which allowed only sharing of content, internet 2.0 can enable sharing and storing anything of value.

> But what makes the blockchain internet most unique is that every transaction that you make, every comment, every click, every search, the data remains with you, timestamped and traceable, instead of going to an intermediary or governing authority, who otherwise can have access to your data and monetize it.

So, with internet 2.0 played on blockchain networks, it will be completely up to the user to lock their data, if they value privacy, or they can choose to sell their personal information to businesses.

So, what does all this mean to businesses? If blockchain provides a digital mechanism, enabling the secure exchange of assets and information on a peer-to-peer network, it means you can do business with an unknown partner anywhere in the world, without the need for trusted intermediaries. Is it, then, the start of a truly open, sharing economy?

Or is it rightful to say the next business revolution is on the anvil, or put it the other way, will business 2.0 run on blockchain?

As utopian as these claims seem to be, it remains to be justified only if blockchain-powered use-cases arrive in scale, serves the purpose they intended to, and prove their value to the stakeholders involved.

Before we categorize and probe these use cases, we must first get hold of the inherent features that define blockchain. Because it is these distinctive features that set to determine not just the success but also the rate of blockchain adoption.

Blockchain by Technology: Identifying Five Core Elements

Distribution

The fundamental premise of blockchains is that it allows the information to be distributed to all the nodes connected to a network. But the one key difference with blockchain distribution is that every computer will maintain a complete copy of the ledger, meaning each participant can run a full node. This necessarily means that as and when a new transaction takes place, the shared ledger running on every node will take note of the transactions added to the chain. Any participant can view the ledger but cannot make any changes to the performed transactions.

Immutability

That brings us to immutability which is the ability of the blockchain ledger to remain as a permanent, unalterable record of transactions. Remember blockchains are a chain of blocks where each block holds the data and a certain hash value. The hash value is a set of alphanumeric strings, cryptographically achieved using two variables —the actual data contained in the block and the hash value of the previous block. Now any attempts to tamper the data within a block would invariably result in the hash value change of the said block and the block following it. Since every other block possesses the hash of the previous block, changes in just one block will cause an avalanche of changes across all the blocks. Any such discrepancies can be detected and traced quickly, thus ensuring the integrity of the chain.

Encryption

If cryptography protects from unauthorized data alterations, then it should, in the first place, allow authenticated users to transact data in the network. But what makes a user authorized? And how will they authenticate the data? Blockchains use public-private keys to send and receive the data. Your public key is your address visible to anyone on the network, but it is the private key that gives you the authority to originate and sign transactions whose authenticity can be verified by others in the network, through your public key. With your private key, you can generate the public key, but it is not possible to reverse engineer and obtain the private key using the public key. Remember, in blockchains, all transactions are recorded sequentially. So, if a transaction has happened, and probably if multiple transactions happen at the same time, who or what will decide which transaction must be next added onto a block? There must be a mechanism, which brings us to decentralization.

Decentralization

Decentralization essentially means there is no central authority governing the transactions. In that case, how will the participants agree to allow a new transaction to get added onto the block? It is here that the miners come into the picture. They validate the transaction ended and puts it into a block containing other validated transactions. Through a consensus mechanism, one miner will be selected, and accordingly, his block will be accepted as the next block in the chain. The process continues, and the other miners will go on to validate the incoming transactions and compete to add the succeeding block. There are different methods to achieve consensus, but there must be a way to incentivize the miners who work to put the blocks onto the chain, which leads us to tokens.

Tokenization

Since the network participants are engaged in validating secure transactions, they must be rewarded with tokens that they can use to trade assets in the network. Now, these need not always represent a cryptocurrency. In use cases which we'll see in the succeeding section, tokens can represent any physical assets in digital form. Some examples would be commodities, fiat currencies, an insurance policy, and a ticket to an event. It can also represent an access right. For example, subscription, software license, voting rights, etc.

Token-free Centralized Blockchains

But not all blockchains are decentralized in their design. As we will see shortly, much of the applications in phases 1 and 2 will be centralized or almost centralized. Also, the need for tokens arises on two conditions: 1. When physical assets must be represented digitally to be traded over a blockchain network. 2. When participants are unknown, and tokens are used to reward these participants to run the blockchain. Since the applications in phases 1 and 2 involve only known participants, and most likely do not involve digital assets trading, the need for tokens would not be seen in these phases but will appear from phase 3. Refer Table 1.1

Table 1.1: Centralized/Decentralized Blockchains

Centralization/decentralization points to governance, which in turn is dependent on four factors:

a. Data b. Access c. Tokens d. Technology

Centralized   **Decentralized**

|	Data	Access	Tokens	Technology	Governance
In-house solutions created for company use e.g., payroll systems	Data distributed within the nodes controlled by the company	The company decides who can access the network	Tokens may not be applicable since all transactions happen between known parties, and these applications would not involve digital assets trading	Company decides the technology	Centralized
Consortium solutions created for industry use e.g., supply chains	Data distributed between participant companies	The consortium decides who can access the network	Tokens may not be applicable since all transactions happen between known parties, and these applications would not involve digital assets trading	Company that initiated the consortium decides the technology	Almost Centralized
New B2C products/ services built on Blockchains e.g., nbatopshot. com/	Data distributed to anyone who uses the service/product	Anyone can access the network	Tokens will be used to reward users who validate transactions between unknown participants To trade digital assets	Company decides the technology	Almost Decentralized
Blockchain cooperatives e.g., bitcoin.org	Data distributed to anyone within the community	Anyone can access	To validate transactions between unknown participants To trade digital assets To run the blockchain	Open source	Decentralized

Blockchain by Business: Charting Growth Curves

Blockchain Adoption Spectrum

In essence, considering the five technology elements, we can conclude that blockchain not just allows unknown participants to safely interact in a digital environment. But it promises to bring upon a new decentralized world, devoid of intermediaries, fail-safe against frauds and bad transactions. All the more, it sets to transform a whole lot of physical and other illiquid assets in digital form, unleashing a new market economy.

However, the growth will happen in phases. As the Gartner research[1] points out, the first phase, which is under way, includes blockchain-inspired use-cases benefit from distribution, immutability, and encryption features. The next phase sees the advent of blockchain-complete solutions, introducing decentralization and tokenization in their networks. In the third phase, which Gartner times it probably after 2025, we will see emerging technologies of the likes of AI and IOT converge and get integrated with blockchains resulting in blockchain-advanced solutions.

[1]The Real business of Blockchains – How leaders can create value in a new digital age - Gartner, Inc.
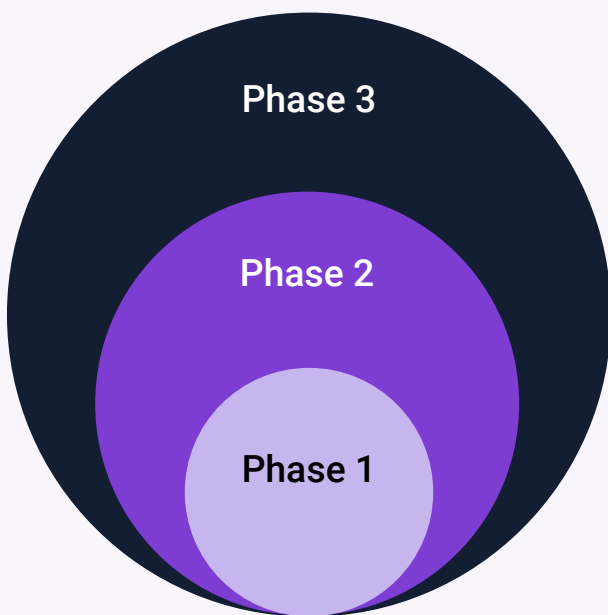
Circles of Trust: Blockchain Adoption Spectrum by Solutions, Use Case & Time Frame

Phase 1:

Solution Type
Blockchain-inspired

Dominant Use Case Type
Truth Ledger & Product Provenance

Time frame
Present & Ongoing

Phase 2:

Solution Type
Blockchain-complete

Dominant Use Case Type
Asset Tokenization

Time frame
Before 2025

Phase 3:

Solution Type
Blockchain-enhanced

Dominant Use Case Type
Blockchain Cooperatives

Time frame
Beyond 2025

Circles of Trust: Blockchain Adoption Spectrum by Technology, Use Case & Governance

Phase 1:

Dominant Technology
Distribution, Immutability, Encryption

Dominant Applications Type
Truth Ledger & Product Provenance

Dominant Governance Model
Centralized

Phase 2:

Dominant Technology
Tokenization

Dominant Applications Type
Asset Tokenization

Dominant Governance Model
Almost Decentralized

Phase 3:

Dominant Technology
Synergy with AI, IoT

Dominant Applications Type
Blockchain Cooperatives

Dominant Governance Model
Decentralized

But it has been more than a decade since the anonymous Satoshi Nakomoto authored the white paper "Bitcoin", and we ought to ask ourselves, have we seen enough blockchain (inspired) use cases in the decade just ended?

What was the rate of blockchain applications adoption? What use cases were sought at the enterprise level? We will have to answer these questions before we go out to map the potential use cases that will see light in the near and far future!

Compelling Blockchain Use Cases: A Review

Certificate of Authenticity

Towards the end of Aug 2021, South Korea began to issue COVID passports to its citizens. The vaccine certificate ensures that the citizens who receive it are vaccinated and holds information as to how many doses they have received. The COVID passport was built using blockchain to ensure the information is tamper-proof, and hence prevents the circulation of fake passes, since fake certificates can be easily rejected if validated against the blockchain incorruptible ledger.

Immutable Records

Online COVID vaccine scams have become a global issue since it lures people to resort to fake passes that are distributed over the internet. Not if these passports are within the purview of blockchain technology. The WHO has recently collaborated with the Government of Estonia to help deliver a

digitally enhanced international certificate of vaccination, a smart yellow card that will function as a COVID vaccine pass. But the agreement between Estonia and WHO extends across a range of health projects and innovations built on blockchain technology. A small country in northern Europe, Estonia has transformed into a genuinely digital society, offering most of its governmental services via blockchain networks. In particular, the health records now reside on a blockchain network which enables even private healthcare providers and doctors to access patient information from anywhere. As of 2020, 99% of health information and process transactions are recorded on the blockchain registry.

Automated Claims Transactions

US-based insurer, StateFarm and the United States Automobile Association Financial Services group have entered a partnership to use a blockchain-based Ethereum solution for the exchange of subrogation claims in auto insurance. Subrogation is a claim by which in an accident the insurance company of the victim can claim to ask for payouts from the insurance company of the driver at fault. What blockchain essentially does here is it maintains a single source of truth of all transactions made between StateFarm and USSA. Instead of manually settling each claim, it tallies all the claims made between them and executes one net transaction after a period of time. Thus, saving a lot of operational costs and enabling both the companies to perform automated transactions without ceding control to a third party.

Warranties based on Smart Contracts

Blockchain technology, in essence, can automate claims processing using smart contracts. Just like a contract that is enforceable by law, a smart contract is enforceable by code. A certain event can trigger the contract, which can enable the stipulated transactions without the need for human intervention. A case in point is not just in insurance but can also be extended to warranty management. Verso, a SaaS-based B2B workflow management portal has deployed a blockchain-enabled warranty management module. While the claims are calculated based on policies and warranty cost, the hashed warranted transaction will be recorded on the immutable ledger. This means, the terms in the warranty contract cannot be changed, which enables "trust" between multiple parties. So, if a warranty claim obeys the contract written on the blockchain, then the transaction can be automated, thus accelerating cash flows. At a time when 2/3 of the warranty costs go towards administration and processing costs, Blockchain-enabled warranty systems promise to bring significant cost savings owing to a reduction in document verification time, fraudulent claims, and warranty mismatches.

A Case for Digital Identity

Facebook is the latest member to join ID2020, a global public-private partnership including conglomerates such as Microsoft, Accenture, and Mastercard. The alliance with the expertise of businesses, governments, and non-governmental agencies aims to create a unified, interoperable digital identity for individuals, which will eliminate the need for paper documentation, and help individuals secure and take control of their private information in immutable ledgers. The human-centric approach to identity integrates the power of biometrics and blockchain to provide a privacy-preserving global identity solution.

Provenance in the Supply Chain

In 2020, Walmart was able to provide FDA (Food and Drug Administration) investigators with detailed information on the origin of potential contamination within an hour, a stunning reduction compared to the 7 days that it would take otherwise. Walmart decided to ensure food safety by inviting its suppliers and distributors in a blockchain program. The transition from a paper-based tracking system to a blockchain-enabled supply chain is resulting in reduced recall costs, reduction in the loss of profits, saving business reputation, and saving lives.

Origins of a Spare

To curb the menace of counterfeit spare parts, Hyundai Mobis, a subsidiary of Hyundai Motors, has rolled out a blockchain-based and AI-powered system called the MAPS (Most Advanced Parts System). According to the firm, the system is being accessed by users as many as 100,000, supporting three million different parts pertaining to 300 car models. The information concerning each spare part resides on an immutable ledger. By scanning a QR code on the packaging, the users can then verify the authenticity of the purchased parts.

Track & Trace Cross borders

Like the manufacturing side of the supply chain, FVL (Finished Vehicle Logistics) involves a long series of stages and processes through which the manufactured cars move from OEM to end customers. From the factory, the car passes through in-country transit networks, sea-carriers, and after arriving in the importing country, follows the customs before local logistics providers take them to the dealer and then to the customer. The existing supply chain doesn't guarantee the real-time tracking of the car. This means that if incidental damage occurs during transit, it will be near impossible to trace where and when the damage has happened. Vinturas, a consortium of auto-logistics providers, operating their supply chain in blockchain networks unleashes a cascade of benefits to its members. The end customer knows where exactly their cars are in the delivery cycle. The fleet owners can exactly plan their fleet allocation process. The car manufactures can reduce their operational costs by 10% and perform root-cause analysis of the damages caused in transit. It is important to note that the consortium enables competitors to collaborate ensuring end-to-end transparency along its supply chain.

Digital Assets Trading

High-emission organizations must meet the regulatory quotas in terms of carbon emission. But various factors prohibit them from complying with the emission quotas, and in such instances, they tend to buy carbon credits from organizations who already have them. The carbon offset trading was however centralized in the hands of intermediaries who dominate the marketplace, managing their own databases, and speculating prices. The lack of transparency and traceability in carbon credits resulted in high-emitters retaining their carbon credits even after using them. The lack of transparency also prevailed in the distribution of funds to low-emitters leaving these organizations unprotected and controlled by intermediaries. ClimateTrade provides a blockchain-enabled marketplace where high-emission organizations can buy carbon credits through financing pre-approved green projects. The transactions get recorded in immutable ledgers, meaning every carbon credit can be traced and tracked in real-time.

Blockchain Cooperatives

Asset Tokenization

Product Provenance

Truth Ledger
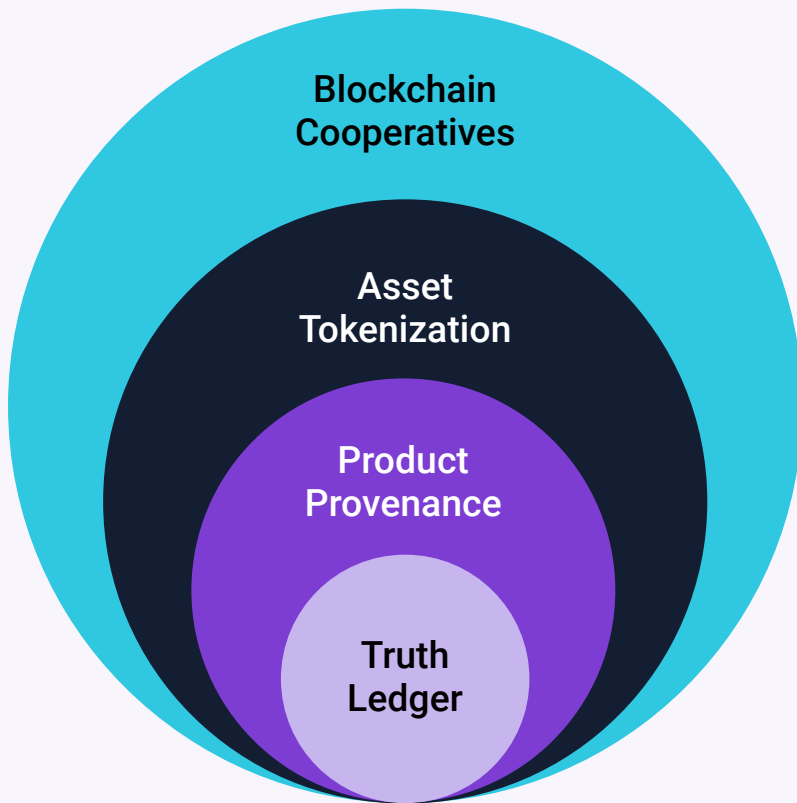
Circles of Trust: A Use-Case Model for Enterprise Blockchain Adoption

The enterprise blockchain adoption will progress in circles in what we call the

"Circles of Trust."

We use a stacked Venn to chart the growth of blockchain adoption. The first circle signifies the adoption of diverse applications, which would have information immutability as the common core benefit out of the blockchain network. The second circle represents the movement of products on a blockchain network, where bigger manufacturing companies come together, form consortiums with their suppliers, and with competitors to track and trace their products along the supply chain. The third circle points to the emergence of new businesses transforming real assets into digital twins. And the fourth circle indicates the advent of decentralized cooperative organizations

Truth Ledger

At the core of a blockchain network is an immutable 'Truth' ledger. Now and in the short run, we will see most enterprises adopting 'truth ledger' applications. These will include but are not limited to automated payments and royalties, create & access unalterable records, identity solutions for compliance & security checks, and real-time verification of transactions.

Functional Area	Use Case	Impact	Gains
Beverages	Coke One North America (CONA) service has created an immutable ledger storing real-time information on the number of bottles. The Bottlers may not have sufficient stock at hand all times. In such situations, the franchisee needing extra bottles can request from the bottler having excess bottles. Thus, the ledger keeps the bottlers aware of the quantity in real-time and accordingly makes up for shortfalls by buying the rest of the quantity from other franchisees.	CONA plans to extend the use-case from its internal supplier to external supplier network, what it terms as the "Coca-Cola bottling harbor." The goal is to create a distributed, integrated private network that will eliminate coordination problems through versioning of commercial documents, help generate tokenized invoices, improve error handling, partial deliveries, etc.	✓ Process innovation driving cost efficiency • New products/ services from existing business • Newer markets based on blockchains
Oil and Gas	The OOC Oil & Gas Consortium Blockchain, a 10 member companies' group, has wielded blockchain technology to automate payments for oilfield-water handling.	The pilot test, which was made on five Equinor wells (one of the companies in the consortium), saw workflow processing time reduce from 120 days to 7 days eliminating 9 steps. Around 85% of all volume measurements have been automatically validated.	✓ Process innovation driving cost efficiency • New products/ services from existing business • Newer markets based on blockchains
Airports	Travelers had to wait as long as 6 hours to get COVID-19 clearance. As international travel resumes, Amadeus, an airlines reservation system has adopted IBM's digital health pass, which standardizes the health checks at the airports. The immutable ledger doesn't reveal the underlying passenger health information but outputs a QR code based on the same. The QR code helps agents perform faster clearances.	Presently, six airlines use the system. Several other airlines of the likes of JetBlue, Lufthansa, UnitedAirlines, and others are using a CommonPass on certain air routes, developed by the World Economic Forum and Common Projects Foundation.	✓ Process innovation driving cost efficiency • New products/ services from existing business • Newer markets based on blockchains
Banking Services	JPMorgan's Liink facilitates faster cross-border payments and cuts down transaction costs. The underlying peer-to-peer blockchain technology will enable banks to validate accounts and mitigate transaction frauds and rejections.	Around 400 banks have signed up for the Liink with 100 banks already live on the network.	✓ Process innovation driving cost efficiency • New products/ services from existing business • Newer markets based on blockchains
Gaming	Microsoft gaming ecosystem is now powered by blockchain technology that enables automatic royalty payments compared to a traditional processing time that will take up to 45 days.	The royalties are calculated 100% in real-time, facilitated by smart contracts. The blockchain application can perform 2 million transactions per day.	✓ Process innovation driving cost efficiency • New products/ services from existing business • Newer markets based on blockchains

Product Provenance

Track and trace applications will be most sought in the supply chains for their ability to fight counterfeits and duplicates. Digital depiction of real products through the method of digital twins (virtual modelling of a real product based on its operational and behavioral characteristics) can tell the story of a product right through its lifecycle. The track and trace applications can help stakeholders instantly trace the origin or the exact location of a real product in question. It will be a few years before blockchain becomes an irrefutable standard for large volume logistics and complex supply chains.

Functional Area	Compelling Use Case	Impact	Gains
Agri-business	Enterprise blockchain, Covantis is a consortium of agri-business conglomerates to simplify and fasten the execution of commodities trading.	Prior to this, Cargill, one of the founding members of Covantis, completed a groundbreaking 12m$ wheat trade with Singapore-based Agrocorp in a matter of hours, which otherwise would entail 7 business days.	✓ Process innovation driving cost efficiency • New products/ services from existing business • Newer markets based on blockchains
Retail	Carrefour, a French supermarket chain tracks its farm-raised eggs and other 30 product lines. Customers with the use of a QR code can exactly locate the origins of these product items.	The company claims that the feature has boosted sales, encouraging the company to add blockchain capability to 1000 more products. Also, expands blockchain to its textile division to trace 450 textile products in France and Spain.	✓ Process innovation driving cost efficiency • New products/ services from existing business • Newer markets based on blockchains
Fashion	Aura blockchain consortium founded by leading fashion conglomerates – LVMH, Prada, and Cartier, is open to other fashion brands to share the challenges faced in the supply chain. The technology enables the customers to access the history of a product and verify its authenticity through a simple QR code.	Unveiled on April 2021, the consortium will enable competitors to collaborate on an innovative solution that will prevent counterfeits and ensure responsible sourcing in its distribution.	✓ Process innovation driving cost efficiency • New products/ services from existing business • Newer markets based on blockchains
Aviation	Honeywell has transferred more than 2 million aviation documents into a blockchain ledger. The ledger powers its GoTrade marketplace, where sellers can list their parts online for a subscription fee. Through the ledger, buyers can verify the history of a part before investing.	GoTrade has completed $7 M in sales in 2020, set to make $25M at the end of 2021, and projects $100M before 2022.	• Process innovation driving cost efficiency ✓ New products/ services from existing business • Newer markets based on blockchains
Unmanned Arial Aviation	Boeing's Skygrid provides real-time awareness of all current and planned unmanned drone flights. The fight logs are immutable thus paving way for faster Flight auditability	NASA projects unmanned flights for cargo will reach 500 million/year and passenger vehicles will go up to 750 million/year by 2030.	• Process innovation driving cost efficiency ✓ New products/ services from existing business • Newer markets based on blockchains

If we were to equate Gartner's studies with our analysis, the use cases seeking Truth Ledger and Product Provenance solutions will be largely blockchain-inspired, meaning most of them will embrace only the features of Distribution, Encryption, and Immutability in centralized environments. They would stop short of tokenizing the assets, and even if they do, they will only employ tokens in a limited fashion.

Organizations seeking Truth Ledger and Product Provenance applications will look to drive cost efficiencies and implementing blockchains would entail a process innovation from the ground up.

Asset Tokenization

Cryptocurrencies have encouraged governments to create their own state-backed digital currencies. But the tokenization of assets will extend to other physical assets as well. The physical assets will be represented digitally in the form of tokens. Faster transactions, fewer settlement times, fractional ownership, and absence of intermediaries will characterize these blockchain-enabled marketplaces. The asset tokenization phase would see existing businesses drive new products/services built on blockchains.

The asset tokenization class would represent blockchain-complete solutions that cannot function in centralized environments. The trading of digital twins will mean that the businesses will have to embrace decentralization, distribution of ownership, and therefore consensus from all the players in the network.

| Functional Area	Compelling Use Case	Impact	Gains
Digital Collectibles	NBA has created a marketplace for trading "memorabilia," similar to trading cards but in digital form. The consumers can purchase the digital cards as crypto-collectible tokens, the transaction of which gets stored in the ledger. The token gives a unique unhackable certificate of authenticity, which can be traded in the marketplace.	The Topshots have generated 230$ million in revenue. Current packs go for as low as 9$. More than 400000 moments have been sold so far with a certain Le Bron James highlight traded for $100,000.	• Process innovation driving cost efficiency ✓ New products/ services from existing business • Newer markets based on blockchains
Digital Shares Platform	Daura offers unlisted companies a platform to raise investments through the issue of security tokens. One token represents one newly created share. Asset tokenization enables SMEs to sell stakes to investors and raise funds for businesses. The shares can be tokenized, traded, and settled instantly in real-time.	The digital share platform for SWISS SMEs is a joint venture of established conglomerates including, Swisscom, SIX, and Sygnum Bank.	• Process innovation driving cost efficiency ✓ New products/ services from existing business • Newer markets based on blockchains
Securities Exchange	The trade settlements in US equities are burdened with unnecessary time delays and expenses. Once the trade is finalized, the Paxos Settlement Service enables the simultaneous exchange of securities and cash between the parties concerned.	Credit Suisse and Instinet become the first two firms to join the blockchain network. The service aims to bring down the trade settlements from two business days to the same day of trade execution.	✓ Process innovation driving cost efficiency • New products/ services from existing business • Newer markets based on blockchains
Cryptocurrency	Coinbase, a secure online platform for buying/selling/storing cryptocurrencies becomes the first principal issuer of debit cards that allows their customers to spend cryptocurrencies anywhere VISA is accepted and withdraw cash from ATM.	Operates 43 million individual accounts from 100-plus countries. Has 20$ billion in storage up from 6$ billion in April 2020.	• Process innovation driving cost efficiency • New products/ services from existing business ✓ Newer markets based on blockchains
Cryptocurrency	Binance, the world's largest cryptocurrency exchange lists 184 tokenized assets. The users through the debit card can exchange their cryptocurrencies into local currencies accepted at 70 million merchants worldwide.	As of 2020, Binance has completed 2$ trillion in trading volume.	• Process innovation driving cost efficiency • New products/ services from existing business ✓ Newer markets based on blockchains

Blockchain Cooperatives

Spurred by the success of asset tokenization, blockchain cooperatives will arise from newer markets. These cooperatives are decentralized organizations marked by no singular governing authority and operating on radical business models that ushers in fundamental transformation in traditional industries landscape. This could also signify the phase where Blockchain-complete solutions will merge with advanced AI and ML technologies. Thus, commencing an era of enhanced blockchain solutions characterized by autonomous human-to-machine interactions and machine-to-machine interactions.

But presently, running a blockchain cooperative could be a long shot. Only a few will scale from production. These ambitious ideas need huge backers but depend entirely on the end-customer who must get abreast with the traits of the underlying tech, which will take not more than 5-6 years.

Functional Area	Compelling Use Case	Impact	Gains
Social Media	Social media gets gamified with Minds. The social network built on blockchain rewards users for content engagement. Creators can monetize their content proportional to their content popularity. Minds stand contrary to most social networks of today that mines users' data for ad purposes.	The crypto social network has raised $10M from tech freedom organization Futo. As of July 2020, it has 2.5 million registered users spread across 240 countries across the globe.	• Process innovation driving cost efficiency • New products/ services from existing business ✓ Newer markets based on blockchains
Journalism	CIVIL offers a platform for decentralized journalism. Provides content publishing and tools for media houses that can operate independently within CIVIL. A token-based monetization will encourage viewers and readers to financially back selected newsrooms and take part in the decisions regarding the platform.	The ambitious blockchain media platform stands shut down. The public token sale did not take off as planned. The company planned to raise $24M, but the token sales saw just $1.5M.	• Process innovation driving cost efficiency • New products/ services from existing business ✓ Newer markets based on blockchains
Infrastructure	Smart Cities would see a holistic integration of blockchains with Internet-of-Things (IoT) networks. Hundreds of city sensors that include drones for goods delivery, automated stoplights, CCTV cameras, etc., would be constantly employed in collecting real-time data. The blockchain network ensures data integrity. The 'smart' citizens can transact with a high degree of transparency and security without the need for a centralized authority. The smart contracts will automate transactions performed between multiple parties (humans and machines).	For a smart city to be functional, the underlying framework needs to be open to support multiple stakeholders. IOTA Foundation is currently working with LINUX, IBM, ARM, and others on project Alvarium, creating an open-source technology stack for building smarter cities of tomorrow.	• Process innovation driving cost efficiency • New products/ services from existing business ✓ Newer markets based on blockchains

Circles of Trust: Blockchain Adoption Spectrum by Business Gains
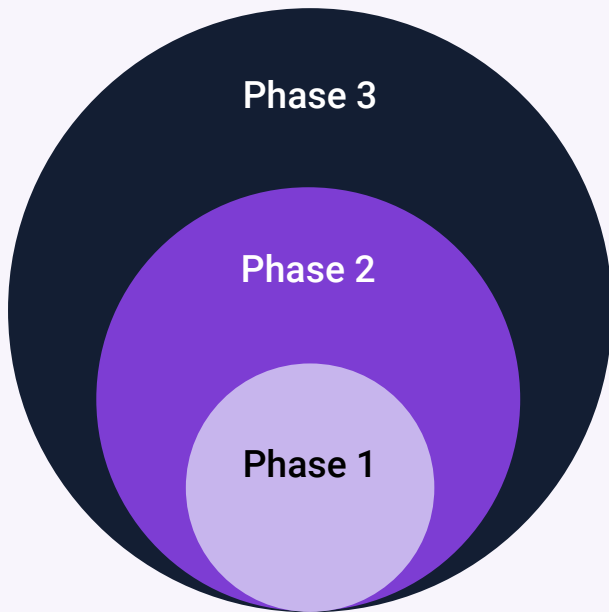
Phase 1:

Dominant Use Case Type
Truth Ledger & Product Provenance

Business Gains
Process Innovation Driving Cost Efficiencies

Phase 2:

Dominant Use Case Type
Asset Tokenization

Business Gains
Introduction of Newer Products/Services from Existing Business

Phase 3:

Dominant Use Case Type
Blockchain Cooperatives

Business Gains
Disruptive Innovation, New Markets

(Diagram: concentric circles labeled Phase 3, Phase 2, Phase 1)

Circles of Trust: Blockchain Adoption Spectrum by Application Type
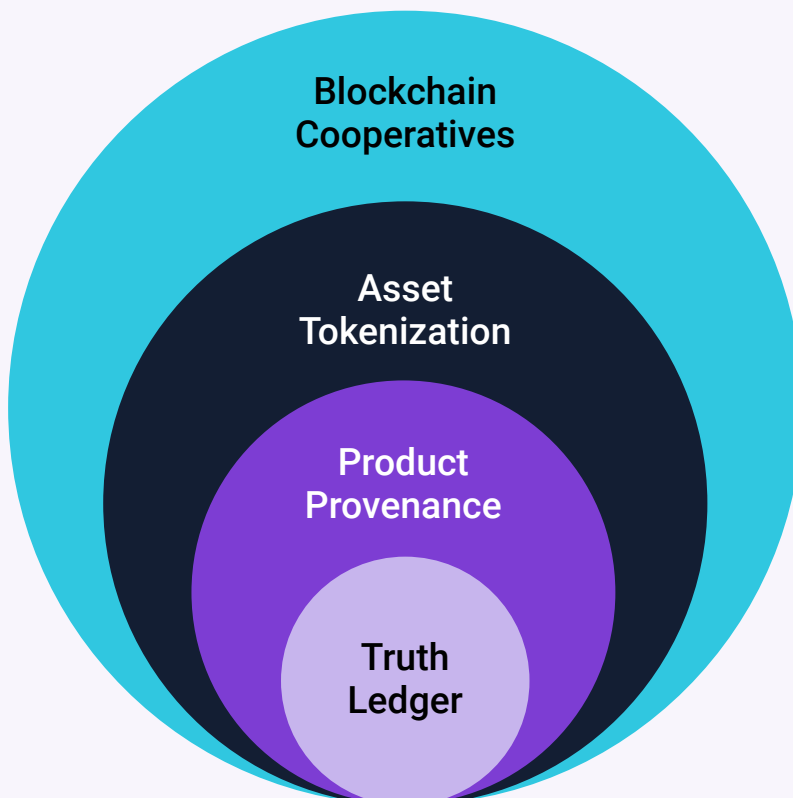
(Diagram: concentric circles labeled Blockchain Cooperatives, Asset Tokenization, Product Provenance, Truth Ledger)

Truth Ledger
- Automated Payments based on Smart Contracts
- Immutable Recordkeeping Solutions
- Digital Identity Verification Solutions
- Real-time Transaction Verification Solutions

Product Provenance
- Track & Trace Applications
- Product Origin Applications

Blockchain Cooperatives
- Blockchain-enabled Societies
- Community-focused applications

Asset Tokenization
- Buy & Sell Digital Assets
- Cryptocurrency Exchange centers
- Blockchain-enabled marketplaces

Final Word

We first arrived at a consensus on what do blockchains mean to businesses? A foundational breakthrough technology that enables secure storage and exchange of value, track and trade digital assets, and perform autonomous transactions with unknown parties devoid of intermediaries. When intermediaries help establish trust between unknown participants, blockchains eliminate the need for trust in business relationships. Because trust is enabled in design and comes as part of the package.

The Internet would transform where the end-users would become more empowered because they have complete ownership of their personal information. The Internet 2.0 will evolve from content exchanges to become the Internet of value.

It was the cloud that came with the first iteration of decentralization. The storage of files became elsewhere. Companies need not store and access from their dedicated enterprise servers. They reached out to the cloud through subscription models and paid for what they used. The second iteration of decentralization will come from blockchains. The distributed ledger technology ensures that the processing power is shared among the network nodes. There is no single point of storage or failure, in which case, the decentralized cloud becomes even more secure.

We then understood the nature of blockchain through its core technology elements: Distribution, Immutability, Encryption, Decentralization, and Tokenization. But the present blockchains cannot include all these elements, with most of them employing only the first three features.

That leads us to chart the growth of blockchain. From blockchain-inspired to blockchain-complete, and then finally enhanced blockchains, in which case we probe what applications will work now, and what type will come later.

We propose that the growth of blockchain enterprise adoption will happen in circles in what we term as the Circles of Trust. In the blockchain-inspired phase, when technologies such as distribution, encryption, immutability dominate, we will have applications based on 'Truth Ledger' and 'Product Provenance.'

In the second phase, when the blockchain network is complete with all core elements intact, we will witness the growth of 'Asset Tokenization' applications riding on the features of decentralization and tokenization.

In the final phase, blockchains are enhanced given their integration with IoT and AI, which will lead to the dawn of decentralized cooperative organizations.

The first phase will represent existing businesses majorly using blockchains to attain never-before cost efficiencies. The next two phases would see enterprises and end-users get comfortable with the technology, and hence together construct newer business markets solely dependent on the novelty of blockchains.

Beyond the Scope

This paper has covered what and when of blockchain adoption. What diverse applications will see success and when that might happen. But an acceleration of a blockchain success would equally depend on how a blockchain is implemented. In our succeeding research, we will explore the options available for enterprises. How indigenous built-from-scratch products would fare when compared to the wiser BAAS[2] solutions. To conclude, blockchains are here to stay, and sooner or later, there would be a time where the presumptions wouldn't matter much because the many blockchain use cases will constitute an indispensable part of our lives.

[2]Blockchain-as-a-Service

End Notes

Gartner, The real business of blockchain – How leaders can create value in a new digital age, 2019

ABI Research, Blockchain adoption in industrial markets – Improving operational efficiency and trust, November 2020

https://www.blockedge.io/blog/dont-overlook-scalability-when-deploying-an-enterprise-blockchain/

https://www.entrepreneur.com/article/288715

https://searchstorage.techtarget.com/tip/Decentralized-cloud-storage-What-you-need-to-know

https://www.oreilly.com/library/view/decentralized-applications/9781491924532/ch01.html

https://cointelegraph.com/news/why-blockchain-is-cloud-20-expert-take

https://www.ibm.com/blockchain/solutions/digital-assets

https://softengi.com/blog/blockchain-and-the-cloud-disruption-2-0/

https://www.europarl.europa.eu/RegData/etudes/ATAG/2018/624254/EPRS_ATA(2018)624254_EN.pdf

https://medium.com/coinmonks/public-vs-private-blockchain-in-a-nutshell-c9fe284fa39f

https://dzone.com/articles/a-guide-to-blockchain-immutability-and-chief-chall

https://www.mangoresearch.co/blockchain-consensus-vs-validation/

https://www.covantis.io/

https://blockheadtechnologies.com/what-is-a-blockchain-token-is-it-just-cryptocurrency/

https://medium.com/@essentia1/50-examples-of-how-blockchains-are-taking-over-the-world-4276bf488a4b

https://www.algorand.com/ecosystem/use-cases/climatetrade

https://www.ibm.com/downloads/cas/OMJRXZAL

https://cryptopotato.com/why-civils-response-to-its-failed-ico-sets-an-excellent-example-for-blockchain-projects/

https://www.ey.com/en_us/news/2020/12/ey-and-microsoft-expand-xbox-enterprise-blockchain-platform-for-rights-and-royalties-management

https://www.cbinsights.com/research/blockchain-insurance-disruption/

https://www.ledgerinsights.com/world-health-organization-partners-with-estonia-for-blockchain-covid-19-certificates/

https://nortal.com/blog/blockchain-healthcare-estonia/

https://steemit.com/

https://www.forbes.com/sites/michaeldelcastillo/2021/02/02/blockchain-50/?sh=1cb1d01a231c

https://www.dgen.org/blog/decentralisation-at-work-cooperatives-on-blockchain

https://www.weforum.org/agenda/2018/03/blockchain-bitcoin-explainer-shiller-roubini/

https://hbr.org/2019/10/the-5-kinds-of-blockchain-projects-and-which-to-watch-out-for

https://blockchain.news/news/coca-cola-enterprise-ethereum-blockchain-optimize-supply-chain

https://medium.com/swlh/does-a-blockchain-need-a-token-66c894d566fb

https://hbr.org/2017/01/the-truth-about-blockchain

https://www.comparitech.com/crypto/cryptography-blockchain/

https://www.skygrid.com/

https://www.iotforall.com/iot-and-blockchain-the-future-of-smart-cities

https://www.thetradenews.com/credit-suisse-and-instinet-use-blockchain-to-settle-us-equities-trades-on-same-day-with-paxos/

https://www.cnbc.com/2021/02/28/230-million-dollars-spent-on-nba-top-shot.html

https://www.lvmh.com/news-documents/news/lvmh-partners-with-other-major-luxury-companies-on-aura-the-first-global-luxury-blockchain/

https://qz.com/2036529/more-than-450-airlines-can-now-use-ibms-digital-health-pass/

https://www.forbes.com/sites/michaeldelcastillo/2020/03/07/honeywell-is-now-tracking-1-billion-in-boeing-parts-on-a-blockchain/

https://www.daimler.com/sustainability/resources/blockchain-pilot-project-supply-chain.html

https://cryptonews.com/news/coca-cola-bottling-harbor-to-use-baseline-protocol-ethereum-7318.htm

https://www.ledgerinsights.com/carrefour-expands-blockchain-traceability-to-textile-products/

https://agfundernews.com/cargill-and-agrocorp-complete-groundbreaking-12m-intercontinental-wheat-trade-using-hyperledger-fabric.html

https://www.epicos.com/article/434006/verso-presents-blockchain-enabled-warranty-claims-management-module

https://www.theregreview.org/2021/05/12/nazareth-role-for-distributed-ledgers-voluntary-carbon-markets/

https://www.accenture.com/in-en/insight-blockchain-id2020

https://builtin.com/blockchain/blockchain-applications

https://newsroom.statefarm.com/blockchain-solution-solves-state-farm-usaa-subrogation-challenge/

https://www.upgrad.com/blog/what-makes-a-blockchain-network-immutable/

https://medium.com/@essentia1/50-examples-of-how-blockchains-are-taking-over-the-world-4276bf488a4b

https://media.consensys.net/learn-how-civils-decentralized-newsrooms-are-reviving-journalism-90bcb84822e3

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For enquiries
sales@blockedge.io