SPECIAL REPORT

How blockchain will disrupt business

ZDNet

TechRepublic

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BLOCKCHAIN AND BUSINESS: LOOKING BEYOND THE HYPE

BY CHARLES MCLELLAN

The term blockchain can elicit reactions ranging from a blank stare (from the majority of the general public) to evangelical fervour (from over-enthusiastic early adopters). But most people who know a bit about the technology detect a pungent whiff of hype, leavened with the suspicion that, when the dust settles, it may have a significant role to play as a component of digital transformation.

The best-known example of blockchain technology in action is the leading cryptocurrency Bitcoin, but there are many more use cases—think of blockchain as the 'operating system' upon which different 'applications' (such as Bitcoin) can run. So, what is a blockchain?

At heart, a blockchain is a special kind of database in which 'blocks' of sequential and immutable data pertaining to virtual or physical assets are linked via cryptographic hashes and distributed as an ever-growing 'chain' among multiple peer-to-peer 'nodes'. Additions to the blockchain can only be made after validation by a majority of nodes using a consensus mechanism, the two main ones being Proof of Work (PoW) and

IMAGE: ISTOCK/ ISMAGILOV

Proof of Stake (PoS), after which the new blocks are distributed to all nodes. At the moment, PoW is the most common consensus mechanism, the best-known example being Bitcoin mining by solving cryptographic puzzles. However, PoS is less costly in terms of computing resources and electricity, and can deliver faster throughput.

Compared to traditional business processes, blockchain can deliver time and cost savings, along with better security—especially in a permissioned network.

A blockchain is therefore a cryptographically secure distributed ledger in which each node has a verified, up-to-date and immutable history of all transactions that have ever taken place among participants that do not necessarily need to trust one another. Validated transactions cannot be altered or tampered with, and can only be reversed by a subsequent transaction.

There are two broad types of blockchain networks: 'permissionless', which anyone can join; and 'permissioned', in which participants are authenticated by whoever is running it. The latter can be further divided into 'private' and 'community' blockchain networks—a single enterprise versus a group of companies involved in a particular business process, for example. In permissionless blockchains, like those underpinning Bitcoin or Ethereum, more reliance is placed on consensus mechanisms to confirm identities and validate transactions.

Business rules that govern what happens to assets during transactions are known as smart contracts, which form a link between decentralized applications (or dApps) and the blockchain itself. Ethereum is the leading example of a smart contract-based blockchain system. The linkage of virtual or physical assets to digital tokens is called tokenisation, while the process of raising funds by offering a new cryptocurrency or token in exchange for traditional currency, or an existing cryptocurrency like Bitcoin, is called an Initial Coin Offering or ICO.

DO YOU NEED A BLOCKCHAIN?

As a distributed ledger, blockchain can be used to record any transaction, and keep track of any asset and associated payments. Compared to traditional business processes, blockchain can deliver time and cost savings, along with better security—especially in a permissioned network. But before we go any further, let's consider the general circumstances in which blockchain technology is appropriate.

The key issues here are the number of participants in the business process and the level of mutual trust, as Cisco's Tom Davies has elegantly encapsulated in this flow diagram:

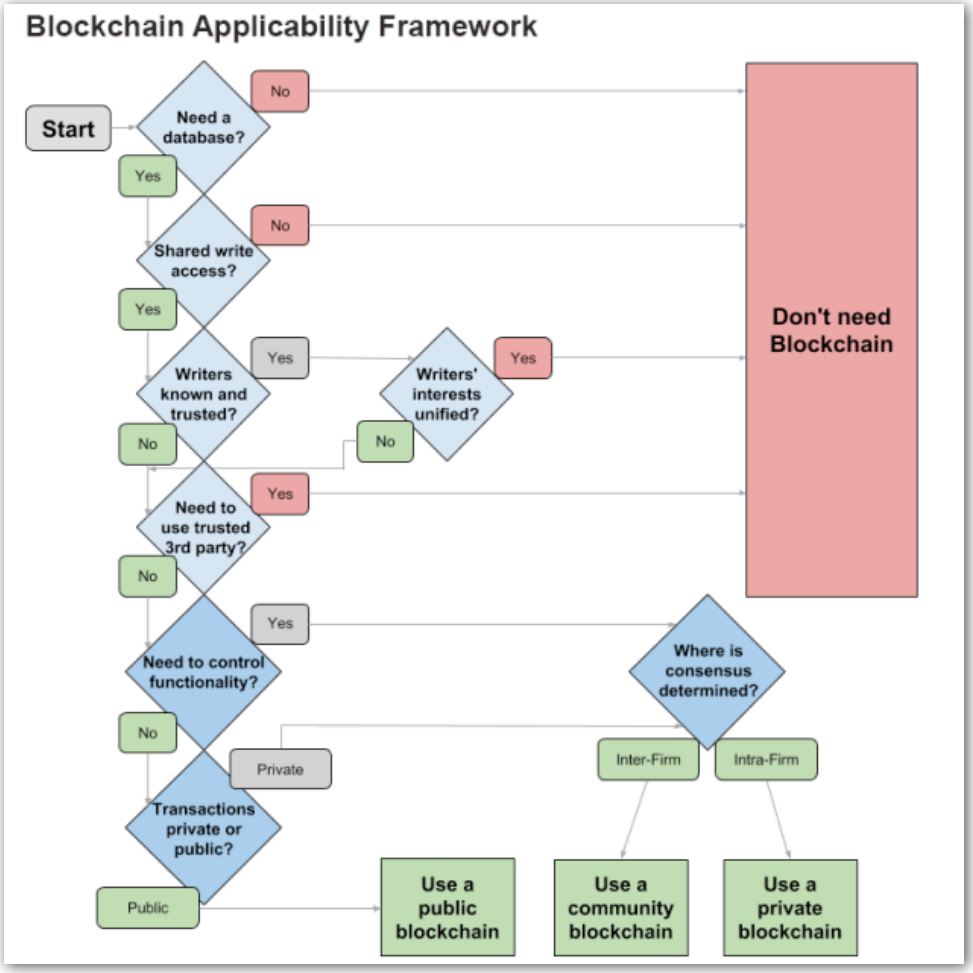


IMAGE: REDRAWN BY ZDNET FROM AN ORIGINAL BY TOM DAVIES (CISCO)

Note that in many cases a traditional database is the more appropriate solution. The key question is whether a trusted third party is available or required: if not, the remaining paths lead to the potential use of a blockchain—be it public, community or private.

Here's how analyst firm Gartner summarises the key characteristics of different kinds of blockchain:

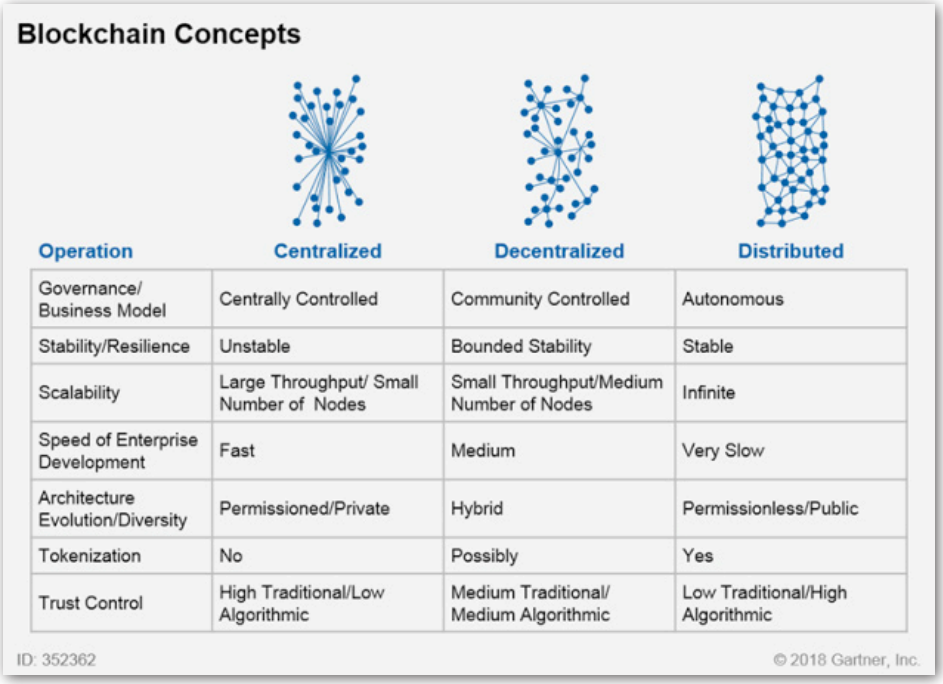


IMAGE: GARTNER

WHAT THE ANALYSTS SAY

Gartner

The latest Trend Insight Report from Gartner on Blockchain-Based Transformation sums up the current position succinctly: "While blockchain holds long-term promise in transforming business and society, there is little evidence in short-term reality." The report notes that most executives are focusing on blockchain to improve current business processes and records management, but stresses that there is also significant potential in digital assets and decentralisation. The analyst firm makes three specific predictions:

- Through 2022, only 10% of enterprises will achieve any radical transformation with the use of blockchain technologies.
- By 2022, at least one innovative business built on blockchain technology will be worth $10 billion.
- By 2026, the business value added by blockchain will grow to slightly over $360 billion, then surge to more than $3.1 trillion by 2030.

Gartner characterises the 2018-2021 phase as 'irrational exuberance', which is followed by 'larger focused investments, many successful models' (2022-2026) and 'global large-scale economic value-add' (2027-2030):

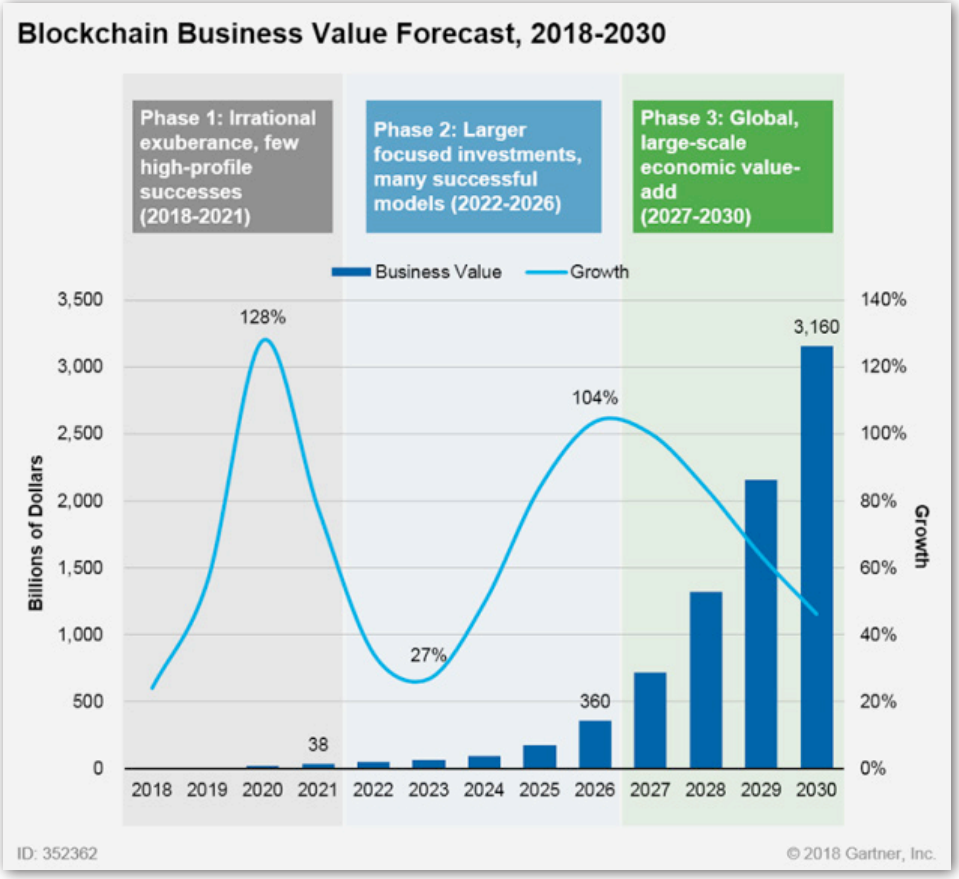


IMAGE: GARTNER

Maximising the potential of blockchain "requires adapting and transforming core models, processes and systems," says Gartner. However, the analyst firm continues, "these systems are literally the last place a business wants change to occur, because of the large risk to operations." As a result, the technology could "take a decade to become significant in business transactions".

IDC

IDC's latest Worldwide Semiannual Blockchain Spending Guide covers Gartner's 'irrational exuberance' phase (up to 2021) and forecasts a compound annual growth rate (CAGR) of 81.2 percent from 2016 with total spending of $9.7 billion in 2021. The biggest blockchain investments—over 40 percent of worldwide spending—will be made by the US during this period, followed by Western Europe, China and Asia/Pacific

(excluding Japan and China), says IDC. (Note that spending associated with various cryptocurrencies that utilise blockchain, such as Bitcoin, is not included in IDC's spending guide.)

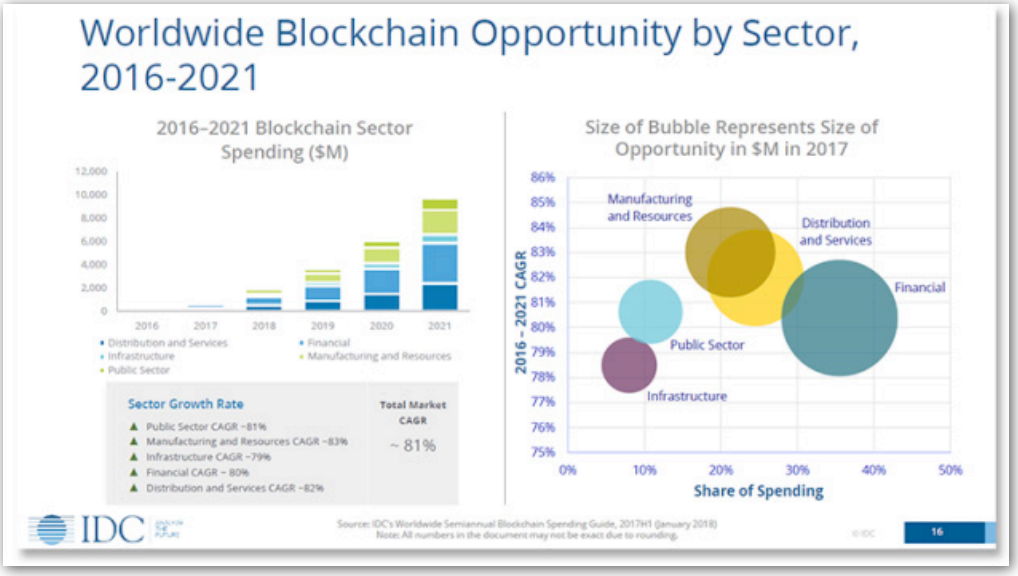


IMAGE: IDC

IDC expects the financial sector to lead the way in blockchain spending for 2018 with $754 million, followed by distribution and services ($510m) and manufacturing and resources ($448m). As far as specific use cases are concerned, the analyst firm's leading contenders are cross-border payments & settlements ($242m in 2018), lot lineage/provenance ($202m in 2018) and trade finance & post-trade/transaction settlements ($199m in 2018). The first of these use cases is a hot political topic in the UK as it attempts to negotiate a post-Brexit customs arrangement with the EU. IDC expects this top three to remain the largest spending areas through 2021. Other prominent blockchain use cases cited by the analyst firm are regulatory compliance, asset/goods management and identity management.

"There are a multitude of potential new use cases for blockchain, as transactions and records are the lifeblood of just about every organization. However, we are seeing initial blockchain spending to transform existing highly manual and inefficient processes such as cross-border payments, provenance and post transaction settlements. These are areas of existing pain for many firms, and thus blockchain presents an attractive value proposition," said IDC's Jessica Goepfert, program director, Customer Insights & Analysis in a statement.

Forrester

In Predictions 2018: Be Ready To Face The Realities Behind The Blockchain Hype, Forrester outlines the key 2018 blockchain trends for CIOs, kicking off with a now-familiar note of caution: "Blockchain technology may

not possess the miraculous capabilities that press articles and those with software, books, or other agendas to sell have ascribed to it. But the potential is undeniable: Blockchain technology, if implemented appropriately, supports new business and trust models."

Key takeaways from the report are: It's Going To Be Evolution, Not Revolution ("expect steady progress on the technology front to reflect enterprise requirements and a more mature approach to projects"); and Security Takes Center Stage ("we'll see more blockchain-based initiatives around fraud management and identity"..."developers and security pros will pay much greater attention to the security risks posed by interfaces with existing systems, serious software bugs, and potential future risks posed by quantum computing").

Echoing Gartner, Forrester notes that "many blockchain and distributed ledger projects merely seek to improve existing processes", whereas "true innovators are looking much further ahead". CIOs are cautioned to set realistic expectations, understand their use cases and related interdependencies, and to start small, building their blockchain ecosystems early. As far as security is concerned, the advice is to grow blockchain expertise in developer and security teams, and focus on integration options and regulatory compliance.

WHAT THE SURVEYS SAY

Gartner

In Gartner's 2018 CIO Survey just 1 percent of CIOs reported any blockchain adoption and only 8 percent were in short-term planning or active experimentation. Emphasising the immaturity of the blockchain ecosystem, 77 percent of CIOs surveyed said their organisation had no interest in and/or had no action planned to investigate or develop the technology.

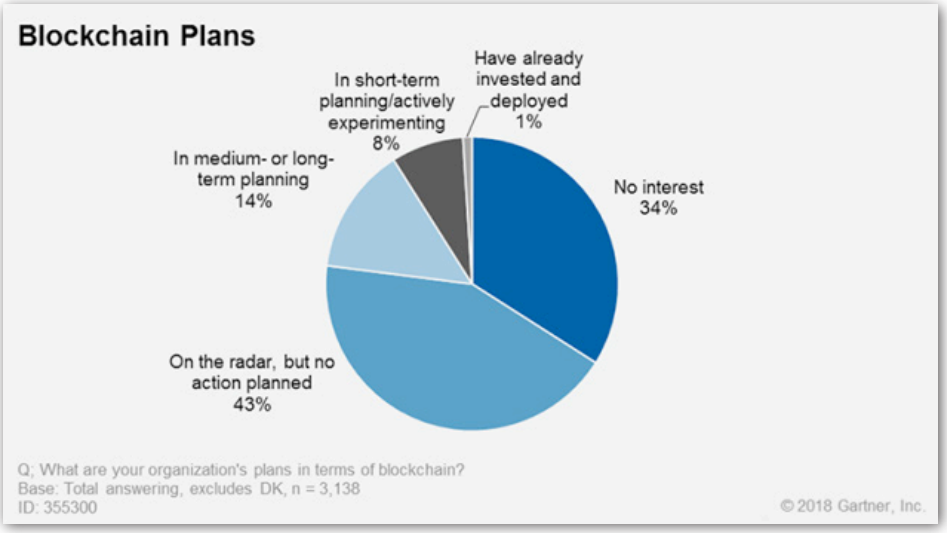


IMAGE: GARTNER

"This year's Gartner CIO Survey provides factual evidence about the massively hyped state of blockchain adoption and deployment," said David Furlonger, vice president and Gartner Fellow in a statement. "It is critical to understand what blockchain is and what it is capable of today, compared to how it will transform companies, industries and society tomorrow."

According to Furlonger, rushed blockchain deployments could result in significant problems of failed innovation, wasted investment, rash decisions and even rejection of a game-changing technology.

"While many industries indicate an initial interest in blockchain initiatives, it remains to be seen whether they will accept decentralized, distributed, tokenized networks, or stall as they try to introduce blockchain into legacy value streams and systems."
—David Furlonger

Skills shortages and IT culture/structure issues are likely to be major barriers to blockchain adoption. In Gartner's survey, 23 percent of the 293 CIOs that were actively experimenting with or have already deployed blockchain said that it requires the most new skills to implement of any technology area, while 18 percent reported that blockchain skills are the most difficult to find. A further 14 percent said that blockchain requires the greatest change in IT department culture, and 13 percent believed that blockchain implementation required structural changes to the IT department.

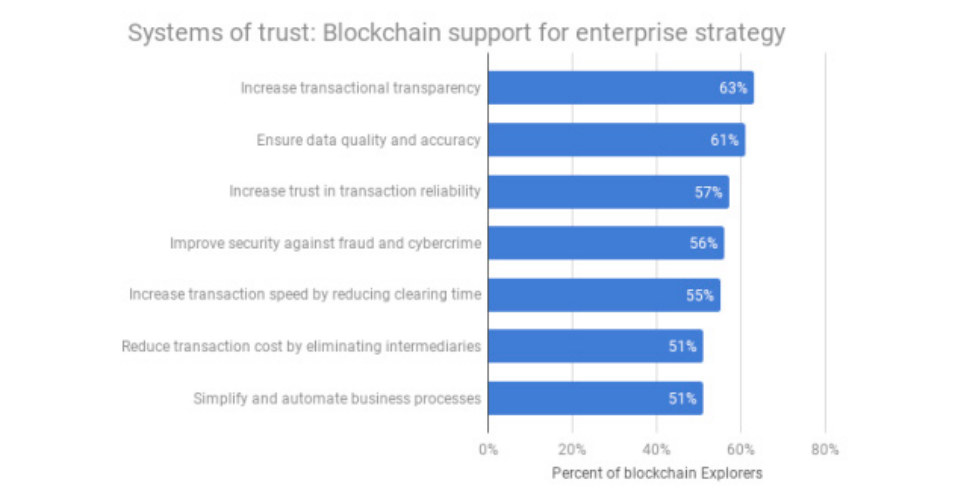
Leading the way in blockchain planning and experimentation in Gartner's survey were the telecoms, insurance and financial services sectors.

"While many industries indicate an initial interest in blockchain initiatives, it remains to be seen whether they will accept decentralized, distributed, tokenized networks, or stall as they try to introduce blockchain into legacy value streams and systems," Furlonger said.

IBM

IBM's Forward Together report, subtitled 'Three ways blockchain Explorers chart a new direction', drew on survey responses from 2,965 CxOs gathered in the first quarter of 2017. Those already experimenting with, piloting or implementing blockchains—33 percent of the survey population—were termed 'Explorers', while those not considering the technology were tagged (somewhat dismissively) as 'Passives'.

Unsurprisingly, given the above definition, all of IBM's Explorers expected blockchain to support their enterprise strategies in some way, with increased transactional transparency coming top of the list:



DATA: IBM/CHART: ZDNET

IBM cites healthcare as a pioneering sector for blockchain adoption, noting its suitability for storing and providing secure access to lifetime patient data. "If every vital sign from a doctor's visit or wearable health device, and records of all medicines taken, illnesses and operations could be securely shared on blockchain, then the quality and coordination of care would be expected to rise and costs to fall," the report claimed.

Another widely held belief expressed in IBM's survey is that blockchain could render the need for trusted intermediaries obsolete, allowing organisations to collaborate and compete in novel ways.

IBM extracts three lessons from its conversations with early-adopting blockchain Explorers, starting with the observation that organizations should identify new opportunities to monetise data and alternative payment models ("Orchestrate economic advantage"). Lesson number two extols the value of industry consortia in promoting business standards so that geographically separate organisations can connect ("Establish a circle of trust"). Finally, the report cautions against a wait-and-see approach to blockchain, noting that the first platforms may shape its future evolution for decades ("Learn fast and keep an open mind").

Underscore VC

Venture capital firm Underscore VC sought the opinions of 'hundreds' of blockchain thought leaders to compile its 2018 Future of Blockchain Survey. Respondents identified more than 30 industries that they consider ripe for 'meaningful disruption' over the next five years. The top 15 were: Financial transactions; Micropayments; Banking; Supply chain; Crowdfunding; Securities trading; Voting; Healthcare; Cloud storage;

Virtual property; Real estate transactions; Legal signatory processes; Energy markets; Small business lending; and Government.

The number-one factor accelerating blockchain adoption was decentralised control, while the leading hindrance was lack of scalability—something that 78 percent of respondents believed will take 3-5 years to solve.

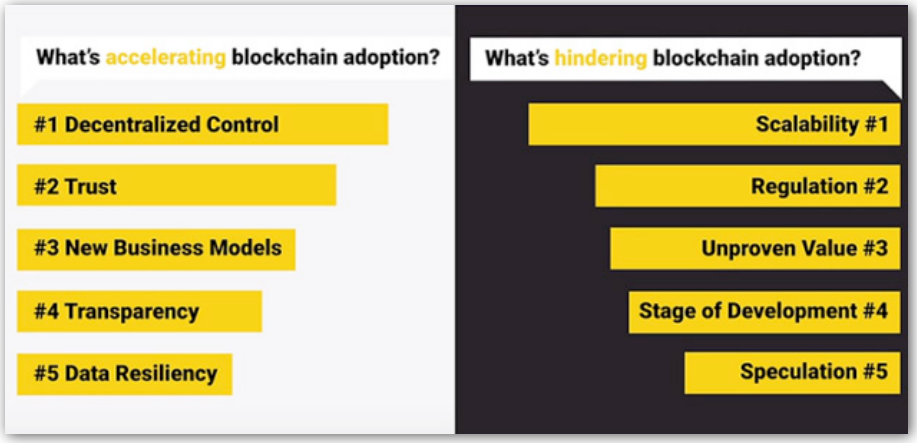


IMAGE: UNDERSCORE VC

Putting blockchain's current state of development into historical perspective, Underscore VC's respondents judged it to be comparable to June 1997 in the dot-com era—that is, three years before the dot-com bubble burst in March 2000.

Over three-quarters (78%) of respondents believed that overall blockchain adoption will be accelerated by the use of private blockchains in enterprises. However, 69 percent also thought that the current ability of enterprises to implement blockchain technology is very low.

Commenting on this discrepancy, Underscore VC co-founder Michael Skok said: "Building on our 16 years of investing experience, surveys, and understanding the way open source and cloud computing have been adopted, the enterprise has generally been a laggard. We expect the same will be true of blockchain. We believe that the public blockchain will be the area of innovation, and the way that will come about is with startups, and upstarts like Ethereum leading with innovative distributed applications (dApps)."

Gowling WLG

Gowling WLG, a Global 100 legal practice and a founding member of the Blockchain Research Institute (part of The Tapscott Group), canvassed FinTech experts in businesses around the world and conducted in-depth interviews with a panel of experts to compile its 2018 report The Ultimate Disruptor: How Blockchain Is Transforming Financial Services.

A key point made by members of Gowling's expert panel is the distinction between cryptocurrencies and the underlying blockchain/distributed ledger technology (DLT).

For example, regarding criticism of the computing and electricity costs of coin mining, Dean Elwood, CEO at Umony, said: "We are not using blockchain as a currency. We are applying the same technology in a different way—we have a DLT chain which represents an audit trail which is cryptographically secure and can prove that auditable elements have not been tampered with. The software has become a commodity and is now low cost to manage. For non-currency/mining use cases, computing power required isn't a problem."

Gowling's expert panel identified a wide range of sectors, headed by banking and finance, that could benefit from blockchain and DLT:

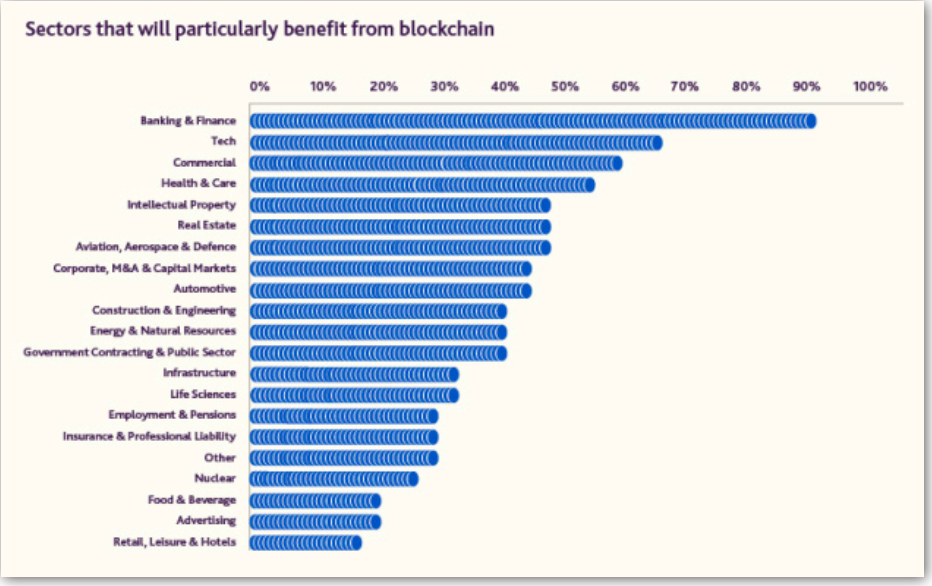
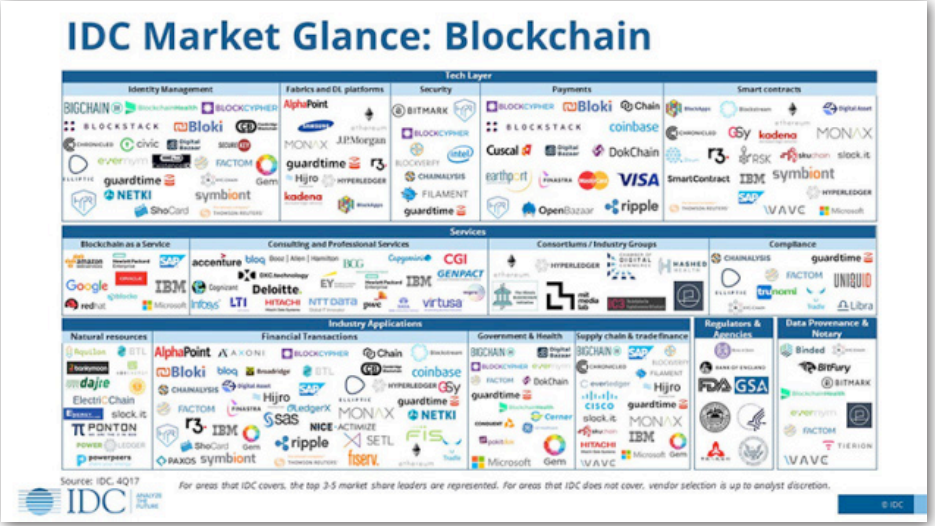


IMAGE: GOWLING WLG & BIZWORD

THE BLOCKCHAIN LANDSCAPE

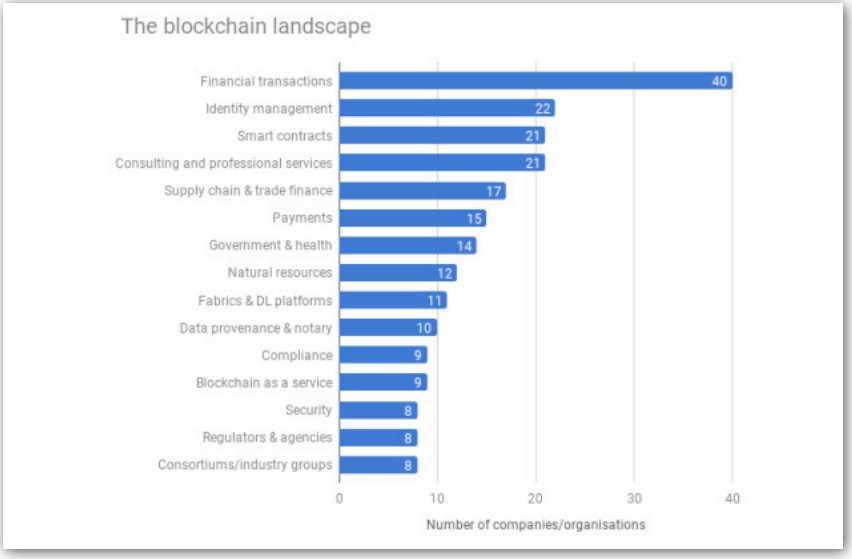
As you'd expect with an emerging technology, the blockchain market is a rapidly evolving one. Analyst IDC has compiled a view of the blockchain landscape as it stood at the end of 2017, showing the major players, and outlining the current structure of the market.

There are 72 companies listed in total, covering four Tech layers (Identity management, Fabrics & DL platforms, Security, Payments, Smart contracts), four Services categories (Blockchain as a service, Consulting and professional services, Consortiums/industry groups, Compliance), four Industry applications (Natural resources, Financial transactions, Government & health, Supply chain & trade finance), plus Regulators & agencies and Data provenance & notary.



Companies listed: Accenture, Amazon, Aquilon Energy Services, BigchainDB, BitVault, Blockchain Global, Blockchain Health Co., BlockCypher, Blockstack, BlockStream, Bloq, Booz Allen Hamilton, Broadridge Software, BTL Group, Cambridge Blockchain, Capgemini, CGI Group, Chronicled, Cisco Systems, Civic Technologies, Cognizant Technology Solutions, Coinbase, Conduent, Cuscal, Deloitte, Digital Asset Holdings, DXC Technology, Earthport, Elliptic Technologies, Ernst & Young, Ethereum, Everledger, Evernym, Factom, GEC, Genpact, Google, GuardTime, Hashed Health, Hewlett Packard Enterprise, Hijro, Hitachi, Hyperledger, IBM, Infosys, Intel, JPMorgan Chase, MasterCard, Microsoft, Monax Industries, Netki, NTT, Oracle, PwC, Red Hat, Ripple Labs, Samsung, SAP, SAS Institute, SecureKey Technologies, ShoCard, Skuchain, Slock.it, Symbiont, Tata Group, The Boston Consulting Group, Thomson Reuters, Tradle, Trunomi, Virtusa, Visa, Wipro (IMAGE: IDC)

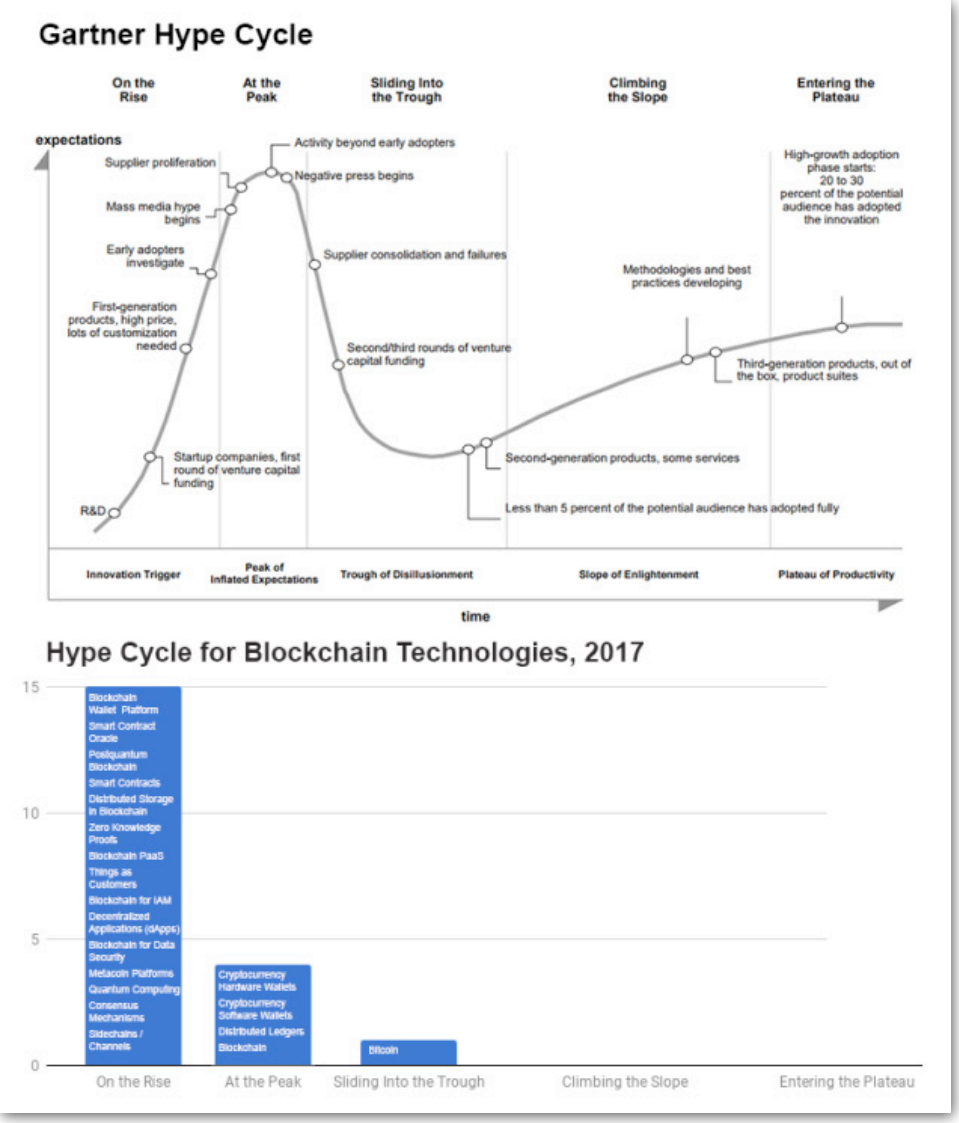
Most companies are involved in more than one market area, and it should come as no surprise that Financial transactions leads the field by some distance:



DATA: IDC/CHART: ZDNET

BLOCKCHAIN ISSUES

As all things blockchain-related approach and reach 'peak hype', the first signs of the inevitable backlash are appearing. Bitcoin has received a lot of negative press recently, for example, which is one reason why Gartner has it as the sole occupant of the 'Trough of disillusionment' in its current blockchain Hype Cycle:



IMAGES: GARTNER AND ZDNET

Security is widely regarded as a major advantage of blockchain, but there are still significant risks inherent in the technology (as currently implemented), according to the authors of a recent paper entitled A Survey on the

Security of Blockchain Systems. Here's a summary of the nine risks identified by Li *et al*, and their applicability to blockchain '1.0' (cryptocurrencies) and/or '2.0' (smart contracts):

Taxonomy of blockchain risks

Risk	Cause	Range of influence
51% vulnerability	Consensus mechanism	Blockchain 1.0, 2.0
Private key security	Public-key encryption scheme	
Criminal activity	Cryptocurrency application	
Double spending	Transaction verification mechanism	
Transaction privacy leakage	Transaction design flaw	
Criminal smart contracts	Smart contract application	Blockchain 2.0
Vulnerabilities in smart contract	Program design flaw	
Under-optimized smart contract	Program writing flaw	
Under-priced operations	EVM design flaw	

The *51% vulnerability* refers to the fact that, if a single miner amasses more than 50 percent of the blockchain's hashing power (in a PoW system) or coin ownership (in a PoS system), that miner can manipulate and modify the blockchain information in various ways.

If a blockchain user's *private key*—their self-generated and maintained identity and security credential—is compromised, then their blockchain account can be tampered with.

Some trading platforms allow users to buy and sell products anonymously using Bitcoin, leading to *criminal activity* such as ransomware, underground markets and money laundering.

Double spending is where the same cryptocurrency is used multiple times for transactions, and is "relatively easy to implement in PoW-based blockchains, because the attacker can exploit the intermediate time between two transactions' initiation and confirmation to quickly launch an attack," say Li *et al*.

Blockchain systems take measures to protect the *transaction privacy* of users. But, say Li *et al*: "Unfortunately the privacy protection measures in blockchain are not very robust." They quote a study which found that actual transaction inputs could be inferred with 80 percent accuracy in the cryptocurrency Monero.

Criminal smart contracts "can facilitate the leakage of confidential information, theft of cryptographic keys, and various real-world crimes (e.g. murder, arson, terrorism etc.)", say Li *et al*, who describe an example involving password theft.

Smart contracts may have *security vulnerabilities* caused by program defects, say Li *et al*, who list a taxonomy of no fewer than 12 types. In one quoted study, 46 percent (8,833 out of 19,366) of Ethereum smart contracts were found to be vulnerable to four kinds of security bug.

User interaction with Ethereum smart contracts is charged by 'gas', which can be exchanged with 'Ether' (Ethereum's cryptocurrency). "Unfortunately, some smart contracts' development and deployment are not adequately optimized," say Li et al. A tool that can auto-discover three gas-costly patterns reported under-optimization in 80 percent of a sample of Ethereum smart contracts.

The 'gas' value of an Ethereum operation is proportional to the computing resources it consumes. However, this can be difficult to estimate, leading to *under-priced operations*. "For example, some IO-heavy operations' gas values are set too low", say Li *et al*, "and hence these operations can be executed in quantity in one transaction. In this way, an attacker can initiate a DoS (Denial of Service) attack on Ethereum."

OUTLOOK

It's clear that, in the terminology of Gartner's Hype Cycle, blockchain is approaching the 'At the Peak' stage, characterised by mass media hype and supplier proliferation, with activity beyond early adopters and negative press waiting to usher in the inevitable slide towards the 'Trough of Disillusionment'.

That's not to say that the current noise around blockchain is all hot air—just that there's a lot of piloting, early adopting, supplier consolidation and VC (or ICO) funding to come before the untenable use cases are weeded out and the long climb up the 'Slope of Enlightenment' begins.

Large parts of the enterprise may well get retooled using more efficient and secure blockchain technology, and new blockchain-based business models may emerge. But don't expect this to happen overnight.

SURVEY: MOST PROFESSIONALS DON'T HAVE EXPERIENCE USING BLOCKCHAIN, BUT MANY SEE ITS POTENTIAL

BY AMY TALBOTT

Blockchain is still an emerging technology, so it was no surprise that in a recent survey by ZDNet's sister site Tech Pro Research, 70% of professionals who responded said they hadn't used it. However, 64% of respondents said that they expect blockchain to affect their industry in some way, with most predicting a positive impact.

Overall, respondents said that blockchain would be most likely to cause changes in the IT/technology and finance/banking/insurance sectors. This was expected, since tech professionals are going to be the ones enabling the use of blockchain, and finance, banking, and insurance industries may be working with cryptocurrencies and smart contracts.

Two open-ended questions generated a lot of chatter among the survey's 443 respondents. Opinions about blockchain's impact on daily life over the next five years was divided. Some said the technology would be revolutionary, while others dismissed it entirely. When asked what needs to happen for blockchain to gain more widespread use, two main themes emerged: education and usability. Many respondents pointed out that the public needs more education about what blockchain is and what it does, and others said a major use case needs to emerge.

This infographic contains more details from the research. For all the findings, download the full report: Blockchain in business: The current state and predictions for the future (available to Tech Pro Research subscribers).

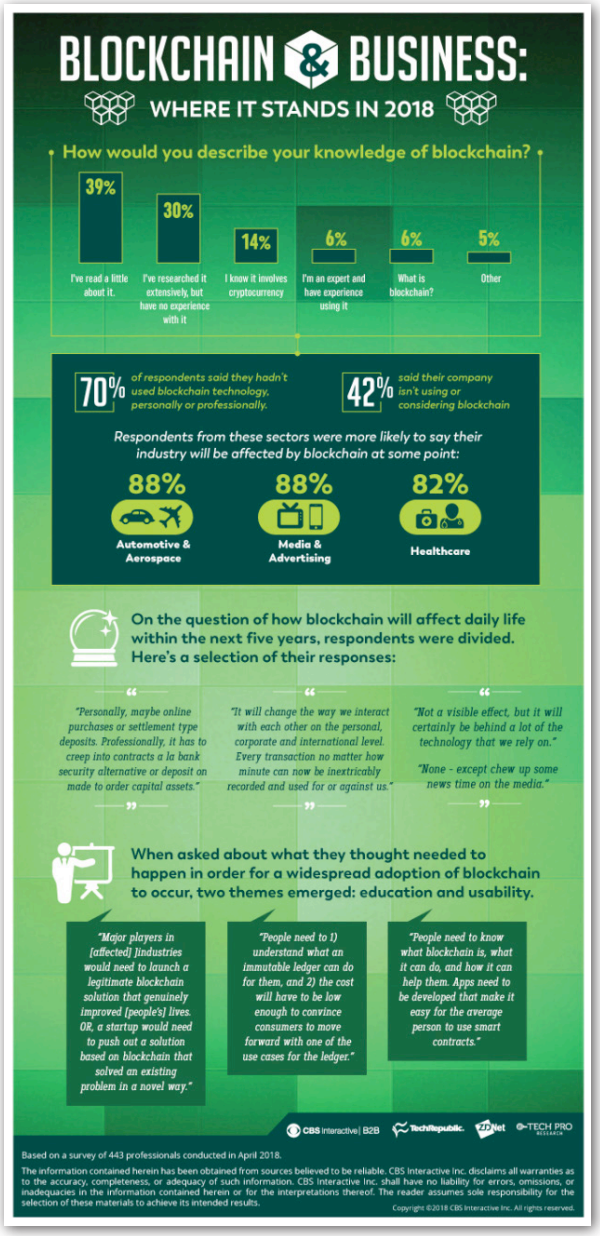


IMAGE: ERIK UNDERWOOD

BLOCKCHAIN EXPLAINED FOR NON-ENGINEERS

BY DAN PATTERSON

Blockchain buzz is inescapable. And while the technology has transformed some companies and minted fresh millionaires in a dazzlingly short period of time, blockchain is as confounding as it is powerful. If you're confused by the hype, you're not alone.

Blockchain is a decentralized, vettable, and secure technology that has, in less than a decade, become a powerful driver of digital transformation poised to help create a new employment economy. Evangelists claim blockchain tech will disrupt industrial supply chains, streamline real estate transactions, and even redefine the media industry. "Think of blockchain as the next layer of the internet," said Tom Bollich, CTO of MadHive. "HTTP gave us websites ... now we have blockchain, which is like a new layer of computing."

Employment data seems to validate blockchain's current hype cycle. Google search data indicates a cresting wave of interest in the tech, and according to Indeed.com searches for blockchain-related jobs spiked nearly 1000 percent since 2015. Enterprise organizations like Capital One, Deloitte, ESPN, and eBay are hiring blockchain engineers, retraining project managers to facilitate integrations, and even searching for specialized attorneys.

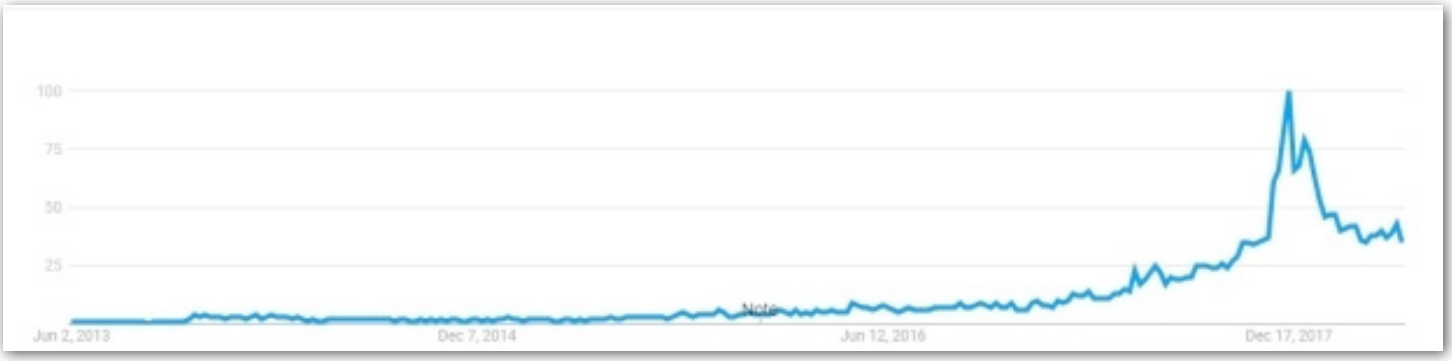


IMAGE: GOOGLE SEARCH TRENDS

But while the technology's applications seem nearly limitless, understanding how blockchain works and why it's important is challenging, even for technology and IT professionals. Blockchain is, fundamentally, an ever-expanding database. Just like a bank record, every transaction is logged and then made available to the public. The database relies on a novel method of encryption, allowing developers to verify the authenticity of each transaction.

The database is strengthened with each transaction, so to incentivize so-called "miners"—individuals or organizations that use powerful GPUs to solve algorithmic challenges—each chain releases a digital "coin," commonly referred to as cryptocurrency. The Bitcoin blockchain releases nodes—or, blocks—of transaction data every 8 to 10 minutes. Miners receive a portion of a coin for their effort, and the chain's encryption is strengthened. Because the code is open and viewable by anyone with a computer, blockchain tech is often referred to as a "public ledger" of activity.

Although most often associated with Bitcoin, blockchain can be stamped with a vast spectrum of data, said Bollich's co-founder and Riot Blockchain's CEO John O'Rourke in an interview with TechRepublic. "It's basically basing your faith in math [as opposed to] faith in some other trusted party that could potentially be hacked," he said. "Blockchain allows all of that [activity] to be digitized, and secured with every single transaction on that ledger."

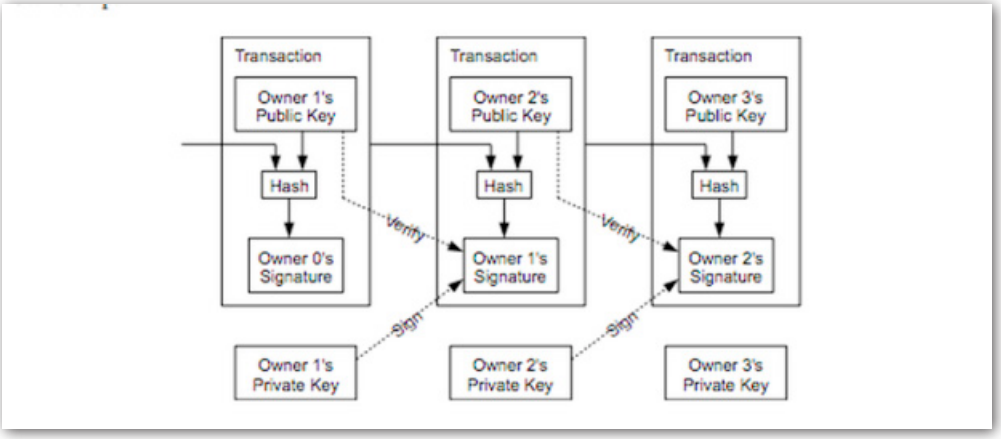


IMAGE: SATOSHI NAKAMOTO

Blockchain tech is not limited to Bitcoin, and the code is easily forked. This has resulted in the meteoric rise of the chain's by-product: cryptocurrency. Ethereum, for example, is a blockchain for applications and produces a coin called Ether. The chain is used by firms like Microsoft and Amazon to validate cloud data, by Google to assist self-driving cars, and by game makers to validate the authenticity of digital goods. The Monero chain emphasizes transaction privacy, and produces XMR, a highly volatile currency.

Digital currency is attractive to some because the coins are algorithmically dispensed and not controlled by a government. In the latter half of 2017 and first half of 2018 initial coin offerings—ICOs—raised billions in speculative funding.

However, a wise man once said, "Don't believe the hype." When it comes to cryptocurrency and blockchain hype, we should all learn from Flavor Flav's immutable wisdom. It's nearly impossible to accurately value cryptocurrency. Some currencies are easy to hack. Most coins falter or never gain market traction, and established coins like Bitcoin and Ether often fluctuate wildly in price. Government regulation seems inevitable, and the SEC is cracking down on fraudulent traders.

Analysts at research firm Gartner, though still bullish on the long-term future of blockchain tech, are quick to caution that enterprise integration is not as easy as the hype might imply. According to a recent report, 14 percent of CSOs expressed concern that the technology will require significant organizational and cultural changes of the IT department. Another 77 percent of CIOs said their organization has no short-term interest in blockchain technology.

Alex Feinberg, a former Google exec and COO of Petram Security, remains confident in the long-term future of blockchain tech. Blockchain startups are on the rise, he noted, and the employment landscape is rosy for talented programmers and integration experts.

"As I started understanding what investment banks did and as I started understanding how the banking system was constructed, and as I understood how money was created," Feinberg said, "it became apparent to me that the US government, the US banking system was in a bind." The solution, he said, was decentralization. And the technological key to innovative decentralization? "The blockchain."

BLOCKCHAIN WON'T SAVE THE WORLD—BUT IT MIGHT MAKE IT A BETTER PLACE

BY STEVE RANGER

One of the most striking features of blockchain is the utopian streak that runs through it—the idea that blockchain can replace the existing authorities like banks and governments with a distributed network of trust, held in place by clever mathematics.

Bitcoin represents blockchain in its purest form: a distributed digital network that anyone is free to join, controlled by no-one and using cryptography to secure transactions that remain visible to everyone. It's a new currency owned by no state.

Enthusiasts point to the success of bitcoin and other blockchain-based cryptocurrencies as the first example of a trend, arguing that blockchain could have a similar impact elsewhere in society. It could replace existing gatekeepers—banks, governments or any other authority—with a peer-to-peer network of trust where actions are transparent and visible to all, ushering in a crypto-anarchist utopia.

For example, instead of the government being in charge of confirming our identity (through passports or ID card databases), a distributed, cryptographically-secured ledger could allow us to control our own data.

But how realistic is this vision?

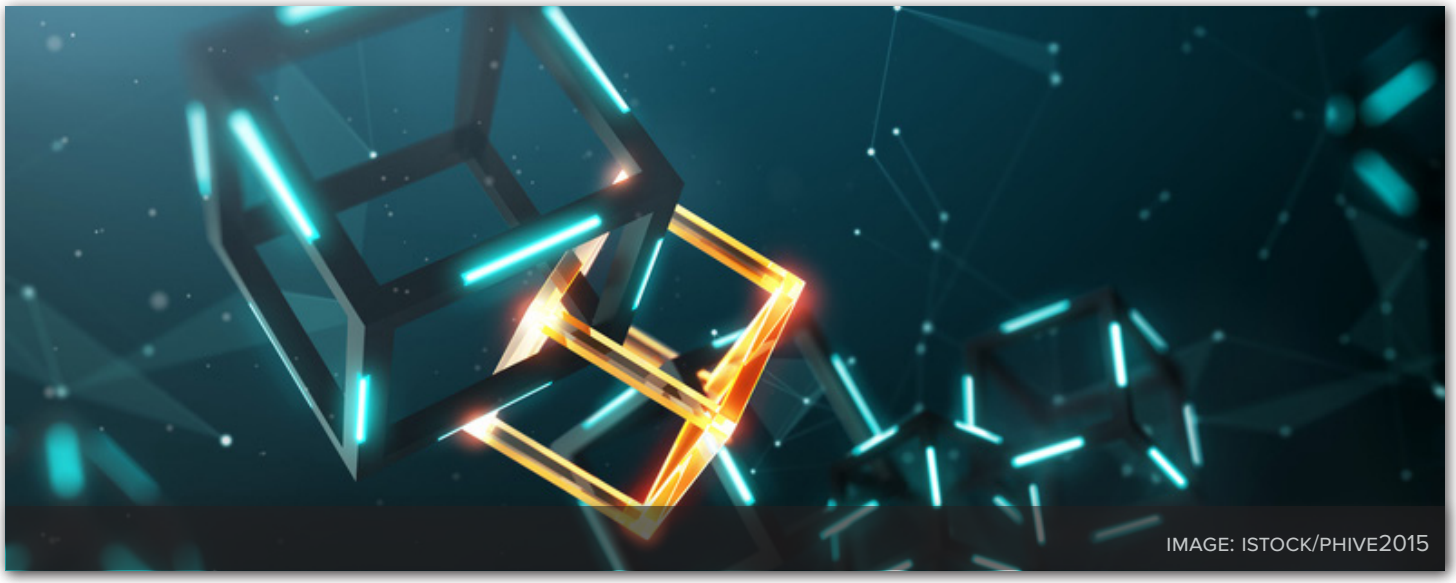


IMAGE: ISTOCK/PHIVE2015

REVOLUTION ON HOLD

"Blockchains shift some control over daily interactions with technology away from central elites, redistributing it among users. In doing so, they make systems more transparent and, perhaps, more democratic," said a report from the European Parliament last year titled How blockchain technology could change our lives.

However, the report goes on: "That said, this will not probably not result in a revolution. Indeed, the governments and industry giants investing heavily in blockchain research and development are not trying to make themselves obsolete, but to enhance their services."

For now it seems, rather than being used to destroy existing authorities, elements of blockchain technology are being used to fix problems with them, especially around the security and reliability of data. While there are some strong reasons why blockchain-style technologies can fix some vexing problems, it's not likely to smash the system any time soon.

"Blockchain is the first time we've had a reliable mechanism that is based on mathematics rather than the frailties of human nature that is capable of maintaining the integrity of the critical systems that make up our lives. No amount of cryptography and clever software will serve as a substitute for the integrity of public officials or financial institutions, but this is a technology that makes it substantially more difficult or expensive to engage in bad behaviour," argues Tomicah Tillemann, director of the Blockchain Trust Accelerator at the New America think tank.

Tillemann sees blockchain as one way of rebuilding or replacing the trust that has been lost in many of the institutions we traditionally rely on. It can help cut corruption, make systems more efficient and help to engage citizens who currently feel ignored or marginalised by the system, he says.

Blockchain-based systems allow you a much higher level of confidence in the underlying integrity of the information, and can also provide a degree of security that no existing database system has been proven to replicate, says Tillemann.

He points to a blockchain-based land registry project in the Republic of Georgia, which combines a private blockchain with data that's then anchored to the Bitcoin blockchain. This makes it much harder for a corrupt official to be able to change who owns a piece of land—something that's much easier to do and cover up on a paper-based system.

"I don't believe blockchain is going to eliminate the need for government or the role of government, but I do believe it can help institutions that are struggling mightily to keep up with the velocity of change," he says.

NEW BUSINESS MODELS

But Tillemann does see a more transformative role for blockchain and also thinks it can create trust and make it easier for individuals to share information, which could lead to new business models.

He suggests that individuals could have their own blockchain-based data wallet, in which they will store everything from their medical records to their votes to their financial transactions. They will then be able to share access and revoke access to that information at will.

"They will have ownership of the data that defines their identity, rather than the centralised actors that control that information in our current systems," says Tillemann.

"This is a technology with profound implications. Now, we don't know yet whether that potential is going to be realised. None of this is inevitable and it could go any number of ways, but the potential is there and worthy of our attention and respect."
—Tomicah Tillemann

In this context, blockchain has the potential not just to upset the traditional gatekeepers like banks, but also the new digital gatekeepers—the Facebooks, Googles and Ubers who have flourished by creating their own networks of trust.

If I didn't need Facebook or any other network to share with my friends, or if I didn't need Uber to be able to trust and pay for transport, it might be possible to create new genuinely peer-to-peer ways of doing business.

"This is a technology with profound implications. Now, we don't know yet whether that potential is going to be realised. None of this is inevitable and it could go any number of ways, but the potential is there and worthy of our attention and respect," says Tillemann.

FILLING A TRUST VACUUM

Eleonora Harwich, head of digital and technological innovation at UK think tank Reform sees blockchain as having a much greater impact in countries where there's low trust in institutions, or where corruption is an endemic issue in public sector. That's because blockchain creates a system where you don't actually need to trust other people or agencies involved in a transaction, thanks to the tamper-proof version of the truth contained in the ledger.

That's handy for freezing out crooked officials, but less useful if you already have efficient and trustworthy authorities. So blockchain usage in government—at least in the UK—is more about efficiency gains than completely overhauling the way we think of public services.

"In its theoretical core, blockchain does have the intention to bring down power structures for sure. But I don't think that's the kind of applications we are talking about in the public sector," says Harwich.

"Radical transparency is a curse. Transparency handled appropriately is a good thing clearly, but transparency badly handled can actually be a threat to personal safety and is untenable in a commercial environment." —Martha Bennett

Potential usages in the UK might include using blockchain to break down silos in government that hold information about individuals. For example, blockchain technology could help with creating a single, secure patient record that individuals can control, says Harwich.

"When you talk about patient-centric care or citizen-centric services, it calls for a restructure of the data infrastructure in which we operate. The whole blockchain world is forcing us to ask questions a bit differently," she says.

However that doesn't mean the government is ready to switch over immediately. Blockchain might make sense when setting up something completely new, but government has been gathering data for hundreds of years and connecting that legacy data to the futuristic world of blockchain won't be easy.

The permanent nature of blockchain-based transactions can also be a headache in some scenarios; how does someone exercise their right to be forgotten if their data is held forever in a blockchain?

BLOCKCHAIN ISSUES

For Martha Bennett, principal analyst at Forrester, the issue of transparency and how to deal with it is just one of the issues with blockchain technology.

"Radical transparency is a curse. Transparency handled appropriately is a good thing clearly, but transparency badly handled can actually be a threat to personal safety and is untenable in a commercial environment. I don't want everybody to know what I'm doing, but if all my actions on the blockchain are accessible to everybody, they know where I am, they know what I've done, so they can try and blackmail me."

Still, blockchain does have its place, says Bennett. "When you have processes involving multiple parties, where everybody should be looking at the same data but they are not, and you have endless friction and endless arguments as to whose version is right and who did what when, that's actually when the concept can come into its own, providing they can agree on how to run the network."

As for the more utopian aspects of blockchain, Bennett is unconvinced. Just because you don't like having your data controlled by other people, that doesn't mean an infrastructure with no conditions for privacy is a great alternative, she says.

Bennett also warns that placing too much trust in the technology alone is unlikely to be successful.

"It's an illusion to pretend that just because you have a blockchain-based network, suddenly everybody will behave in an appropriate manner. Rules and regulations are what make a civil society function; you cannot provide consumer protection in an unregulated environment."

BLOCKCHAIN CONFUSION

Part of the confusion around blockchain is that when people talk about it they don't necessarily mean blockchain technology, they mean 'let's do things differently', says Vili Lehdonvirta, associate professor and senior research fellow at the Oxford Internet Institute.

"They mean 'let's come up with digital identities for objects and people that allow us to make processes more efficient, but let's do it in a way that doesn't result in those identities and all that data being owned by a Silicon Valley monopolist'," he says.

Blockchain has become a catch-all term for this kind of a vision, even if it doesn't use the distributed permissionless model of Bitcoin. And certainly not every project needs to use blockchain either.

The desire to create a system that isn't controlled by a digital gatekeeper like a Google or a Facebook might be increasingly understandable, but that doesn't mean technology alone can fix the problem.

"In practice there isn't any simple technological silver bullet; you can't just install blockchain and you're all set, and we have this digital Nirvana which is all egalitarian and there are no gatekeepers. No, that's not how it works," says Lehdonvirta.

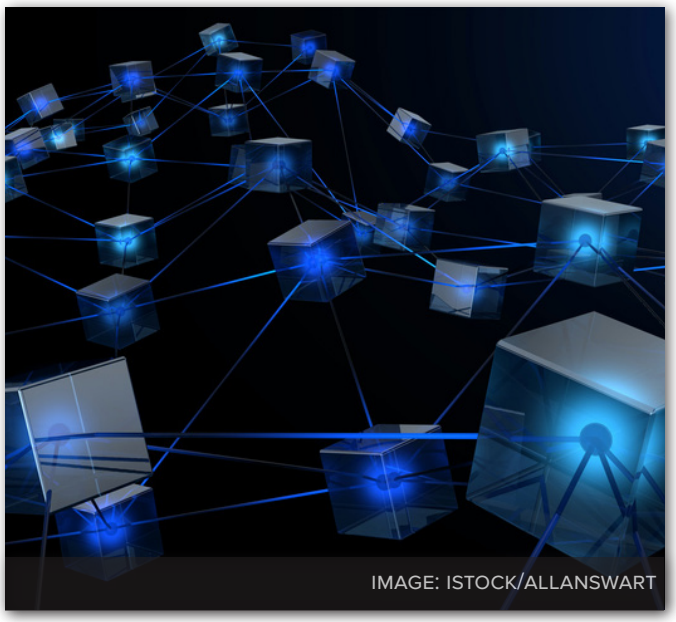


IMAGE: ISTOCK/ALLANSWART

For example, while blockchain does offer the potential for more transparency, not everyone in every sector wants all transactions visible to everyone. And even where more visibility of transactions might be good for some (like in the art market, where it would enable—at least in the UK—artists to know when their work had been resold, enabling them to receive a cut) not everyone wants that.

"There are parties that benefit from opacity and inefficiency who are the gatekeepers often in these markets, and they are not so keen on these changes", says Lehdonvirta. "It's not like there's going to be this avalanche and everybody is going to adopt technology because it's best for everyone."

Blockchain is not a morally neutral technology; it has been created by software developers with their own agendas and interests, which means it's far from immune to politics. "There's people involved—it didn't just fall from the sky," Lehdonvirta points out.

"It's more distributed that some other software systems, but it still has politics, it still has gatekeepers, it has power relationships, it has interests. There isn't a technological solution to the problem of politics; you still have to somehow decide who's in charge and who makes the rules."

The idea that there's no authority at all in a blockchain is perhaps missing the point. "You're still going to have people in charge; the question is who do you want to have in charge—do you want to have a government, or do you want to have some system of software developers and commercial interests in charge?"
says Lehdonvirta.

10 WAYS THE ENTERPRISE COULD PUT BLOCKCHAIN TO WORK

BY ALISON DENISCO RAYOME

Despite the hype, enterprise blockchain adoption remains limited: Only 1 percent of more than 3,100 CIOs surveyed recently by Gartner said they had implemented some kind of blockchain within their organization, and just 8 percent said they were in short-term planning or active experimentation with the technology.

The distributed ledger technology has the promise to make many operations more efficient and enable new business initiatives. But limitations in the technology itself as well as the business issues that arise with its implementation have curtailed mass adoption, said David Furlonger, vice president and fellow at Gartner.

"All firms can do right now is experiment," Furlonger said. "They have to look at multiple offerings in the marketplace and understand the different governance models, data management architectures, security levels, and how it impacts their business."

"The companies asking themselves, 'What problem can I solve with blockchain that existing solutions can't solve?' are the ones that are going to succeed." —Michela Menting

A large number of companies are now inquiring about the technology, said Martha Bennett, principal analyst at Forrester. "Many of the firms I speak with have projects going on, but not always with a firm view on whether to operationalize them," Bennett said. "There are a few highly ambitious projects under way, but these haven't gone live yet."

Putting blockchain to work depends on the use case, Bennett said. "If there is a use case that calls for multi-party collaboration around shared trusted data, with or without an added element of automation, then that's worth pursuing if the existing system is error-prone, full of friction, or otherwise deficient," Bennett said.

However, with the hype around blockchain, many companies are looking to implement the framework without a strong reason, said Michela Menting, digital security research director at ABI Research. "I think a lot of those will be failed projects," Menting said. "The companies asking themselves, 'What problem can I solve with blockchain that existing solutions can't solve?' are the ones that are going to succeed."

Here are 10 ways the enterprise can put blockchain to work now, or in the near future.

1. SUPPLY CHAIN MANAGEMENT

Supply chain management is one of the most promising areas for blockchain initiatives, Bennett said.

Centralization is sometimes a problem, because you don't have visibility to all of the parties involved. But blockchain can enable each party to see what others are doing on the same ledger, Menting said. "It doesn't mean that all their data has to be visible, but data about the specific product or service that they're manufacturing or selling can be visible to everyone," she said. "It means you can trust things like quality and control, and that the third-party contractor is qualified and is adhering to standards."

This could also be useful for tracking any product, from food to cars. "You can see the chain of trust all the way from the first person who starts in that supply chain, whether it's the farmer, or the manufacturer in China, or whatever," Menting said. "Anything where companies want more visibility into something where there's lots of different parties is one of the use cases where blockchain can really help solve a problem."

2. PAYMENTS

One of the largest current use cases for blockchain is in financial services, said HMB consultant Brett Koenig. This year, blockchain spending will be led by the financial sector, spending $754 million in 2018 and driven largely by rapid adoption in banking, according to IDC. Banks including Barclays and JP Morgan Chase have blockchain initiatives, and the technology can enable easier payments across international borders.

Blockchain adoption is most common among large enterprises like national banks, which are large enough to absorb some risk if a project fails, as well as among startups with high flexibility, Koenig said.

3. DATA GOVERNANCE

Blockchain can be particularly useful for countries that are focused on data protection and privacy, like the EU with the General Data Protection Regulation (GDPR). "We'll see blockchains where the control of the user data is back in the user's hands, and then users can decide who has access to that data," said ABI Research's Menting. This includes providing consent to share your data with third parties, as well as revoking that access. It would also allow users to see where their data is being shared with third parties, instead of having to check website terms and conditions.

"I think we'll see some very interesting use cases around data management and companies, either the social media-type companies changing to adapt to a blockchain, or new companies coming up and then giving back that control to the end user, so they can do what they want with their data," Menting said.

4. SMART CONTRACTS

With blockchain, businesses could code payments, delivery, and transportation of goods into a smart contract, along with maintenance, Menting said. For example, say a robotic arm in a factory has a bolt that is wearing down. The factory operator could look into their code for the smart contract that says they can buy a replacement from the manufacturer, and the smart contract would trigger the buying process. The manufacturer could deliver the part, and a currency would be exchanged between the smart contract, the factory, and the manufacturer.

Similar use cases will exist for consumers as well, Menting said. For example, if you rent a vacation home, you might sign a smart contract with the rental agency that unlocks the door for you after you've made a payment.

5. IDENTIFICATION

Microsoft and Accenture recently announced a partnership to use blockchain technology to provide a legal form of identification for 1.1 billion people worldwide as part of the global public-private partnership ID2020.

"You're giving an opportunity to people to interact in a marketplace where they have not been able to before," said Gartner's Furlonger.

The United Nations (UN) is also currently using blockchain across 16 agencies for humanitarian causes, including the World Food Program, to help refugees purchase food with only an eye scan.

6. SHARED PROCESSES

Blockchain can help organizations better collaborate, Furlonger said. "If enterprises could turn off existing siloed systems and share among themselves a more inclusive back office processing operational type system, it would in theory produce more efficiency and cost-effectiveness," Furlonger said. The question that remains is whether or not companies would then pass those savings on to their customers, he added.

7. DISRUPTING BUSINESS MODELS

Blockchain could allow for the removal of intermediaries, as well as the associated costs and frictions in terms of the creation of new forms of assets and expanding a company's overall economic footprint, Furlonger said.

8. FOOD SAFETY

IBM is partnering with food suppliers including Dole, Nestlé, and Walmart to better regulate food safety using blockchain. In the global food supply chain industry, this means all growers, suppliers, processors, distributors, retailers, regulators, and consumers can gain permissioned access to information about the origin and state of

food in their transactions. All members of the ecosystem can use the blockchain network to trace contaminated foods to their source in a short amount of time, to ensure they are quickly removed from store shelves.

"They are able to speed up how long it takes to get data about where their products are at through transit, and see more data about what temperature the food was kept at and different food standards," said HMB's Koenig.

9. DIGITAL RIGHTS ACCESS

Blockchain can help professionals track their intellectual property, Koenig said. For example, Kodak is working on a platform called Kodak One that allows photographers and artists to manage digital rights and access to their work, so that they can better track who is using their pictures, and make sure that people aren't infringing copyright restrictions, he added.

10. MEDICAL RECORDS

Doctors' offices own patient medical records, but because people typically see a variety of different doctors and specialists over their lifetime, there is no single, easily-accessible record, Koenig said. Blockchain could allow for each person to have a single, shared medical record with every doctor, diagnosis, and medication.

However, due to the amount of regulation in the industry, it will likely be years before any true impact is realized, Koenig added.

WHY BLOCKCHAIN COULD TRANSFORM THE WORLD FINANCIAL SYSTEM AND WHAT THAT WOULD MEAN

BY TEENA MADDOX

IMAGE: ISTOCK/JAVENLIN

Blockchain is on target to disrupt the world's financial system, as the secure technology allows faster and more cost-effective processing of transactions through a shared digital ledger that can be recorded and verified electronically.

"Every bank in the world is testing some sort of blockchain or similar electric technology," said Pete Woodard, CEO of IBC Group, a global ICO consulting and blockchain development company.

Darryn Jones, vice president of business development at the Greater Phoenix Economic Council, said there are four factors making blockchain a potential disruption to the financial industry:

- It will reduce the cost of cross-border transaction fees. This will have major institutional and political implications for un-banked populations in unstable economies.
- Identity management is one of the most compelling use cases for blockchain in the financial sector. Knowing your customer requirements is becoming more stringent as regulators combat money laundering and other illegal financial activities, and blockchain's underlying protocols support more robust identity management by both consumers and the financial institutions they participate in.
- Smart contracts enabled by blockchain technology will streamline the settlement and titling processes for financial transactions that involve the exchange of goods and services.
- While blockchain technology is promising, the main downside is its scalability. Transactions on a blockchain platform are currently limited to seven transactions per second. This will be the most significant risk factor and barrier to entry for the deployment of blockchain protocols in the fintech sector—most notably as it pertains to global payments and other high-volume transactions.

BENEFITS OF BLOCKCHAIN

The benefits of blockchain for the financial industry include faster clearing and settlement of transactions, which means that banks can lend out money quicker than before. It also reduces the amount of human labor around transactions.

Transparency, security and cost savings are additional benefits of blockchain, and savings in identity management could be huge.

Blockchain will help banks more easily verify someone's identity, with permissions set up via the technology. It will be easier, and more cost efficient, for individuals to do transactions within a network and a financial institution once they're using blockchain.

"There are a lot of players getting involved in this—the folks of Goldman Sachs, some of your large telecom providers. They're actively participating in this space to solve this billion-dollar problem of how do we verify people's identities, because banks are spending a ton of money complying with anti-money laundering legislation," Jones said.

RISKS OF BLOCKCHAIN

But there's also a risk to banks, which have traditionally operated as a trust mechanism, because blockchain eliminates the need for a centralized party.

Woodard said, "Say I have $10 and you're receiving the $10; the bank is in the middle to validate that I have that and you'll receive it. So the trust that a bank provides, §the fee that it derives, can be replaced by blockchain. Maybe that's not all of the services a bank offers, but it's quite a lot."

Once blockchain is put in place, the entire network will see that someone is paying someone else $10, and it will be noted in the digital ledger of each member of the network. The transaction is listed in the digital ledger, which cannot be altered.

Dafeng Guo, co-founder of EOS Asia, said, "I think this is going to stay with us for a long time, because if we can achieve certain business transactions or financial transactions, whether it's a bank transfer or any financial operation that does not need a central party anymore, then it means all the money that we previously gave to the banking system, or the central party, we don't need to pay these people anymore. It's led us to look at certain industries in a very different way."

BLOCKCHAIN ADOPTION TIMELINE

There is time for banks to prepare. Until blockchain reaches scalability, it won't undergo mass adoption. And federal regulations prevent fast adoption of blockchain that would lead to scalability.

"Until the legislative environment evolves to accommodate the technology and shows understanding of the protocols, these firms are going to be restricted in how they adopt and innovate. A lot of what we are seeing in the market now is testing. I think we are years away from deployment," Jones said.

The financial industry is, by its nature, conservative, so while investment banks are interested enough to test blockchain, they will run a proof-of-concept and wait until the technology is mature before they deploy it to customers, Woodard said.

Woodard said he expects banks will start in fintech and roll the technology out to a small group of customers, and if the technology is proven to work for that group, it will be rolled out to the core platform. "Some banks will say that they're coming out and testing, others that they're not, but I know most, if not all, have either public or internal projects that they're testing. And they'll find a very small portion of their business that they can test on first. If that works they'll roll it out to broader sections of the organization," Woodard said.

According to Maryanne Morrow, CEO of 9thGear.io, "Blockchain technology is barely at the beginning of transforming financial markets. So much of what exists today in terms of processes and regulations is simply the result of the history of transactions—mostly securities transactions—and the institutional and regulatory inertia that developed over time. Blockchain is a revolutionary technology which will not simply allow, but force, financial transactions to be executed in a more efficient manner."

"Tokenization will happen, but not quite yet. Ironically, while many are focused on the 'tokenization' of these processes, it seems unlikely that financial institutions, their regulators or central banks are ready to make that leap at this stage. It will be a multi-step process to overcome that inertia, but it is inevitable," Morrow added.

HOW USING BLOCKCHAIN IN THE SUPPLY CHAIN COULD DEMOCRATIZE INNOVATION ITSELF

BY CONNER FORREST

IMAGE: ISTOCK/THITIVONG

Opinions about the business value of cryptocurrency are mixed, but the blockchain technology that underpins it has emerged as one of the potential next big things in enterprise technology. Organizations are just beginning to dip their toes in the blockchain waters, but a few industries have emerged as ripe for blockchain disruption.

Chief among those: supply chain.

For the uninitiated, blockchain is a decentralized, distributed ledger technology that maintains transactional records known as blocks. The blocks are cryptographically secured and are immutable, making it easier for members of a given blockchain network to track the transaction history of a given asset and confirm its provenance. So it's pretty clear why this would work so well for a supply chain.

"There are many ways blockchain can be used across the supply chain, providing transparency, traceability and visibility into processes and operations, all while enabling revenue opportunities," said Anoop Nannra, head of blockchain initiatives at Cisco.

First, it's important to look at how the technology is being used in the supply chain. The most glaringly obvious use case is services and asset management, where blockchain is used to track ownership of items and minimize leakage, Nannra said.

Blockchain efforts in the supply chain are still nascent, but are showing progress in agriculture and food, shipping and logistics, government, oil and gas, healthcare, and manufacturing.

However, blockchain can also help with managing suppliers. The ledger can be used to validate certain reputation scores, Nannra said, and offer the aforementioned visibility into risks in a given supply chain and a given supplier's compliance standards. Blockchain can also be used to maintain pricing integrity, uphold contract terms, track chain of custody and automate logistics, and add traceability to combat counterfeit products, Nannra added.

Blockchain efforts in the supply chain are still nascent, but are showing progress in agriculture and food, shipping and logistics, government, oil and gas, healthcare, and manufacturing.

The food industry is particularly lacking in digital prowess, so the arrival of blockchain and the Internet of Things (IoT) at the same time will help it link the physical and digital world in food supply chains, according to Csilla Zsigri, senior blockchain analyst at 451 Research. One good example, Zsigri said, is Walmart's blockchain experiment.

"Using blockchain technology, the company was able to trace a package of sliced mangos back to the farm in 2.2 seconds, which previously, through a mixed digital and paper-based method, had taken nearly seven days," Zsigri said. "These kinds of business outcomes can help drive adoption of blockchain. Although, it's important to emphasize that it's not blockchain alone, it's a set of technologies including blockchain, that can help drive efficiencies across the supply chain."

The impact on logistics is pretty substantial as well, as noted in blockchain's ability to establish chain of custody and automate certain processes. In March 2017, for example, IBM and Maersk announced a joint partnership to create blockchain tools for cross-border transactions for multiple actors in the logistics supply chain.

Government systems like identification are also utilizing blockchain, Zsigri said. Microsoft has laid out a plan for a blockchain-based ID, and the Dubai government is using blockchain to reach its goal of becoming fully digital by 2021, Zsigri said.

Healthcare has its own problems that blockchain can solve. Data is siloed and there are too many intermediaries to make health data properly accessible, Zsigri said. "Using blockchain alongside other technologies can help shift focus to the patient by giving it control of its medical data and drive efficiencies within the ecosystem. In Estonia, for example, each citizen has a trackable e-health record," she said.

In the energy sector, blockchain is used in streamlining financial processes, especially around trading. Companies like BP and Wien Energie are investing in the technology, Zsigri said.

EARLY DAYS

Despite the potential use cases and market applications, actual usage of blockchain in supply chains is very limited. Zsigri said that, according to a 451 Research report, more people are talking about the technology than actually using it—only 4 percent of enterprises are using blockchain in production.

Andrew Stevens, a research director at Gartner, said that "through 2020, 90 percent of supply chain blockchain initiatives will remain at the proof-of-concept stage."

Stevens also noted that blockchain is "very much in a learning and development phase for many, many organizations." He said companies have to balance the press to get involved with it, without jumping in too early.

However, once blockchain does advance in the supply chain, Nannra said, new methods for financing the movement of physical assets will emerge. It will also lead to a renaissance of the Circular Economy.

"As supply chain asset metadata attribution takes hold on blockchain, having full visibility into the genealogy and upkeep of an asset may also drive more value for produced goods as they come onto the secondary market," Nannra said. "We are already starting to see this in the heavy industry space for mining equipment. As a result, new business models are emerging in this space that normally would only be associated with high priced collectors' items."

So what will it take to get there? It starts with clear messaging, Stevens said, both internally and across supply chain partners. As Zsigri noted, it must provide value and make sense for each participant in the supply chain. There also needs to be clear understanding of the IP generated and who owns the data.

It also requires a certain level of digital prowess and interoperability.

"There are elements of a requisite level of what we like to call 'supply chain interoperability' that does need to be established for those participants, those companies, and peers, and trading partners to be at that level of digital maturity so that they can really optimize any discussions around blockchain itself," Stevens said.

To take advantage of blockchain, Stevens said that a company needs a good level of understanding of how the technology will impact their business and what areas of their supply chain will actually benefit from the introduction of blockchain.

HOW BLOCKCHAIN COULD CHANGE HOW WE BUY MUSIC, READ NEWS, AND CONSUME CONTENT

BY NATALIE GAGLIORDI

Blockchain, best known as the technology behind Bitcoin, is a secure, encrypted database architecture that logs and links all transactions on a tamper-proof ledger distributed amongst multiple parties. In effect, a blockchain creates an immutable golden record of time-stamped transactions related to any product that can be bought and sold.

In the context of buying music, news and other digital content, the promise of blockchain is to provide decentralized control, trust, and transparency when transacting virtual property. For the creators of digital content and virtual property, this means enforceable copyrights, transparency around royalty payments, and payments made securely without an intermediary.

In the music and news media industries in particular, the blockchain could be key to rights management, procuring micro-payments of advertising and eventually paving the way for a pay-per-stream/read model. As the market shifts to blockchain over time, consumers could see lower prices for content, while the content creators see increased returns.

"A key function of blockchains is that they cut out the middleman," said Shidan Gouran

president of Global Blockchain Technologies Corporation. "This will enable musicians, social media personalities, and writers to effectively get paid directly by their audience, giving them all of the pie instead of just a piece."

IMPROVING A FLAWED SYSTEM

A major pain point in the media space today is the lack of transparency around royalty payments and rights management.

In music, streaming services such as Spotify, iTunes and Apple Music pay a fraction of a penny every time a song is streamed. For the artists who fail to rack up millions of streams, the payouts are measley. Meantime, there's rampant infringement within copyright structures.

"With smart contracts on the blockchain, copyright becomes more enforceable," said Tim Leonard, CTO of transportation software company TMW Systems. "People from around the world can see the copyright information on the ledger, and the copyright laws become a lot more defendable within a court of law."

The online news business faces its own set of challenges when it comes to monetizing content. As print publications fizzle out and online news operations take over, media companies are erecting paywalls to generate revenue and fund quality journalism. The catch is that most casual news readers would rather miss out on a story than sign up for a monthly subscription.

With blockchain-verified micropayments, however, readers could pay for only the stories they choose to read.

"Because of blockchain's trustless consensus mechanism, content producers will be able to distribute their content directly to users, removing the long chain of middlemen, hence reducing content cost, while enhancing the speed of content delivery."
—Christian Ferri

What's more, blockchain inherently provides evidence of ownership of content, in both digital media and music. For example, with a blockchain-based cryptocurrency, accessing an article would automatically send a micropayment to a smart contract that's been originally coded to pay out all of the parties involved in the creation and publication of that article, with the appropriate payment splits, in a transparent and immutable manner.

"Also, because of blockchain's trustless consensus mechanism, content producers will be able to distribute their content directly to users, removing the long chain of middlemen, hence reducing content cost, while enhancing the speed of content delivery," said Christian Ferri, president and CEO of BlockStar, a firm that incubates decentralized technologies.

One of the early pioneers experimenting with blockchain as a new model for music is British singer-songwriter Imogen Heap, who in 2015 turned to the Ethereum blockchain-based Ujo platform to launch the song "Tiny Human" for $0.60 per download. Heap has also founded her own blockchain-based offering, Mycelia, that aims to give artists more control over how their music is sold and circulated.

CHALLENGES TO ADOPTION

There are challenges, of course, to achieving a blockchain-based panacea for digital content purchases. Questions linger over whether there's a single blockchain capable of scaling to an entire industry, and the effectiveness of reconciliation if multiple blockchains were required.

There are also certain legal considerations associated with blockchain's transparency, including the potential to violate of data privacy laws, applicable privacy policies or data security regulations.

And then there's the barrier of human understanding when it comes to the mechanisms and utility of blockchain.

"People look at blockchain as almost taboo," said Leonard. "But when people get past that and start to understand the power of blockchain and completing transactions, it can take a lot of things to the next level."

COULD BLOCKCHAIN BE THE MISSING LINK IN ELECTRONIC VOTING?

BY DANNY PALMER

Elections are one of the key pillars of a democratic society, but the process of voting is finding itself challenged with the ever-increasing power of the internet.

There's the security issues around electronic voting booths; researchers have warned they're vulnerable to hacking and cyber attacks; such weaknesses could be used to undermine trust in an election if they were exploited.

In order to bolster security, accuracy and efficiency of elections, there are those who suggest the implementation of blockchain technology.

Blockchain is a decentralised, distributed, electronic ledger used to record transactions in such a way that transactions made using it can't be subsequently altered without the agreement of all parties. Thousands of network nodes are needed to reach consensus on the order of ledger entries.

Most famously, blockchain is used for bitcoin transactions, but it is finding use cases in everything from storing medical records to authenticating physical transactions. Such is the relatively sudden interest in blockchain technology, governments are even examining its potential use cases.

Indeed, blockchain infused elections have already taken place: In March, Sierra Leone voted in its presidential elections and votes in the West Districts were registered on a blockchain ledger by Swiss-based firm Agora.

By storing the data in this way, election data was "third-party verifiable and protected against any possibility of tampering" the company said, with the results publicly available to view.

But while this represents a step towards blockchain-based elections, it wasn't one in the full sense of the word, as it was used to secure, rather than cast the votes.

"In Sierra Leone, voters voted in the traditional way, then they used the blockchain system to record those votes in an online fashion. It wasn't a true experimentation using blockchain as the instrument itself," Rick Holgate, Research Director at Gartner told ZDNet.

Nonetheless, he said, there are advantages of using blockchain in this way—although it isn't yet ready for anything outside small, controlled elections.

"The motivation for using blockchain in a voting environment is to make it easier for citizens, more reliable, more trusted, more distributed. There are some fundamental things about that idea which are engaging and inspiring," Holgate said.

However, there are also various issues which need to be overcome in order to conduct a fully blockchain-based election.

"The cleverest blockchain structure in the world won't do anything about someone with a metaphorical gun to their head and being told how to vote." —Catherine Hammon

One of the key things about voting is that it is anonymous and outsiders shouldn't be able to access information about how someone voted. But in order for citizens to cast a vote, they need to be eligible and there has to be some way of verifying that. Balancing these two elements is a challenge.

"Once it's on the blockchain, you want person A to be able to see that's their vote, but you don't want anyone else to see what happened, because it doesn't help with making sure the election is fair," Catherine Hammon, digital revolution knowledge lawyer at Osborne Clarke, told ZDNet.

And while those advocating blockchain for voting say it adds to the integrity of elections, Hammon pointed out that it doesn't change anything if the voter is being intimidated.

"The cleverest blockchain structure in the world won't do anything about someone with a metaphorical gun to their head and being told how to vote," she said.

Neither is blockchain going to solve anything if the cybersecurity of voting terminals remains weak. Researchers have repeatedly found that voting terminals from various manufacturers are vulnerable to attack. If the unit itself isn't protected from interference, using blockchain technology is rendered pointless - even if the intentions are good.

"Blockchain is useful, because it's a distributed system, international observers and interested third parties can have a fully separate copy of that data which they can work onto to attest that the data within the network is valid and hasn't been manipulated," Joe Pindar, Director of protect strategy at Gemalto told ZDNet.

"But that's only half the problem because the other half of the problem is right at the end point: the machines themselves where you're actually voting and the simple act of a person applying to and having the legal authority and the right to vote," he said, adding "Those are a whole class of challenges that blockchain has no play to solve."

Nonetheless, there are countries which are pushing along with an attempt to introduce blockchain voting—one of them is Brazil, which wants to store election data using the Ethereum blockchain. It's a massive task, one which will need to collect and verify data about 145 million registered voters.

If citizens are expected to verify themselves, that once again creates potential issues for the democratic process as identities can be stolen or otherwise compromised.

"There's the aspect of can you authenticate voters when votes are being cast. Brazil has that challenge, expecting citizens to authenticate themselves online," Holgate said.

"But if the citizen's information is subject to theft or compromise, where someone else could impersonate them online, you have a problem in trusting if the voter is who they say they are. There are a lot of unknowns".

Another one of those unknowns is scaling a blockchain system up to cater for what could be hundreds of millions of votes being processed.

When Bitcoin reached a value of almost $20,000 in December, transactions got a lot slower due to the number of people attempting to buy and sell the cryptocurrency. If the speed of transactions is this for voting, it's going to cause problems - because election results are needed within hours.

"It'd be incredibly difficult to scale. There's a statistic on bitcoin transactions that can only handle seven a second. If you do that in an election, it might be possible in a voting context if you've got thousands rather than millions," Hammon said.

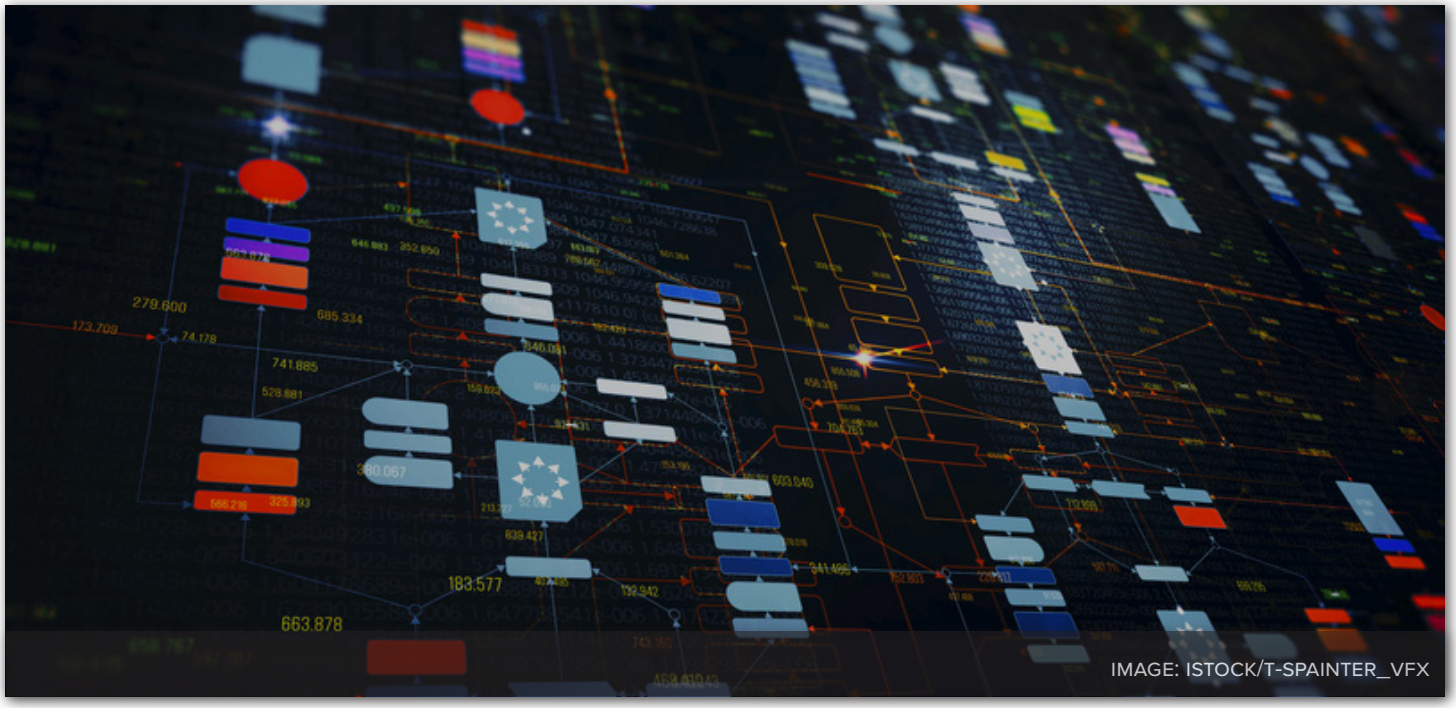


IMAGE: ISTOCK/T-SPAINTER_VFX

"But if you're talking about millions of votes, take the Brexit referendum with 35 million votes cast. If you could only verify those at seven a second, it'd take 55 days to get everything worked out. There's a question mark," she added.

One area where blockchain can improve elections is in transparency—not only because the ledgers can easily be viewed, but also because the start-ups providing the technology have an opportunity to publish open source code which shows how the system works—and that it can be trusted.

"There are these small groups of people innovating with radically different things, but when it comes to what they've produced, it has a proof-point you can review and satisfy yourself, that yes, this is secure. That is one of the really strong benefits of start-ups in this space doing open source work," Pindar said.

Like other new and emerging technologies, block-chain isn't going to provide a silver bullet for electronic voting—or counting paper ballots—but if issues around anonymity and verification are ironed out, it can certainly provide some benefits, such a completely locking down data and ensuring it can't be tampered with.

"Once the data about the voting is on the blockchain, it's locked down, it can't be changed, you can add up the count and see it's correct. That's really valuable," Hammon said. "It isn't a cure-all remedy for electric voting, but there are many ways in which it does help with someone of the problems."

As evident by Sierra Leone and some other trials, this technology is being tested at a local level, but can we expect it at a national level any-time soon?

"Blockchain today is like 1993 in internet years, when it was a very much a green space without a lot of experience and everyone was trying to play in that space. All that energy was great, but ten years on, a lot of the entrants were gone, eclipsed by late entrants who dominated the market," Holgate said.

"That's where blockchain is today. It's a lot of small, niche entrants and we haven't seen the dominant late entrants show up. Until they show up and dominate the market, it'll be a fragmented immature market. And it's still three to five years away before they arrive".

Combine that, with how government and the public sector tends to move slowly when it comes to innovation and there's the feeling that blockchain-based national elections are still a number of years away.

And the systems will need extensive trials and testing before they're allowed to be rolled out a national scale—because a national election isn't something which can be allowed to go wrong because of a technology failure.

"There's interest in it, but nobody wants to do it first. You can't get an election wrong then later say it was a technical disaster, we have to do it again—that's not an option." Hammon said.

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