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# Prepare for Blockchain Disruption

CS6-2 – Tuesday, May 8, 2018

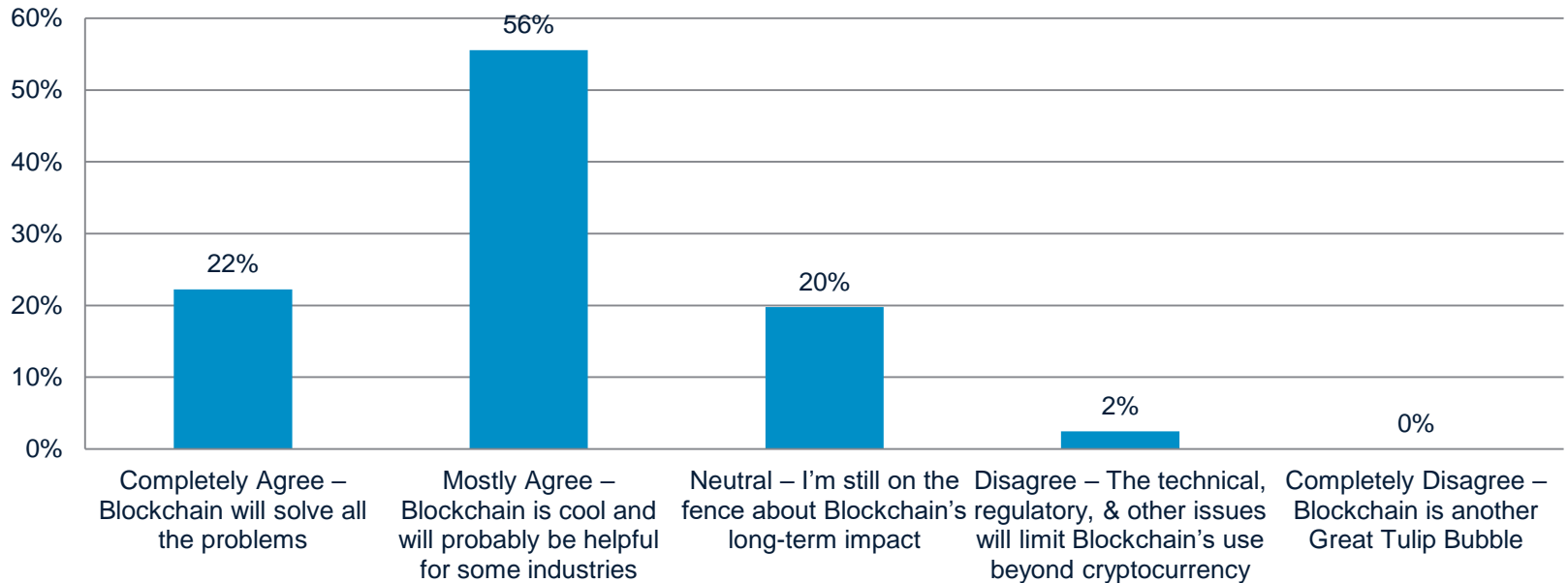
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# What is Blockchain – A Brief History

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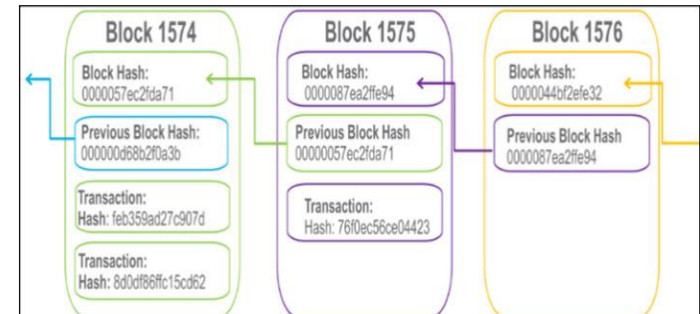


# What is Blockchain and its Underlying Architecture?

Blockchain is an algorithm and a distributed data structure for managing data without a central administrator among people who know nothing about one another. Originally designed for the crypto-currency Bitcoin, the blockchain architecture was driven by a rejection of money and bank-controlled payments.

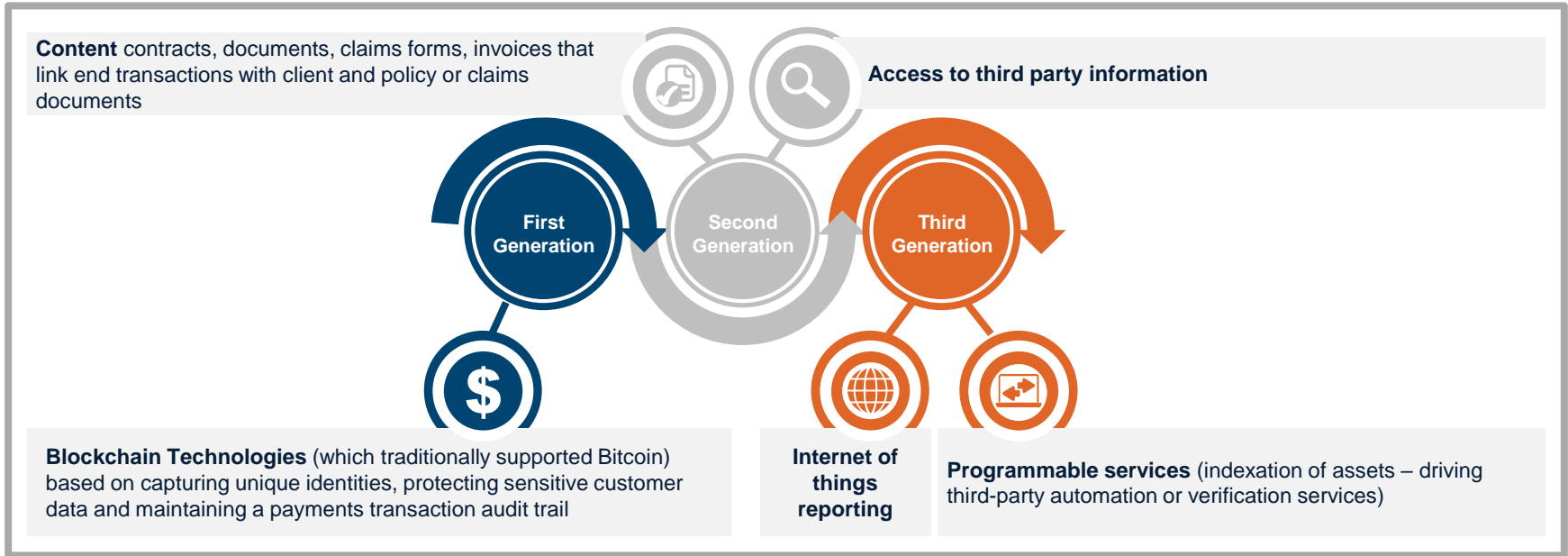


- Blockchain owes its name to the way it stores transaction data — in blocks that are linked together to form a chain (**Shown in Figure**). As the number of transactions grows, so does the blockchain. Blocks record and confirm the time and sequence of transactions, which are then logged into the blockchain, within a discrete network governed by rules agreed on by the network participants.
- Each block contains a hash (a digital fingerprint or unique identifier), timestamped batches of recent valid transactions, and the hash of the previous block.
- The previous block hash links the blocks together and prevents any block from being altered or a block being inserted between two existing blocks. In this way, each subsequent block strengthens the verification of the previous block and hence the entire blockchain.
- The method renders the blockchain tamper-evident, lending to the key attribute of immutability (explained in the next slide).



# History of Blockchain

Blockchain has evolved in ways that provide opportunities for every industry. As a result, blockchain has delivered a mechanism to re-architect certain aspects of the business model:



# Key Characteristics of A Blockchain Network

## Consensus

For a transaction to be valid, all participants must agree on its validity.

## Provenance

Participants know where the asset came from and how its ownership has changed over time.



## Immutability

No participant can tamper with a transaction after it's been recorded to the ledger. If a transaction is in error, a new transaction must be used to reverse the error, and both transactions are then visible.

## Finality

A single, shared ledger provides one place to go to determine the ownership of an asset or the completion of a transaction.

# Blockchain and Distributed Ledger (1/2)



## **What is distributed Ledger?**

A distributed ledger is a database of transactions that is shared and synchronized across multiple computers and locations – without centralized control. Each party owns an identical copy of the record, which is automatically updated as soon as any additions are made.

## **Blockchain is one type of distributed ledger**

Blockchain and distributed ledgers are the building block for transferring value through internet from one place to another, without a need for a centrally coordinating entity. “Value” refers to any record of ownership of asset – money, securities, land titles, etc.

## **Why is distributed ledger important?**

Distributed ledger technology (DLT) could fundamentally change the different industrial sectors, making them more efficient, resilient and reliable. DLT could address persistent challenges of financial sector stakeholders and potentially transform sectors such as manufacturing, government financial management systems and clean energy.

## **Would it be better to wait for the technology to mature?**

Waiting for “perfect” DLT solutions could mean missing an opportunity to help shape it. To understand how DLT can address challenges in the different sectors, we need both research and real-life applications and pilots.

# Blockchain and Distributed Ledger (2/2)



## **What else needs to be addressed in light of this disruptive technology?**

With the advent of any new technology that disrupts an industry, countries will need to review and resolve various related legal, regulatory and technological issues, including consumer protection, financial integrity concerns, speed of transactions, and environmental footprint.

## **What is the future of distributed ledger?**

Whether distributed ledger technologies, such as blockchain, will revolutionize how governments, institutions and industries work is yet to be identified. Articles in the academic and financial press have questioned whether distributed ledger technologies as they exist now are sufficiently reliable to put into wide-scale use. Issues include the paucity of regulations for this new form of exchange and security concerns.

## **Which areas can distributed ledger serve?**

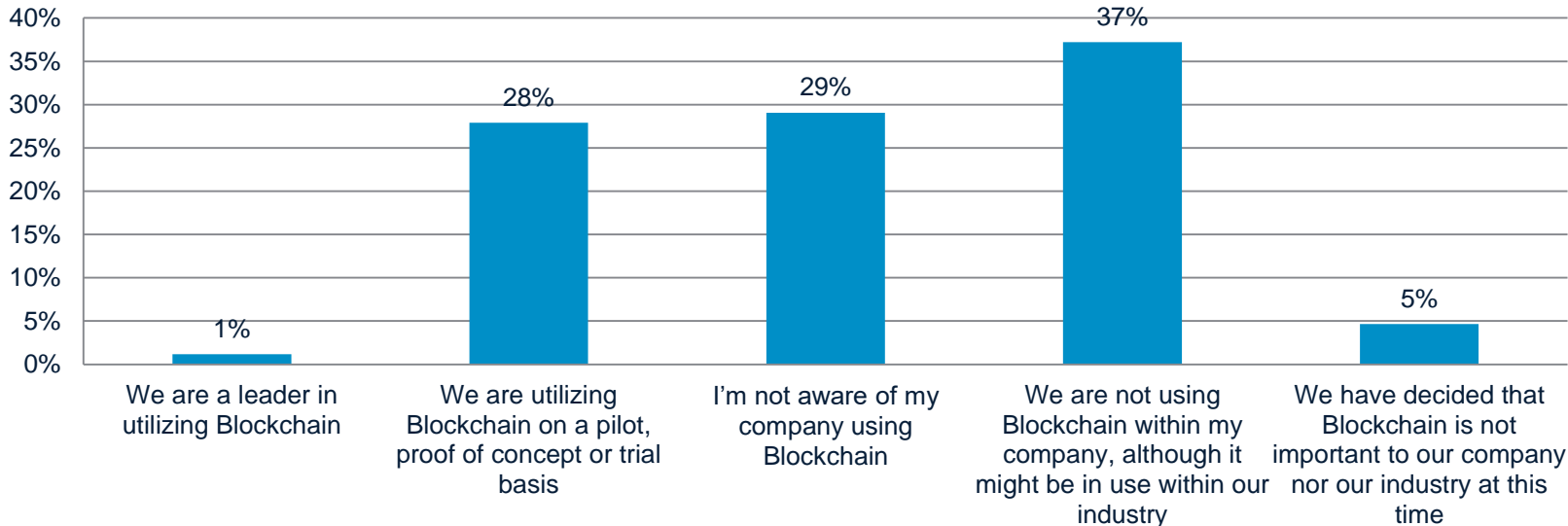
Distributed ledgers can be used in multiple areas, including government and business dealings, in addition to financial transactions. Distributed ledgers can be used in tax collection, property deed transfers, social benefits distribution and even voting procedures. DLT can be used to process and execute legal documents and other similar exchanges.



# Blockchain Beyond Bitcoin and Cybercurrency

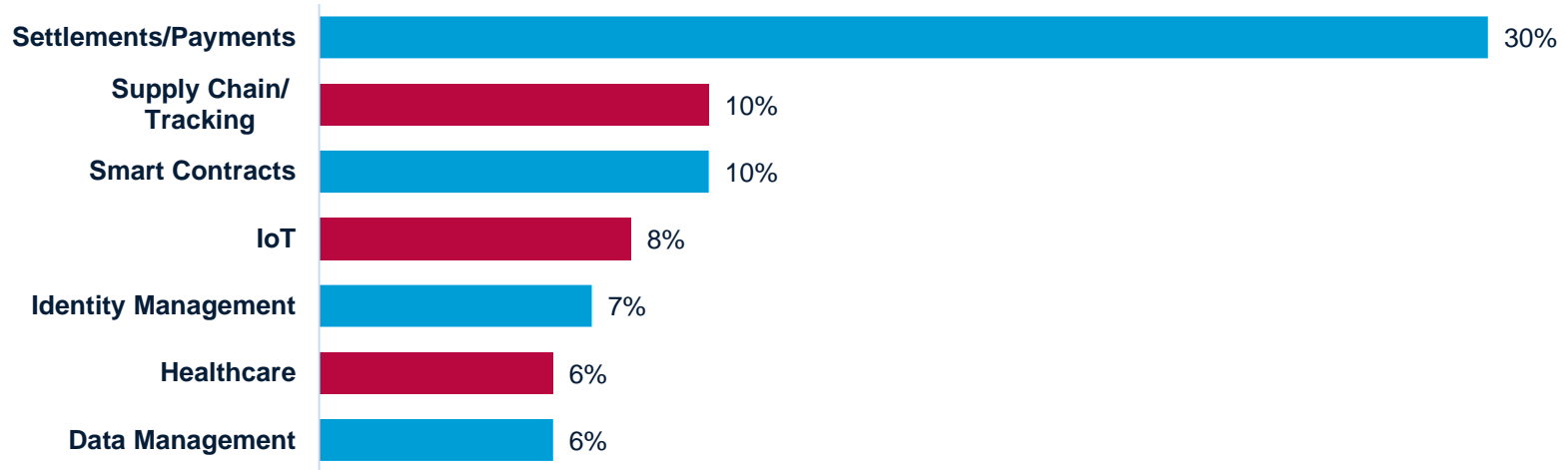
# My company is currently utilizing Blockchain in areas other than cryptocurrency.

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# Usage of Blockchain Industry Wise

Among companies deploying or considering deploying blockchain, here's the breakdown of what they plan to use it for. Settlements/payments clearly dominate early deployments.



# Usage of Blockchain (2/4)



## Energy Markets

- LO3 Energy has developed a technology for trading of solar energy locally using a peer-to-peer blockchain solution. The first real application with 50 physical units has been tested in Brooklyn, in cooperation with Siemens. The project “Brooklyn microgrids” applies smart meters for tracking energy generation and consumption combined with smart contracts for energy transactions between actors on the grid. One key question raised is the scalability of the project. Specifically, the computing power that is needed for validating the microgrid transactions and that is increasing with the grid size is considered as one of the key challenges for scaling the project.
- Other companies trying similar concepts are Wien Energy, that is focusing on energy trading between utilities, and Innogy, conducting tests with blockchain to automate the billing process of charging stations for electrical vehicles.
- Further development in the energy sector has been made by the startup Electron, that is creating technology that enables customers to faster switch their electricity suppliers.



## SMART PROPERTY

- The registration and transfer of property rights—land or other valuable assets like cars—can be realized through blockchain in a secure and efficient way. A first application has been tested in Sweden, with actors such as the Swedish National Land Survey Lantmäteriet, telecommunication company Telia, banks Landshypoteket and SBAB, and startup ChromaWay. Intangible assets can be transferred over blockchain; for instance, intellectual property rights, wills, art and other documents, which could be stored in the immutable blockchain.
- Current actors developing solutions for this are Binded, Pixsy, TinEye and Ascribe.

# Usage of Blockchain (3/4)



## Supply Chain Management

- IBM and Maersk tested the application of blockchain in logistics. They showed in a PoC(Proof of concept), that a blockchain can be used to track containers during the shipping process. By reducing the paperwork, providing important information more rapidly and preventing shipping fraud, IBM and Maersk hope to reduce the shipment costs dramatically.
- Start-up Project Provenance Ltd. is trying to secure the traceability of certifications and other important information of products on a blockchain. The idea is that every product gets a “digital passport” that proves its authenticity and helps to determine its origin, thereby preventing the sale of fake goods.
- “Everledger” is using blockchain to register diamonds and secure their transaction history and ownership. In the future, the start-up wants to extend the application of their technology to more luxury goods.



## IoT and Industry 4.0

- The Super Computing Systems AG published a whitepaper in which they propose the usage of blockchain to timestamp sensor data for Industry 4.0 applications. To increase trust between different parties, they want to create sensors that can save and thereby timestamp their data on a blockchain.
- Tile Data Processing Inc. investigates the usage of blockchain to provide access to data that is generated by IoT devices. The idea is to enable customers to sell their IoT data via the service “tilepay”, where they can register and collect data and decide who can purchase it.
- To enable small and midsized companies to leverage the benefits of IoT, IBM has introduced their Watson IoT platform. The platform helps companies to save selected IoT data to a private blockchain, which is used to share the protected data among all business partners involved.

# Usage of Blockchain (4/4)



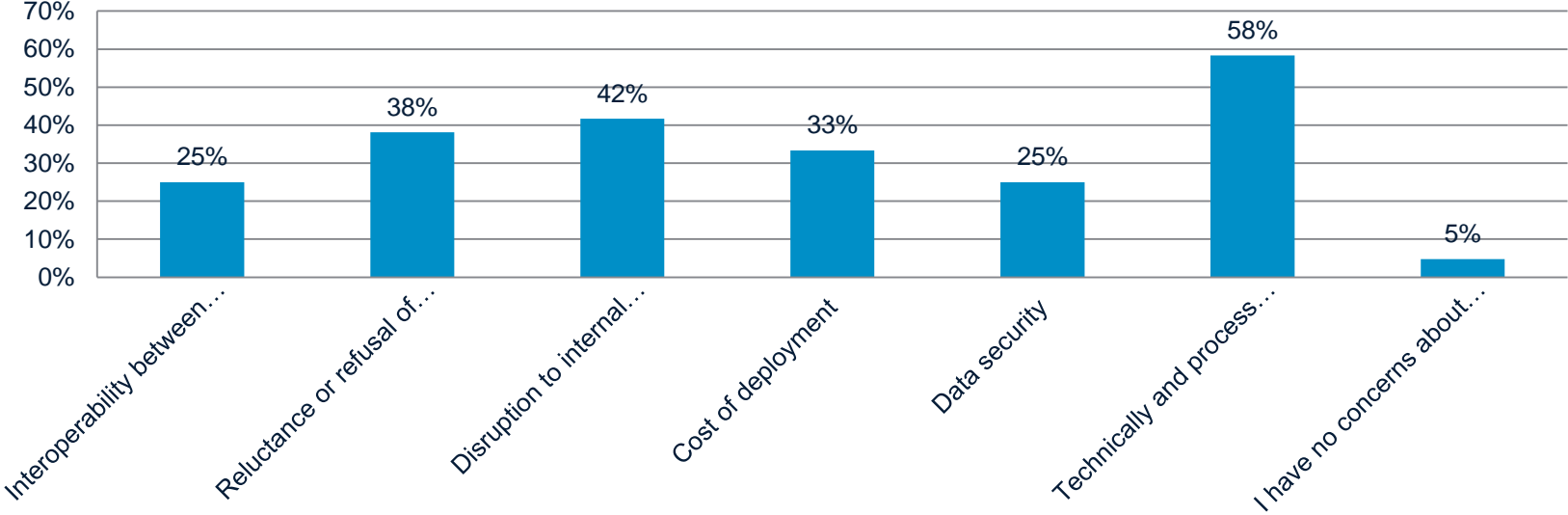
## Healthcare Industry

- In October 2015 Philips partnered with blockchain recordkeeping startup Tierion on an “unspecified” project to examine how the technology could be applied to use cases in healthcare. In March 2016 the Philips Blockchain Lab was founded in Amsterdam to investigate how blockchain could be applied to healthcare. US blockchain startup Gem also partnered with Philips to launch Gem Health, an initiative for building a “patient-centric approach to healthcare” using blockchain technology. They provide the data infrastructure to support a network, connecting companies that work in all levels of healthcare. According to the company, “Blockchain technology addresses the trade-off between personalized care and operational costs by connecting the ecosystem to universal infrastructure. Shared infrastructure allows us to create global standards without compromising privacy and security.”
- The Estonian eHealth Foundation partnered with the data security startup, Guardtime, to develop a blockchain-based system that will secure the medical records of more than 1 million patients. The Estonian e-Health Authority is thereby ensuring the integrity of data for its residents. For this initiative Guardtime employed a Keyless Signature Infrastructure (KSI), a blockchain technology solution integrated into an Oracle database engine that delivers mass scale data authentication without dependency on a centralized trust authority.
- Boston-based Beth Israel Deaconess Medical Center recently teamed up with researchers at the MIT Media Lab to test a blockchain application pilot called MedRec. The authentication log was put to work at Beth Israel, tracking six months of inpatient and outpatient medication data with MedRec code deployed.
- The US Food and Drug Administration (FDA) announced a research partnership with IBM Watson to study blockchain tech and explore how data from electronic medical records, clinical trials and health data from wearable devices could be better shared and audited using the blockchain approach.

# Blockchain Strategic and Technical Risks

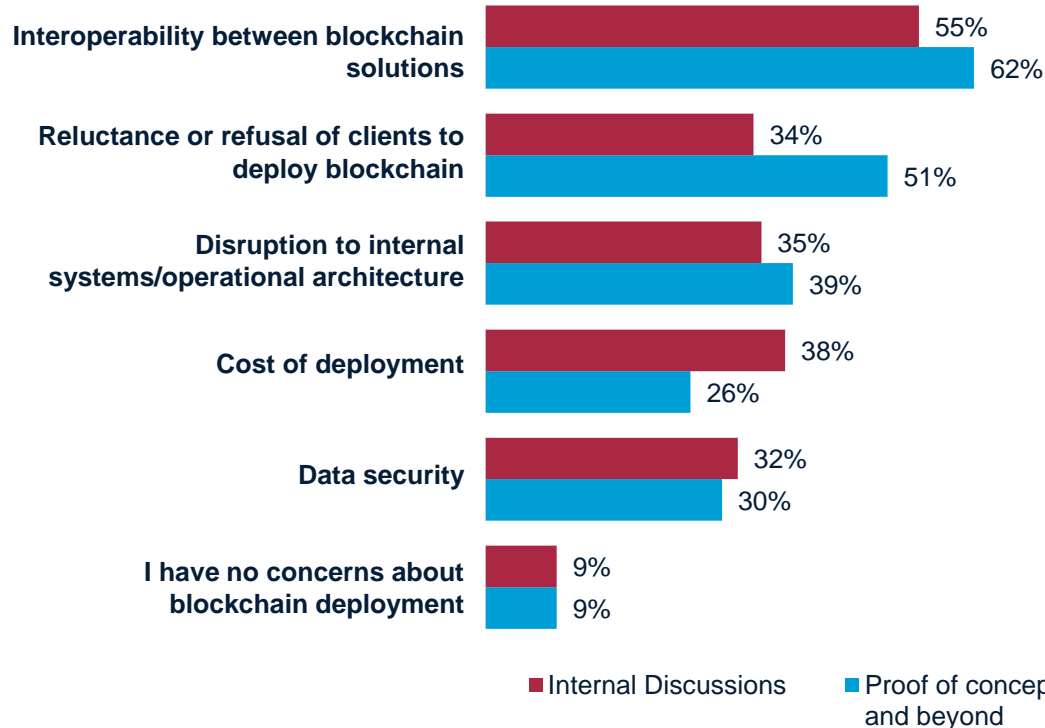
# Blockchain poses a range of risks for an organization. Please select below the risks you believe Blockchain poses to your organization

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# Company Concerns due to Blockchain



- Amongst the largest companies (those with 20,000 or more employees) that were considering deploying or were in the process of deploying blockchain, more than half (54 percent) had reached the PoC (Proof of Concept) stage, with a further 16 percent involved in trial deployments.
- Amongst all companies that had reached the PoC stage, two-thirds (66 percent) expected blockchain to be integrated into their systems by the end of 2018.
- Integration was expected to take progressively longer as companies got larger; amongst the smaller companies surveyed (those with fewer than 1,000 employees), 81 percent expected integration to be completed by the end of 2018, compared with 57 percent of companies with over 20,000 employees.

# General Risks Associated with Blockchain



## Scalability

- The time required to put a transaction in the block.
- The time required to reach a consensus.



## Data privacy

- Transaction transparency on the blockchain not easily compatible with the privacy needs in banking.



## Decentralized Autonomous Organization

- Who is responsible if laws are broken? and their creators?
- Who or what is claimed against in the case of a legal dispute?
- What, if, any, is the liability of DAOs



## Jurisdiction

- Complex jurisdictional issues as nodes are located anywhere in the world and require careful consideration in relation to the relevant contractual relationships.



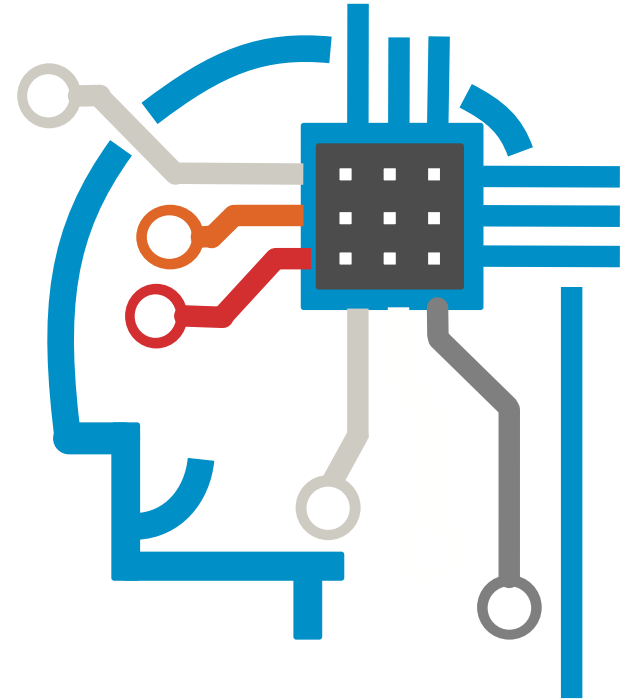
## Encryption

- Anyone with the encryption key can read the encrypted data if the key is made public, while if the key to unlock the blockchain is lost you can never get it back.



## SLA and Performance

- No guarantee for availability and performance from vendors offering “blockchain-as-a-service”



# Strategic Risks of Blockchain



Firms need to evaluate whether they want to be at the leading edge of adoption or wait to adopt until the technology matures. Each of these options have varying levels of risks to business strategy.

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The choice of the underlying platform could pose limitations in the services or products that can be delivered via this platform.

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Given the peer-to-peer nature of this technology, it's important for entities to determine the right network to participate in, as their business strategy could be impacted by the different entities participating on the chain.

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Smart contracts can potentially encode complex business, financial, and legal arrangements on the blockchain, and could result in the risk associated with the one-to-one mapping of these arrangements from the physical to the digital framework.


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According to [Bank Of America](#) the technology could hamper bank's ability to comply with anti-money-laundering regulations, pose a competitive threat and force the company to spend more money to keep up with the times.


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# Technical Risks Associated with Blockchain




Blockchain technology provides transaction security, it does not provide account/wallet security. The distributed database and the cryptographically sealed ledger prevents any corruption of data. However, value stored in any account is still susceptible for account takeover.

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There are cyber security risks to the blockchain network if a malicious actor takes over 51 percent of the network nodes for a duration of time, especially in a closed permissioned framework.

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Existing policies and procedures will need to be updated to reflect new business processes. Additional technology concerns could include speed, scalability, and interface with legacy systems in implementing the technology.

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One question for any business organizations considering blockchain technology is who will have access to the data. Since any kind of failure in securing the data can result in access to an unauthorized person.

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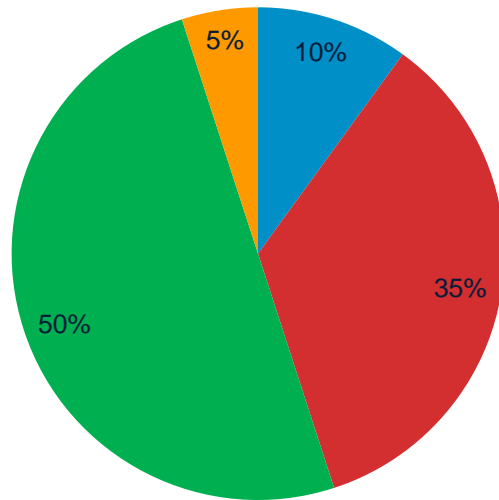
A lack of real-world enterprise testing, and the rapid development of Blockchain platforms results in making it risky to stay ahead of curve.

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# Blockchain – Next Steps for Auditors

# As an auditor, are you ready for Blockchain?

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- Yes I'm an early adopter & have been reading and directing my personal development time in this area
- Sort of I've read a little and believe I understand the basic concepts.
- Not really I've heard about Blockchain but have spent very little time in researching Blockchain.
- Nope not ready at all. I still can't remember why I selected this session.

# Is Internal Audit Ready for Blockchain?

Blockchain technology offers the promise of a safe, transparent, rapid and affordable digital solution to many industry challenges.

However, this same technology also poses challenges and opportunities to internal auditors wishing to provide maximum value to their organizations.

In order to rise to the challenges and capitalize on the opportunities, internal audit departments must be able to place auditors – **well trained** on both blockchain technology and on all blockchain projects **right from their inception**.

# Blockchain: A Game Changer for Audit Processes

## Imperatives for Internal Auditors

### Adapt to the New Environment

- Internal auditors need to **update themselves** as the information will be in new formats.
- Internal auditors will need to understand that some work being routinely performed today will become **redundant**.
- For example, with a shared ledger there will no longer be any requirement to reconcile differences between systems of record. Instead, there will be one version of the truth and all stakeholders will have access to it.
- There will be a **new technical environment** where critical information is created and stored and internal auditors must be able to access information contained in this environment.

### Updated Knowledge and Skills

- Internal auditors must possess **the knowledge, skills, and other competencies** needed to perform their individual duties.
- Before adopting blockchain, **training** people on blockchain is a necessity.
- In order to effectively deal with blockchain-based applications, the focus must be on **understanding the basics of the technology** and, in particular, the evolving area of governance.

### Early Involvement

- Internal auditors need to get involved at the **planning stage** of blockchain-based applications.
- All systems must have adequate governance, risk management, and controls, and it is much easier to build these in right from the start than to retrofit them after a problem has been identified.



# Blockchain: A Game Changer for Audit Processes

## Changes to Businesses

### Effective Automated Controls

- Auditors need to assess whether **effective automated controls** are in place to validate transactions before they are executed.
- For example: If an entity's employee accidentally or deliberately sends bitcoin to a wrong or unauthorized address (recipient), there is currently no way to reverse that transaction.

### Effective Disaster Recovery

- Auditors need to have **effective disaster recovery and loss mitigation procedures** in place.
- For example: If a private key is lost (e.g. through a software or hardware malfunction) the entity loses access to any virtual currency (such as bitcoin) that is associated with this private key. These bitcoins will no longer be accessible to anyone on the bitcoin network; they are effectively out of circulation, forever.

### Phishing Attacks

- Auditors need to determine whether internal controls to **prevent and detect phishing attacks** are indeed operating effectively.

# Blockchain: A Game Changer for Audit Processes

## Changes to Businesses

### Real-time Access To Information

- Blockchain-based applications provide real-time access to information. **Continuous auditing** will allow internal auditors to use this real-time access to transactions to increase the value they bring to their organizations.
- Internal auditors will also need to maximize the value of “real-time” information, the value of sampling will have to be re-evaluated when the use of data analytics, on continuous information, is **technically feasible**.

### Work Collaboratively Across Organizations

- There are public blockchains, such as Ethereum, that applications may be run on and that have preexisting governance structures, but there are also private/consortium blockchains that are only open to identified stakeholders.
- Each of these blockchains will have their own governance structure, one that may involve a number of stakeholders across multiple organizations. Internal auditors from these multiple stakeholders will need to work together to ensure all their requirements are met.

### Triple-entry Accounting

- Auditors may, for example, be eventually required to verify the application of blockchain consensus mechanisms or protocols. This could be accomplished through “triple-entry accounting,” where existing double-entry accounting systems are retained while **blockchain ledger entries would be a “third” entry**, the result being a mutual confirmation of transaction integrity.

# Way Forward for Auditors

Blockchain certainly has the potential to enable numerous new digital solutions to many of the challenges large organizations face.

Auditors must, however, take the necessary steps **today** to ensure that the blockchains of tomorrow are subject to **the same high standards as all other business systems and processes**. Otherwise, we risk that potential being unrealized.