

# 2017 OUTLOOK: BLOCKCHAIN IMPACTS ON ENTERPRISE AND GOVERNMENT

An Analysis of Local and Global Trends  
in Blockchain Technology

## **Think Consortium on Blockchain**

Mike De'Shazer

Tai Kersten

David Van Isacker

[thinkconsortium.com](http://thinkconsortium.com)

*Seoul, KR*

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**“You should be taking this technology as seriously as you should have been taking the development of the Internet in the early 1990s.”**

***Blythe Masters***

CEO, Digital Asset Holdings

Former Head of Global Credit, JP Morgan

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## Introduction

Welcome to the Think Consortium 2017 Outlook for Blockchain Impacts on Enterprise & Government, which highlights the key topics and trends that will shift operational methods of consumers, armed forces, public offices, central banks, corporations and investors.

This report includes analyses drawn from the work of more than 100 academic papers and media sources. Embedded in this year's outlook are three broad topics:

- **Compliance & Government**
- **Enterprise Integration**
- **Service & Products**

The Think Consortium team is led by senior R&D professionals working to develop a variety of solutions by understanding corporate government and societal issues touched by the blockchain. The team works with top executives at many of the world's leading firms to identify key areas of growth opportunity in a changing digital landscape being transformed by A.I, Big Data, Blockchain, and Virtual Reality.

We hope you'll enjoy reading what our team has found. To join the conversation about these emerging trends, visit our website at [www.thinkconsortium.com](http://www.thinkconsortium.com), where you can join in-person and/or virtual events focused on blockchain topics.

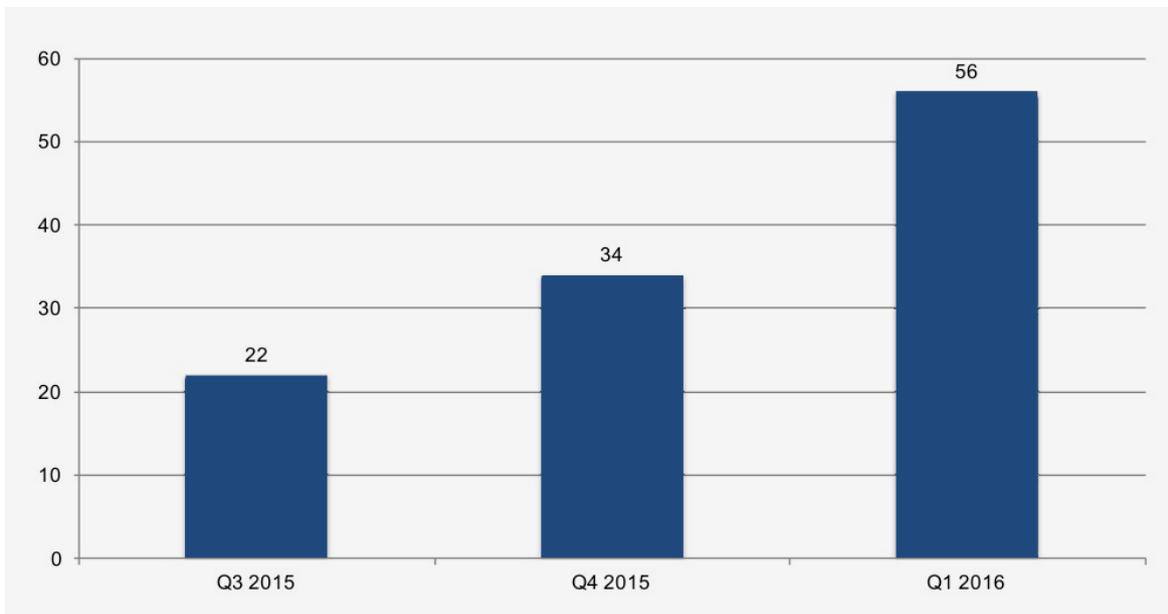
For sales inquiries, contact us at:

**[info@thinkathon.io](mailto:info@thinkathon.io)**

# 2016-2017 KEY EVENTS & PROJECTIONS FOR BLOCKCHAIN TECHNOLOGY

On the first day of June 2016, the Federal Reserve chairwoman Janet Yellen met with the heads of over 90 central banks to discuss blockchain technology and the future of banking. Meanwhile, on the other side of the United States, a team at Disney painstakingly worked on the entertainment giant’s own blockchain in Seattle.

As bankers and government officials discussed asset transfer and the world’s largest entertainment company was changing the way intellectual property licensing could be issued, an unknown hacker laid out plans to steal over \$60 million (USD) worth of cryptocurrency on the second largest public blockchain in the world. That hacker (or group) would be successful in this pursuit on the Ethereum blockchain 25 days later.



*Figure 1 : Number of Blockchain announcements by traditional firms in late 2015/early 2016*

While most of these actors in the theater of blockchain were focusing on innovations outside of the world’s oldest blockchain, Bitcoin, one of the largest e-commerce websites on the planet issued the very first SEC-approved bond on the Bitcoin blockchain 3 days after the conclusion of the ninety-member central banker conference in Washington D.C.

2016 saw the first major reversal of transactions in an immutable blockchain database following the aforementioned heist. Likewise, the world's largest bank announced that it was building its own banking platform based on the source code from that very same blockchain where the hack took place. That company was J.P. Morgan. The banking behemoth coined their permissioned blockchain, "Quorum" while simultaneously joining a consortium called Hyperledger along with IBM who launched yet another blockchain, and—the stories go on...

The following is a list of key events in the 2016 Wild West Frontier of blockchain, describing announcements and implementations of the distributed ledger technology that are leading to the institutionalization of blockchain in 2017 and beyond.

## Highlights & Analysis

### **1. Visa set to compete with SWIFT by offering blockchain alternative to intra-bank SWIFT messages**

Since the 1980s, SWIFT has been the leading money transfer system between banks, with the first transfer occurring in 1977, two years after the company's founding in Brussels. The main benefits of SWIFT were a worldwide processing service and liability protocol, both of which allowed banks to seamlessly transfer fiat currency. Since 2003, the company also provided the ability for banks to transfer equities and other securities in a similar fashion.

Visa was formed as a joint effort by many banks to unify lines of credit between consumers and stores in the 1960s. Prior to the 2000s, Visa operated as several companies in geographic locations owning a similar license. In 2016, Visa partnered with Chain, a startup building a revolutionary blockchain technology to pilot a program aiming at allowing businesses to transact directly with each other without necessarily needing a banking intermediary. Visa's B2B Direct Blockchain service will be opened to select merchants in 2017 who will find enormous cost savings remitting money between each other locally and overseas, with the ability to bypass SWIFT transfers. To win in this market, Visa will need to keep fees competitively low, build great ecosystems of pilot merchants in the international manufacturing and distribution sectors, guarantee security of its platform, and begin to open up to more strategically significant merchants rapidly.

## **2. Disney set to perform B2B, customer transactions and data storage using its own blockchain**

In 2016, the world's largest entertainment company, Disney, discontinued distribution of its corporate scrib, Disney Dollars. This coincided with its announcements and foray into blockchain technology, potentially set to replace and track new forms of corporate currency at Disney. With the open-source release of its blockchain technology, called Dragoncoin in late 2016, Disney is positioned to enhance its margins in the coming years with B2B settlements according at the time of transaction between departments, reducing back office costs. Additionally, as Disney focuses on becoming an industry leader in the emerging virtual reality industry, intragame/environment virtual currency is needed for users to exchange value.

Disney's road to cost saving and adding additional revenue via blockchain technology in 2017 will be defined by its ability to integrate virtual currency into its games and allow the the sell of digital content via Disney-tokens backed by its blockchain. It is likely Disney will continue to invest in early stage startups that are innovating in this area, as they did with rising VR startup LittlStar. As Disney grows in this area, it is also positioned to work closely with other large entertainment companies and its own subsidiaries to develop platforms for managing royalties more efficiently for content distribution. These investments into blockchain technology has the potential to add to Disney's bottomline tremendously in the coming years.

## **3. Dubai's Initiatives to go completely blockchain by 2020**

The ratio of credit for non-productive GDP to productive GDP is a long standing yard stick for determining financial bubbles, ever since the collapse of the Japanese economy in the 1990s, and as was seen throughout the 20th century in the US and Europe. The United Arab Emirates has seen skyrocketing real estate prices, matched with a credit explosion, bringing massive investment into products and services of the future.

Liquidity is necessary for the growth of an economy, and Dubai is using its excess capital in interesting sectors. For example, besides having offices built completely with 3D printers and building some of the world's smartest cities, the United Arab Emirates has been on a shopping spree snapping up financial technology companies and incorporating the benefits of blockchain into it future plans for growth. In this regard, it was no surprise that in late 2016, the Crown Prince of Dubai announced the UAE's intention to transfer all official documents and perform all government transactions on a blockchain by 2020.

The impacts of this announcement are enormous. Lately, startups such as Loyal as worked with the government to promote tourism in the form of blockchain-based loyalty points (called Dubai points) to provide and track deals based on customer interactivity with certain location which can drive up local businesses outside of the top 3 tourist attractions there, such as the Burj Khalifa. Dubai's, and ultimate the UAE's, impact will be rooted in its ability to partner with nearby countries, as it has already begun doing with a recent partnership regarding remittance with India's ICICI. Additionally, with help from fast-paces innovators

from around the world, Dubai is poised to reach its goal of full blockchain integration by 2020. In this regard, Dubai is attracting innovators with a friendly government environment, that parallels almost none around the world with regards to cooperation between the public and private sectors.

#### **4. China and Russia's central security depositories move to transfer cross-border securities on the Blockchain**

Central Security depositories (CSD) play one of the most important roles in the exchange of any asset in the world. Every government typically has one major CSD which holds a majority of certificates or representation of certificates, so that it can easily orchestrate with major exchanges to keep track of ownership based on trades on said exchanges. Regarding China and Russia, an agreement has been reached between the major CSDs to share research on Blockchain technology in a move to develop systems to link settlement of transaction on the technology.

To most traders, the effects of this will be felt in the coming years as user experiences begin to track in real-time transaction hashes that match trades to events occurring on blockchains to prove ownership or rights and allow for more transparency in the financial services industry. This lowers costs for settlements, but also paved the way for startups and other companies working in the space to build products that recognize these transactions and can track them in a way relevant to investors and exchanges. As trade relationships between China and Russia strengthen, it can also play an integral role in linking the two economies allowing for greater cohesion on economic policies, ease of reciprocal investment tracking and ease of monetary transfer among corporations in the two nations.

#### **5. T0 issues first publicly traded security via ETC and Keystone Capital**

Overstock, a survivor of the 2000 tech bubble and influencer on the e-commerce retail space, takes in an approximate sales volume of \$3 million (USD) a day. Notably, it has also begun representing 500,000 of its preferred shares on the Bitcoin blockchain. In mid-2016, Overstock became the first company in history to sell a bond that was issued on a blockchain. With its latest partnership with Electronic Trading Co and Keystone Capital, shareholders can purchase and track shares on Overstock's t0's platform. The CEO, Patrick Byrne, has recently accused Cede & Co of actually possessing ownership of over 98% of American issued stocks while consumers have a "right", "like a polaroid snapshot", of those shares. With the t0 platform, he hopes to issue shares directly to brokers and have them tracked by their purchaser's number.

The Bitcoin blockchain, via the Blockchain's Colored Coin feature, lays the groundwork for new and existing companies to issue shares on the platform. 2017 is likely to see major players place their shares on the world's oldest Blockchain, with those drawing significant

press and potential investors interest outside of the conventional interests of Wall St. venture capitalists, potentially driving up shares in those companies in the short-term. With increased confidence in ownership of those shares, the blockchain-based share may serve as a premium factor and add to valuation metrics, pushing shares in those companies higher. Companies joining the t0 platform will be a phenomenon to watch in 2017.

## **6. IBM's massive investment partnerships involving Blockchain**

IBM, in September 2016, announced all of its business units would have some aspect of them involving blockchain technology. In a public report, they outlined their vision to become trailblazers in the blockchain industry predicting that more than 15% of financial institutions would be on the blockchain by 2017. Given such enthusiasm about the blockchain, IBM has focused their business on garnering innovative solutions through their Bluemix Blockchain Garages located in 4 cities: Singapore, Tokyo, London and New York. At these facilities -usually located in co-working spaces to leverage the startup mentality- IBM consultants and C-level executives work with potential clients to leverage IBM design thinking and workshop new ideas in order to develop proof of concepts for clients in the price range of \$200,000 to 300,000 (USD). From there, IBM seeks to integrate current solutions or build new solutions.

IBM's channel to success in this arena will be very much tied to its ability to grow its developer community around its technology, Hyperledger Fabric. This approach is slightly hindered, however, by a lack of a truly open-source approach. Rather, IBM relies on a large group of esteemed consultant and sale teams to pursue potential government clients. IBM Blockchain representatives, for example, have appeared in front of US congressional leaders to make the case for investigating blockchain in government such as IBM VP, Jerry Cuomo, earlier in 2016.

While IBM has contributed its Fabric Blockchain code to the Hyperledger Project, other firms such as R3 are competing for dominance in the blockchain sector based on their technology and partnerships. IBM's success, regarding the bottomline, will be tied to its ability to tap developer interest to build out solutions on top of its technology, further develop its current platform, and sell this solution to specific customers, including government, healthcare institutions, manufacturing companies, exchanges, and military units.

IBM has the opportunity to leverage its current relationships, and 2017 will be a significant year as their activity collaborating with other firms will determine whether they can garner the right use cases to nail a foothold in the blockchain space.

**Other stories that had a large impact on blockchain this year include:**

- China announces that it will implement blockchain into its Social Security System to help manage its 1.9 trillion yuan <sup>[1]</sup>
- Capital One has teamed up with the startup Chain, similarly to Visa; however, focusing on the health care insurance space. <sup>[2]</sup>
- R3's continued growth in partnership with leading banks and Hyperledger project. <sup>[3]</sup>
- \$81 million (USD) Bangladesh Bank Heist from New York Federal Reserve Bank underscores need for blockchain. <sup>[4]</sup>
- Ethereum Blockchain's own \$80 million (USD) heist that turned into a \$4 million (USD) heist. <sup>[5]</sup>
- South Korea eyeing blockchain for everything financial. <sup>[6]</sup>
- Accenture CEO publicly criticized the use of blockchain. <sup>[7]</sup>
- Georgia's government issued and transfer land deeds via the blockchain. <sup>[8]</sup>
- US Government opens office prompted by advert on blockchain technology. <sup>[9]</sup>
- Federal Reserve Governor proposes use of blockchain technology by the central bank. <sup>[10]</sup>
- NASDAQ inches closer to full blockchain integration for equity trades, files patents. <sup>[11]</sup>

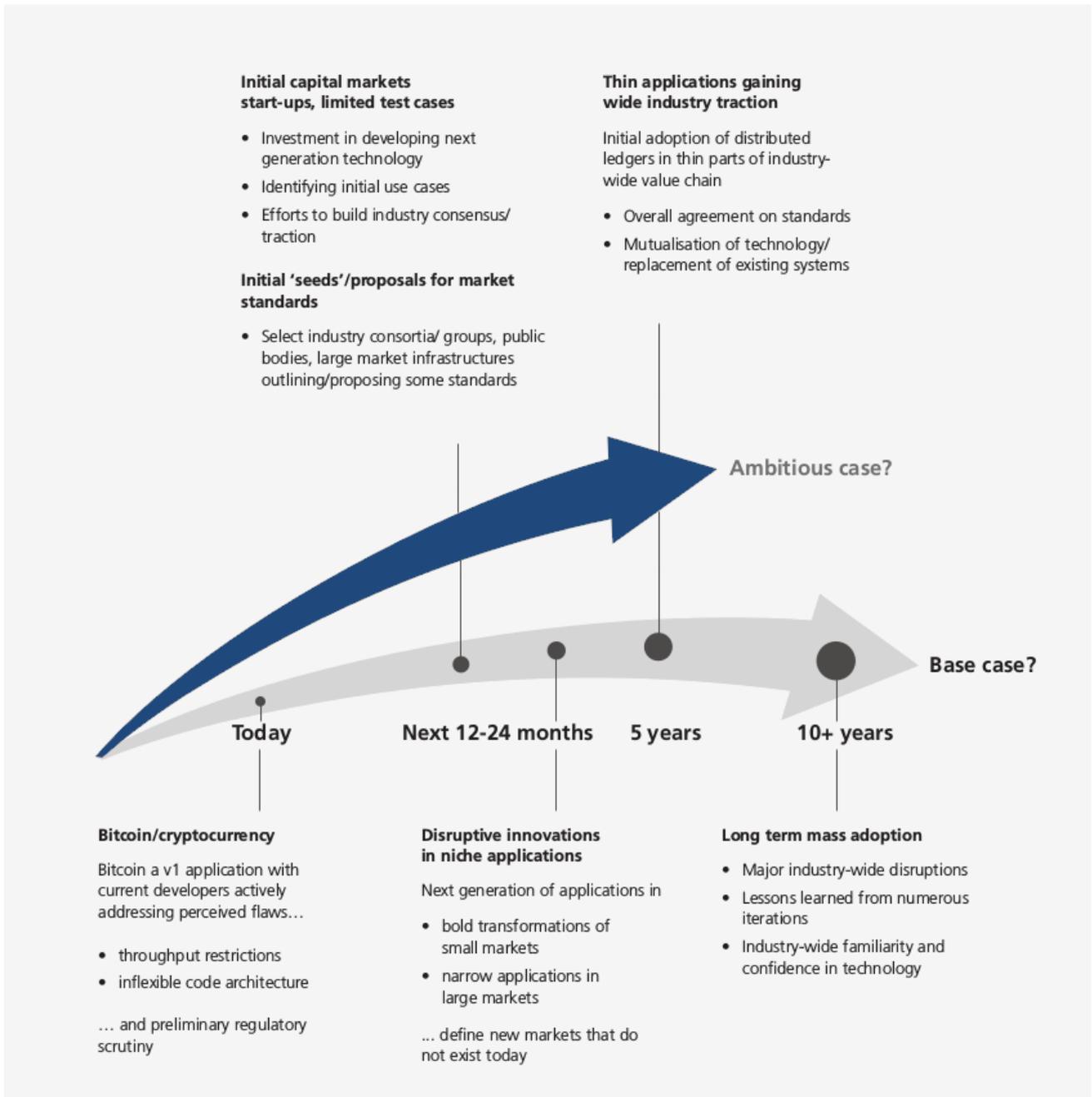


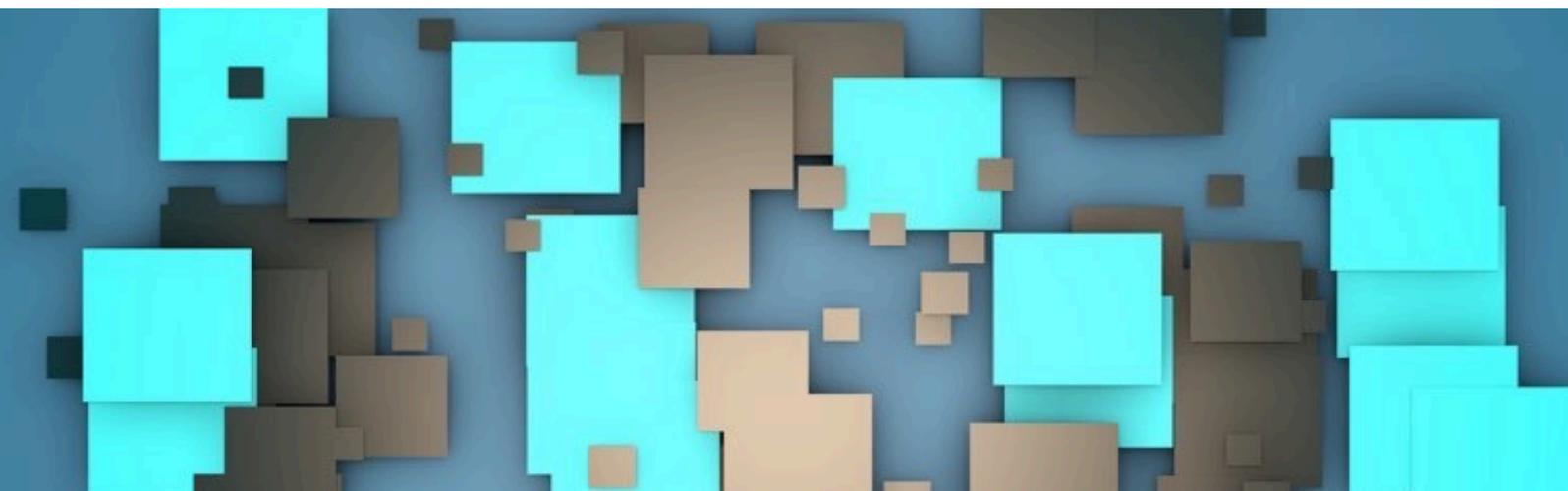
Figure 2 : Global forecast on Blockchain technology (Source : Olver Wyman – Reconstruction)

## Repercussions regarding the enterprise in 2017

The key impacts for the enterprise in 2017 is new demand from investors for blockchain-backed securities stemming from a sense of immutable ownership and transfer control. More enterprises will be solicited by blockchain enabled counterparties to transact with data and assets on blockchains to lower costs in compliance and enhance transparency along with speed.

## Repercussions regarding government in 2017

The key impacts of the latest trends with regards to government will come from more calls to run pilot programs to streamline validation processes. In developing nations, NGOs and political parties will put increasing pressure on the continued pursuits of stamping out corruption and enhancing systematic confidence of citizens via immutable distributed record keeping to drive enhanced security for property purchasers.



## SUMMARY

There are many definitions of blockchain, although the primary goal of most implementations of the technology is about finding one truth across multiple locations when dealing with data. Technology product and integration firms such as IBM have blockchain solutions in which transactions optionally include trust mechanisms, meanwhile, bitcoin, the original implementation of blockchain technology, is for the most part. trustless.

In most implementations, blockchains are distributed and decentralized; however, some implementations are centralized. Some blockchains have cryptocurrencies built into their architectures, while others avoid association with crypto-currency completely. Some blockchains are not merely a distributed database, but a distributed computing environment with a database, allowing for the execution of smart contracts in addition to the typical transaction and data transfer capabilities between parties.

# COMPLIANCE & GOVERNMENTS

**"By using blockchain governments could become a lot more efficient across a number of different departments."**

**- Patrick Spens, Transformation and Assurance Director At PricewaterhouseCoopers (PwC)**

# AUDITING AND THE BLOCKCHAIN

While most public companies around the globe are required by law to perform audits via external auditors, most medium-to-large companies, whether public or private, perform regular audits for the purposes of ensuring stakeholder expectations are met by management and operational teams. Blockchain technology has become increasingly popular among the “Big 4” auditing firms, with special attention from Deloitte, PwC and most recently, Ernst & Young.

## Automated Compliance Future-state benefits

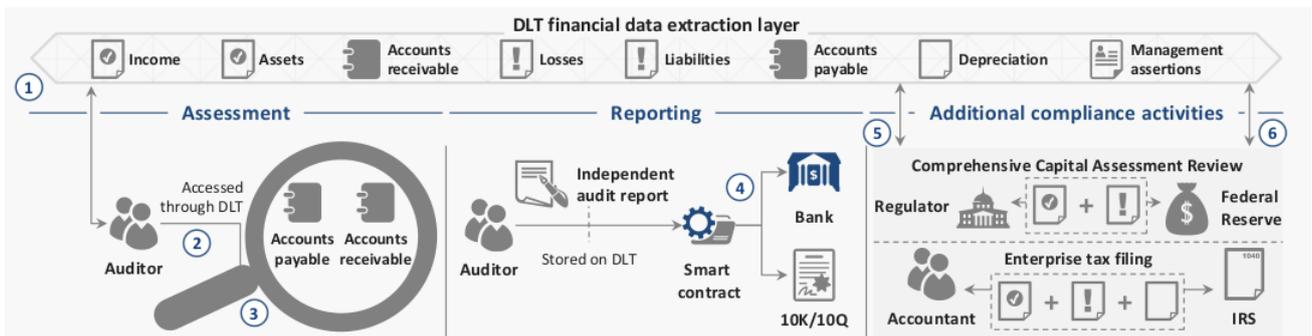


Figure 3 : Automated compliance process (Source : World Economic Forum Report)

Part of the interest from auditing firms stems from some of the inherent disruptions anticipated by blockchain technology which threatens to cut billable hours through efficiency which may affect auditing firms who depend on billable hours. Another subject-of-interest has been on firms’ ability to become industry leaders in the space and develop technology that could potentially be licensed to other firms and drive a new revenue stream for future audits from within the company and outside of it. This attention stems from areas where blockchain technology has the capacity to thrive in, including:

## Verification

One of the key factors to performing a successful audit is validating the veracity of documents and transactions. When data is stored on a distributed, consensus-driven blockchain, verification regarding time and date of inputted data or transactions virtually becomes a non-issue with regards to veracity.

## Flow of Funds & Double Entry Bookkeeping

In addition to the ease and transparency of verifying a transaction and documents, tracking how those documents or funds within transactions move in and out of the company becomes incredibly simple, as well, as all transactions have input data from the previous transaction that form them. It will be essential for firms to fully integrate blockchain solutions into all layers of their organization to make this a reality. If firms do not fully integrate with blockchain technology to track data and assets, the auditing process will remain very similar to the it is today.

Since auditing and management consulting firms have great advantages in conceptualizing solutions to meet large enterprise needs, there is enormous potential profitability to be gathered by these firms in integrating blockchain into the existing systems of large organizations, in coordination with their technology partners. There is also great potential with regards to entirely new solutions for highly capitalized market entrants. To this end, PwC is working on this primarily in Amsterdam with its Blockchain Experience Lab. Similarly, Deloitte has research teams around the globe focusing specifically on this problem. Deloitte is piloting a new identity solution for tracking corporate profiles and manage authority mechanisms securely.

Whereas in the past, auditors needed to track how a debit corresponded with a credit through a company's double entry bookkeeping mechanisms, the blockchain provides a solution to settle this in a decentralized immutable way immediately. The cost-saving implications are profound.

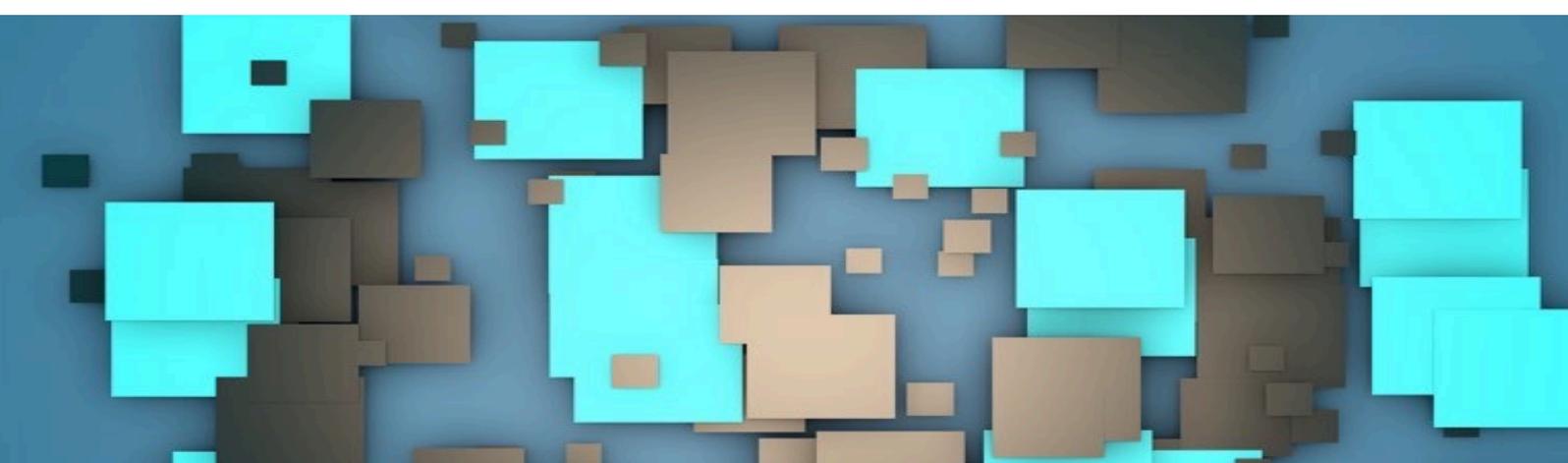
## Cost Reduction

While efficiencies hold the promise of reduced cost, auditing companies can see this as a losing bet since much of an auditing firm's revenue derives from billable hours. There are two sides to the blockchain argument for auditors: One is that auditors can become more efficient and cut cost themselves, thus billing clients less without much disruption to their current profit margins. The second argument is that companies will rely on software to do much of what auditors historically had to verify as a third party.

## Reporting

According to the World Economic Forum's Whitepaper on Blockchain, one of the greatest benefits of distributed ledger technology (DLT) to the world's leading financial institutions is the fact that "Smart contracts can capture obligations and drive reporting, minimizing operational errors and accelerating outcomes".<sup>[2]</sup>

Blockchain-driven auditing seems like one of the most promising use-cases for blockchain technology. Large third-party auditing houses often possess the economic power and potentially the ability to convince decision-makers to promote blockchain technologies on a global scale.



# GOVERNMENT AND CRYPTOCURRENCIES

Several government agencies and central banks around the world have begun investigating measures to incorporate blockchain backed cryptocurrencies into their financial systems while others have shown a certain degree of reluctance towards cryptocurrencies. With such disparate stances between countries on cryptocurrency as well as misunderstandings stemming from historical Bitcoin scandal in others, cryptocurrency adoption and or legalization represents a public relations challenge as much as, if not more than, a technological one.

## North America

In late 2015, the US Commodities Futures Trade Commission (CFTC) listed Bitcoin as a commodity while a New York Judge upheld this listing in a court of law in June of 2016.<sup>[1]</sup> In May of 2016, The United States Federal Reserve Governor of St. Louis wrote a piece on FedCoin, a concept of a central bank backed cryptocurrency.<sup>[2]</sup>

Canada has made a statement that it does not plan to have its own state backed cryptocurrency anytime soon.<sup>[4]</sup>

In Mexico, the government has placed limits on the size of unregulated cryptocurrency transactions between parties to prevent hard-to-trace transactions by criminal syndicates and other participants.

## South America

In Venezuela, where hyperinflation has had many negative impacts on the local economy, non state sponsored cryptocurrency use has grown rapidly as citizens protect their funds from uncertainty despite government crackdowns.<sup>[5]</sup>

Throughout South America, cryptocurrency adoption is occurring in niche and early-adopter markets. Regarding low-fee remittance, blockchain technology has gained growing popularity throughout the continent.

## Europe

In Russia, there has been tightening of regulation and some bans on bitcoin use. However, the government has begun research on developing its own state backed cryptocurrency.<sup>[6]</sup> In the EU, the main tone around cryptocurrencies has been mostly focused on preventing its use by terrorist organizations.<sup>[7]</sup> In the Netherlands there has been ongoing research over the last 2 years in developing a state backed cryptocurrency.<sup>[8]</sup>

Following The United Kingdom's exit from the European Union, The Bank of England stated its continued interest in Central Bank Digital Currencies (CBDC). [8b]

## Asia

The prince of the United Arab Emirates has decreed that all government records and financial transactions take will soon be recorded through blockchain technology.<sup>[9]</sup>

In contrast, The Pakistani government has banned the ownership of cryptocurrencies.<sup>[10]</sup>

Further East, China has announced and begun development of a state backed cryptocurrency.<sup>[11]</sup> In South-Korea, the government is investing 2.6 billion dollars into financial technology with blockchain based financial sector at the forefront of that.<sup>[12][13]</sup> Some believe South-Korea is developing its own cryptocurrency.<sup>[12][13]</sup> Meanwhile, The Bank of Mitsubishi in Japan has announced plans to issue a bank backed cryptocurrency in the third quarter of 2017 with little to no opposition from the Japanese government.<sup>[15]</sup>

## Oceania

Australia's government has recognized bitcoin as a currency.<sup>[16]</sup>

2016 saw an "eyeing" of large banking institutions by government authorities. Allegedly, there has been growing fair-play concerns stemming from banking account closures of accounts held by citizens dealing with cryptocurrency exchanges owned by overseas blockchain companies. This fair-play concern has not been widespread but underscores Australian banking interest to somewhat restrict transactions from non-Australian-based firms.

## New Developments

With the advent of cryptocurrencies on blockchains such as Ethereum, launched in 2015, that enable smart contract execution, some logic can be built into so called token and contracts allowing central authorities to have control over the flow of funds in the case of fraud or terrorism financing. However, because smart contracts, once deployed, are immutable, they can cause widespread damage to a system or institution.

This was the case for the cryptocurrency and smart contract based token DAO which contained over \$200 million (USD) in consumer assets at one point. A few months after its launch, a programmer identified a vulnerability in the smart contract code and was able to confiscate an amount worth \$65 million (USD) at the time. However, The Ethereum Foundation, the developers of the underlying blockchain, were able to perform a hard fork, a mechanism that can be leveraged by blockchain operators to create a copy of a blockchain with some transactions being altered and move the participants onto that copied but altered network.

This presented a possible solution to future institutions who may be interested in pursuing blockchain but are concerned with the vulnerabilities associated with irreversibility. In the case of Ethereum, the original transactions still exist and cannot be deleted, however, the participants using it have voted to use the new chain.

Globally and over time, there have been many stances on blockchain based cryptocurrencies. One primary issue local lawmakers around the world have had with flagship cryptocurrencies is on consumer protection since these transactions cannot be reversed by a central authority. This has led to massive fraud in some areas.

2016 was a tumultuous year for cryptocurrencies. Governments have been laying the groundwork to introduce their own cryptocurrencies beginning as early as the end of 2017. It is likely however that multiple developed countries participating in state or central bank backed cryptocurrencies is something that will get more adoption by 2020.

2017 will bring more experimentation and growth in cryptocurrencies, especially among government and central bank-backed cryptocurrencies, with wider adoption of traditional cryptocurrencies such as Bitcoin, Ethereum, Monero, Zcash and Dash.

# OWNERSHIP, GOVERNMENT AND BLOCKCHAIN

## Overview

Around the world, federal and municipal governments have delved into research and development regarding integration of blockchain technology and social services to help legislate ownership, asset transfer, identification and record keeping. Governments, such as South Korea, Sweden, Georgia, Honduras, The United Arab Emirates, The United Kingdom, and Singapore, have led the march, pledging to promote grants, records, and land ownership on distributed ledgers. Similarly, local and state-level governments such as Delaware in the US have begun promoting the use of blockchain among agencies to enhance efficiency. <sup>[1]</sup>

## The Impact

Many government bodies have expressed interests in one or more implementation categories of blockchain: Verification, movement of assets, ownership recordation, and identity.

Verification, by its nature, is largely concerned with proving that an event took place by a certain person or entity on a specific date and time. Movement of assets refers to the tracking of financial transactions and physical goods. Ownership recordation's importance regarding blockchain derives from tracking the chain of ownership/possession of land and property titles. Identity connects the other three areas of importance, in verification, asset movement, and ownership recordation rely on connecting an event or asset to a specific entity or person(s).

Governments continue to invest in the crypto-currency aspect of blockchain with South Korea placing over 2.65 billion USD into building out a governmental asset transfer system using a blockchain powered currency. This undertaking is in cooperation with multiple large Korean financial firms. Korea is anticipated to announce the next phase of this initiative in first quarter of 2017.<sup>[2]</sup>

Moving even further than the Korean government, Dubai in UAE has pledged to go entirely paperless by 2020, handling entire all government processes, such as payroll, document and property titles on blockchain technology. Dubai crown prince Shaikh Hamdan Bin Mohammad Bin Rashid Al Maktoum cites organizational efficiency and cost savings, and global leadership as his reasons for migrating data and transactions to blockchain. Likewise, others have touted the environmental and societal benefits that would result from cutting back over 100 million (USD) paper transactions, mostly used to prove validity over computerized data, and 25 million work hours per year globally.<sup>[3]</sup>

Dubai hopes that by being a trailblazer in the industry, the country will become a global leader in blockchain and e-government initiatives. This is important because much of the benefit of blockchain comes from interconnectivity of nations and organizations. The benefits of leading the pack in this area is seeded in future financial growth, much as the United States and Central Reserve Bank benefits from a global reserve currency. Dubai is focusing on an initiative dubbed 'Future City' with blockchain as a focal point of success. The initiative is spearheaded by The Dubai Future Foundation and the Smart Dubai Office.<sup>[3]</sup>

As governments become more involved with blockchain technology, some legal professionals have begun questioning some of the claims made by blockchain advocates while others have begun fearing for job slumps in the legal industry itself. While automated smart contracts can handle executing basic transactions and can model certain legal instruments, solicitor Richard Howlett surmises that smart contracts are at least highly limited by their code and at most a great tool which will need legal professionals to actually legislate ownership.<sup>[4]</sup> The legal profession and government bodies creating legislation in this growing area will benefit from technical backgrounds. The extent of these impacts will be evident in the coming years; however, 2017 will largely be experimental, yet foundational, regarding this area of blockchain implementation. It is certainly an area to watch.

As blockchain solutions mature, as well as general awareness, entire governmental organizations and legal apparatuses are poised to transfer most data authentication, ownership deeds, asset movement activity recordation and financial transactions onto the blockchain.<sup>[5]</sup> Governments will be faced with issues and discussions regarding legislation dealing with privacy protections, new phases of cyber security preparations, dependable IT support, and development of protocols and standards.

# SECURE DATA STORAGE AND TRANSMISSION ON THE BLOCKCHAIN

## The Problem

Protection of consumer and employee data in digital format has been at the forefront of security concerns since the advent of the internet. Improper handling of personal data by corporations and governments creates a significant amount of legal liability. For companies, the cost of litigation and settlement can pale in comparison to the opportunity cost of lost customers, system repair and diminishment of brand.

## The Solution

New solutions in blockchain based data storage such as StorJ and Filecoin allows for simple-to-use distributed encrypted file storage. For companies, the ease of transaction or merging with existing systems with blockchain technology will lower the barrier of entry to blockchain for enterprise throughout 2017. <sup>[1][2]</sup>

Likewise, the Department of Defense in the US has begun investing in blockchain technology for secure data transfer and cyber security monitoring in databases and other computing systems. <sup>[3]</sup> These moves are creating greater confidence by large institutions to look into these as well. PwC the world's largest auditing service company has begun investing in blockchain technology and specifically advertising the benefits of data validation provided by the technology. <sup>[4]</sup>

The vulnerabilities of companies fully and quickly adopting such technologies is the same as most blockchain integration in general: these technologies are new and very much unproven outside of the theoretical and limited testing sense. There is a possibility be data breaches in these systems. This industry will need to mature over the years much like cloud technology in general before large corporate adoption. <sup>[5]</sup>

This represents a opportunity for startups whose customer bases are smaller with lower levels of expectation. In the long run, as some of these companies grow, there will be great savings on corporate investigations and external auditing as the validity of records is implicit.

# THE MILITARY & BLOCKCHAIN

## Overview

While many of the use-cases often discussed surrounding blockchain tend towards financial and business problems, many other organizations are currently investigating non-financial uses for blockchain and related technologies. One of the most high profile of these organizations is the US Defense Advanced Research Projects Agency (DARPA) which is one of the many agencies defending the United States from the threat of illicit hackers.

In the past decade, cyber-threats have increased significantly in numbers and complexity, and digital information security is a mission critical aspect of any technology system. Governments are seeking to find systems that hold up to both the speed of a changing cyber-battlefield while also integrating the most advanced cryptographic protocols.<sup>[1]</sup>

## The Impact

DARPA has already begun investigating blockchain uses with mission critical infrastructures, even going so far as to looking into securing nuclear weapons. The heart of this initiative is the concept of Information Integrity. Since information stored on a blockchain cannot be modified and any access or additions can be immutably tracked, systems on blockchain are protected from hackers looking to cover up their tracks.<sup>[2]</sup>

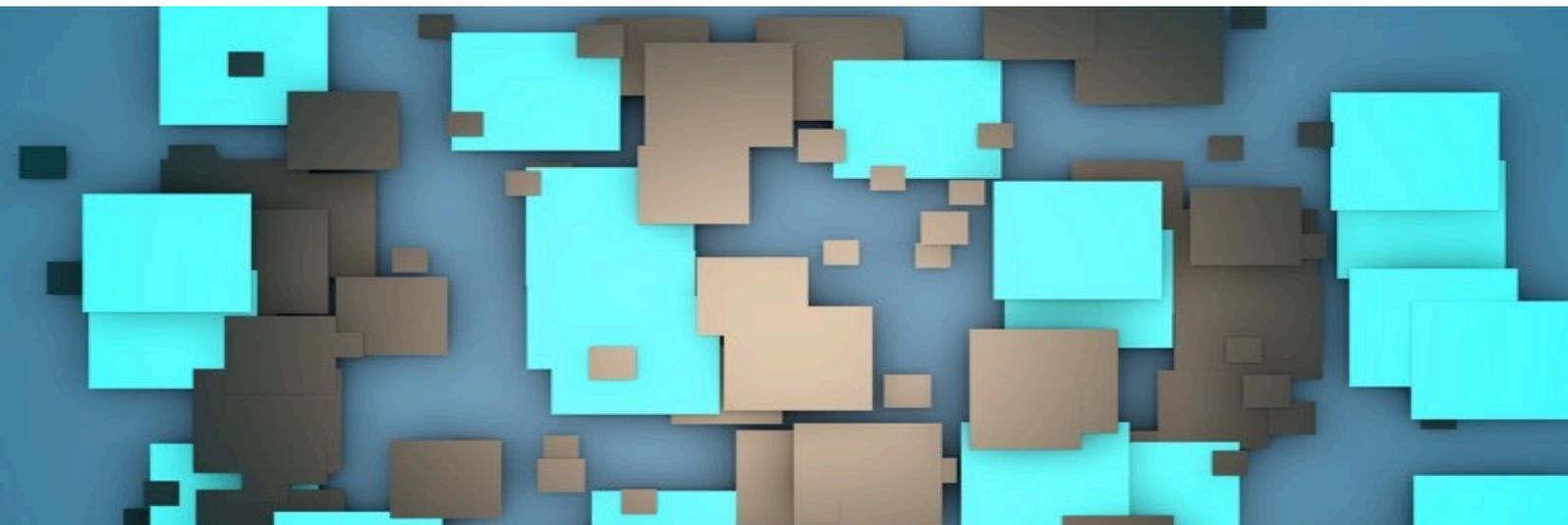
Many believe Blockchain is a fitting mechanism for verifying data, and DARPA recognized this when they awarded a 1.8 million dollar (USD) contract to the firm Galois to develop an unhackable information verification system built on top of a blockchain system created by the company Guardtime. DARPA has been one of the most active organizations looking for non-financial uses of blockchain.<sup>[3]</sup>

In April 2016, DARPA has begun issuing contracts for a secure messaging platform with blockchain being a possible contender. The contract request is as follows:

*“With this messaging platform the business logic of the DoD ecosystem would be mapped onto a network of known entities using distributed ledgers. By doing this, significant portions of the DoD backoffice infrastructure can be decentralized, ‘smart-contracts’ can be instantly and securely sent and received thereby reducing exposure to hackers and reducing needless delays in DoD backoffice correspondence. As an example, Military Interdepartmental Purchase Requests (MIPR) could be implemented using the secure ledger. Regulators with access to the ledger could read the correspondence and thus easily verify that a MIPR transaction didn’t violate Federal Acquisition Regulations (FAR).”<sup>[4]</sup>*

By using blockchain and smart contracts, The Department of Defense would place their entire backoffice infrastructure on a blockchain. Likewise, they would use business logic code to ensure compliance under military protocols. The specification goes on to state that a cryptographic standard could be mounted on top of the Blockchain.<sup>[4]</sup>

Although this use-case may seem extreme, the underlying principles of the outlined software mirrors the financial uses for compliance and supply chain regulations with an extra emphasis on hackability and cryptography. We expect more contracts to be issued for this technology stemming from the Department of Defense on behalf of The Civil Engineering Corp, Force Support Squadrons, and any division dealing with Procurement (which are many).



# ENTERPRISE INTEGRATION



**"Banks and other financial institutions are thinking about this. Now, what we will start to see in 2016 and 2017 are responses from the other industries that will be impacted by blockchain."**

***- Brian Forde, Former White House Senior Adviser for Mobile and Data Innovation***

# COST OF BLOCKCHAIN INTEGRATION

## Overview

As with any new integration of technology, the real costs of integrating blockchain into existing enterprise and government systems or creating new systems will fluctuate greatly based on use case, scale, software stack, bureaucratic hurdles, licensing agreements and other factors. Research and development cost estimations will take into account investment costs, licensing, and ancillary benefits which can once again fluctuate the cost of blockchain implementation. The financial benefits of using blockchain or distributed ledger technology to streamline data consistency, asset management, data security and operational confidence can save large firms and government organizations millions per annum in compliance management, asset transfer, remittance, payroll, settlement, auditing, legal, and regulatory fine costs.<sup>[1]</sup>

## The Impact

According to research and analysis firm CB Insights, exploratory investments in blockchain firms and research averaged \$200 million (USD) in 2015.<sup>[2]</sup> Cumulatively, the amount of private investment going into blockchain related firms and technologies exceeded \$1.2 billion (USD). Venture capital investment into startups accounts for a small percentage of this investment, with a majority of the private investment stemming from large financial firms, such as PricewaterhouseCoopers (PwC) and financial consortiums such as R3. This investment trend has slowed as of Q4 2016.<sup>[3]</sup>

Waning private investment could be taken as a signifier of waning interest in blockchain. Whereas much private capital has been already been deployed, 2016 has been rife with reports of growth in governmental bodies investing in blockchain research and development.<sup>[5]</sup> For instance, the South Korean government has recently launched an initiative to place \$2.65 billion (USD) into a potential national crypto-currency and blockchain system, while Dubai has pledged to place their entire governmental documentation structure and transaction mechanisms on a blockchain by 2020.<sup>[6]</sup> Growth in government and private investment, as well as exploratory research, will see 2017 yielding initial cost reports by large institutes regarding the cost of implementing blockchain throughout enterprises and government bodies.

As blockchain moves through research phases and initial introduction into existing systems, early adopters will begin considering the cost of integrating the technology into existing systems or adding out-of-the-box blockchain solutions, while a minority may follow J.P. Morgan and Overstock.com's initiatives of building their own blockchains. Overstock has developed the t0 platform for public offering of preferred shares and bond issuance on the Bitcoin network, while J.P. Morgan is currently deploying its own Quorum blockchain, based on the Ethereum codebase.<sup>[7]</sup> A consultation with an IBM Bluemix Blockchain Lab in Tokyo, specializing in brainstorming the implementation of blockchain and developing a proof of concept over a period of several weeks, currently costs between \$100,000 and \$300,000 (USD), while the cost and complexity of implementing such solutions range from company to company.

Initiatives to integrate blockchain into existing systems will incur the same cost hurdles as many other software integrations with consultation, implementation, and maintenance costs similar to what was seen as many firms began focusing on big data and implementing data storage mechanisms to store and process that data. Integrating and testing software systems can reach anywhere from 15 to 80 percent of a technology department's budget depending on the scope, expertise, type of software, and structuring of management around the technology. According to PwC, tech departments from leading Fortune 500s often spend over \$500 million (USD) in deploying and maintaining software systems throughout the lifetime of particular systems. As is, some experts have predicted that integrating blockchain through large scale organizations will be as an expensive endeavour as typical large scale infrastructure overhauls. This cost may be a deterring factor for organizations, creating a large opportunity for firms who can provide these services in a cost-effective manner.<sup>[2]</sup>

The savings in compliance, infrastructure, securities exchange, and international trade granted by integrating blockchain throughout an organization and connecting this technology to other partner, client and suppliers is projected to far exceed estimated costs over time.

Although the cost-benefits of blockchain are great, it is important for industries to proceed with caution as the benefits of blockchain will largely be found in the implementations of the technology in the coming year. Moving forward, companies considering blockchain integrations and/or overhauls will need to take into account enterprise scale, overall footprint of software systems on the organization, trade partner blockchain integration, implementation complexity, transition risk, and team capabilities.

# PRODUCTIVITY: PROS AND CONS OF BLOCKCHAIN

## Overview

Much like the computer or the internet boosted productivity in the beginning 60s and 90s respectively through speed of calculation and data exchange, blockchain technology can boost the speed of validity confirmation across organizations.<sup>[1]</sup>

The negative aspects of this oncoming speed and ease are similar to those brought by the advent of computers and the internet: job loss and displacement. For instance, Blockchain technology deployed within the financial services industry can slim down settlement departments since transactions cannot occur if invalid. However, whenever processes become automated by machines or software systems, new types of jobs replace those who are lost.<sup>[2]</sup>

## Pros & Cons

Jobs are set to be created in the creation and management of smart contracts that work as self executing immutable agreements on blockchains. If in the event a piece of code has a vulnerability in it, a company may unintentionally spend millions of dollars in a transaction that it authorized a smart contract to make. Settlement professionals will likely play a role in helping to develop and test many of the first real world implementations of blockchain in finance.

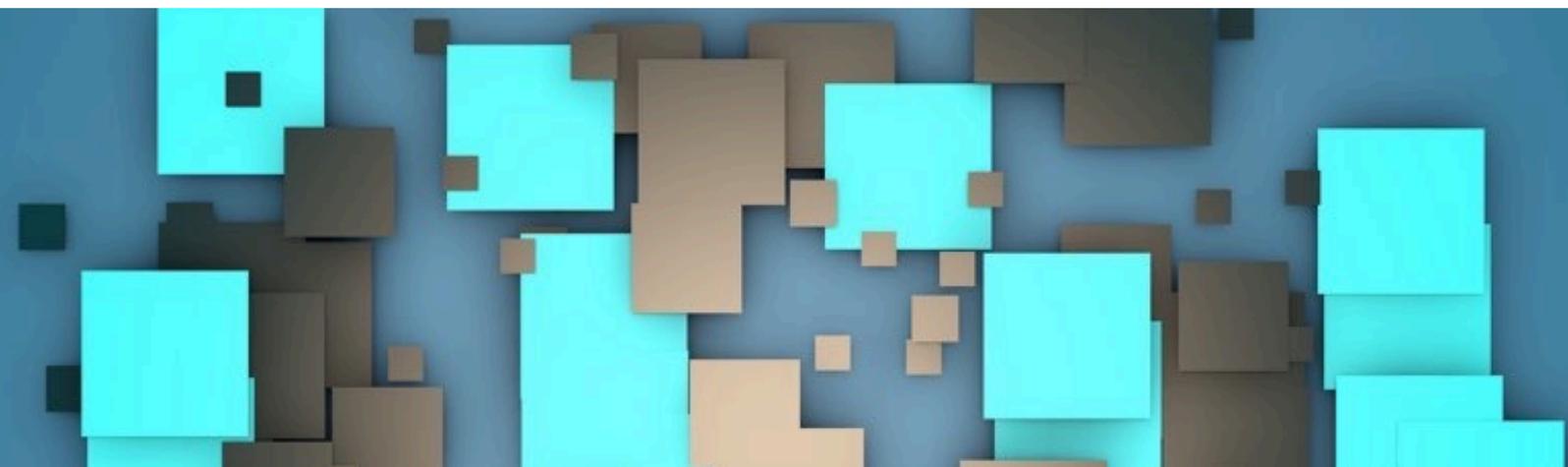
Furthermore, the verification process becoming more expedient and accurate presents productivity opportunities within organizations that require paper verifications both in shipping and paper costs. Additionally, the speed of transactions on a blockchain and eventually the ability to bypass brokers due to one essential truth through widespread adoption throughout organizations means large cost savings. Matching these benefits with smart contracts that check for regulatory hurdles and authorize themselves as compliant before transacting can vastly reduce corporate compliance costs, especially within financial institutions where compliance cost in the US average 4.5 billion dollars per average community bank.

In 2017, more banks and enterprises will adopt blockchain technology. However, improvements in terms of productivity will not be made until major interoperability between public and private blockchains matures and industries establish tested protocols. This process is likely to take a few years. Currently, solutions that solve interoperability problems, such as through a technology called 'side chains', are fairly new although there are already a fair number of implementations of this technology. Additionally, some blockchains are built for interoperability with other chains such as Monax industries Eris.

Furthermore, as more organizations leverage blockchain technology and as more governments record the ownership and transfer of ownership on blockchain people will begin to have an ability to track their own productivity benefits of their work on a global economic scale. More than likely, we will not see many of these developments, even in 2017.

BNP Paribas recently opened an innovation lab in its NYC office with its 2500 employees working to develop solutions on top of the blockchain to process big data. The goal of Paribas and many others popping up within organizations through 2016 has been to identify ways in which blockchain technology can improve productivity in the workplace. <sup>[3]</sup>

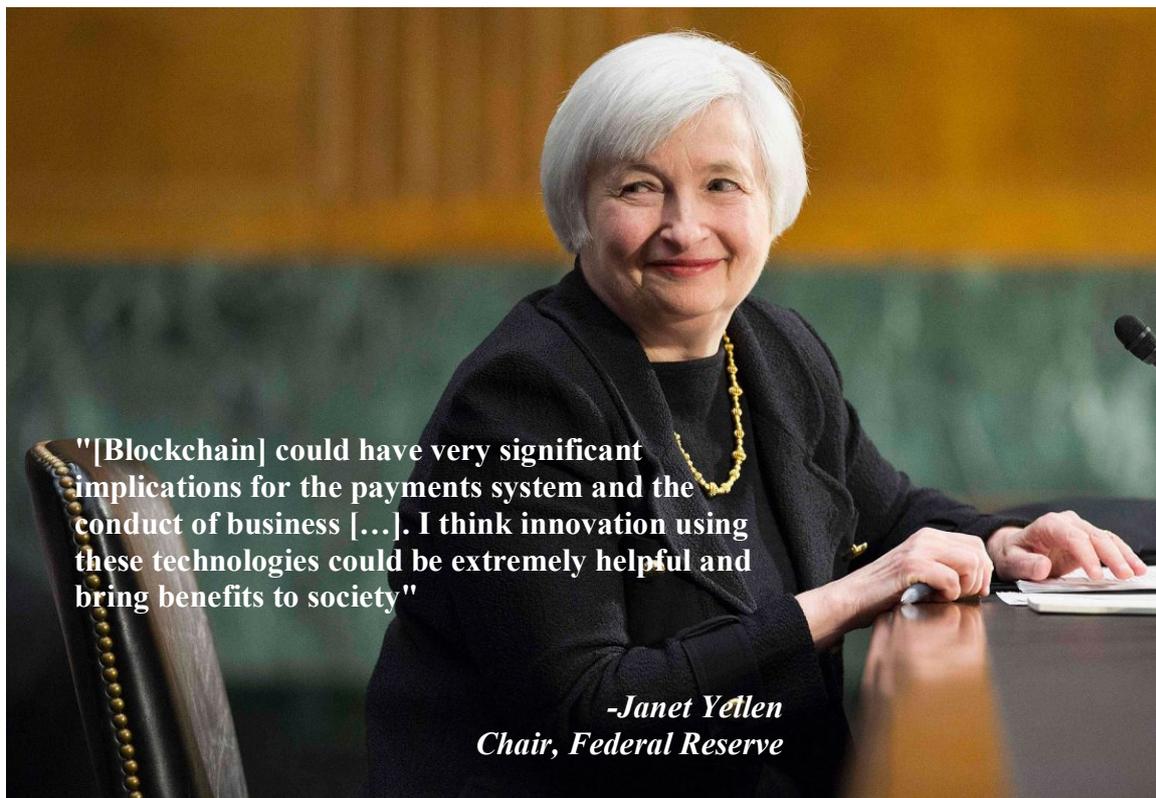
There seems to be an optimism among firms such as BNP that Blockchain can internally enhance organizational productivity. In 2017, we are likely to see more organizations and open hackathons focusing on addressing and building products that leverage blockchain technology to enhance business activities.



# CURRENT IMPACTS ON ASSET MANAGEMENT, BROKERS AND EXCHANGES

## Overview

From 2014 to present, large firms in the financial industry have been increasingly interested in researching how blockchain can benefit their operations and assist with compliance and making operations more efficient. From fund management firms to brokerage companies in Asia, Europe and the Americas to entire exchanges in most major financial hubs around the world, the blockchain has become a hot topic, with talk of speed, cost-reduction and scaling capabilities matched by regulatory compliance at the forefront of these discussions.



**"[Blockchain] could have very significant implications for the payments system and the conduct of business [...]. I think innovation using these technologies could be extremely helpful and bring benefits to society"**

***-Janet Yellen  
Chair, Federal Reserve***

## Asset Management

In the United Kingdom, asset management firms Schroders Investment Management and Aberdeen Asset Management have established a program consisting of five of the UK's largest fund houses to test and implement blockchain technologies for traders. They are interested in speeding up and verifying cross border payments and experimenting with blockchain for exchanges.<sup>[1]</sup>

The primary goal of these effort is to find ways to create transactions without the need for a trusted intermediary, a much touted facet of blockchain. The other aspect of blockchain which appeals to these management firms are lowering the risks of human error and tampering while reducing the number of man-hours and creating dramatic operational cost savings.<sup>[1]</sup>

## Brokerages

Medium-to-large brokerages and emerging startups have also begun investigating uses of blockchain for clearing stock trades instantly. In India, small company, uTrade has developed a blockchain solution named uClear which validates and posts transfer details across multiple ledgers such that all involved parties are aware of occurred trades. Since all trades are open to the parties, fraud is immediately detectable removing many of the headaches over compliance that brokerages manage on a daily basis.<sup>[2]</sup>

## Exchanges

With a similar goal in mind, stock exchanges from around the globe have begun investing in blockchain initiatives to overhaul their infrastructure. From Seoul to New York, stock exchanges are examining implementations of blockchain for optimizing trade settlements. In 2016, The Korea Exchange (KRX) announced plans to begin building a system for allowing off-board, direct, trades powered by blockchain. In the same week, Scotland announced plans to build an entire equity trading platform on blockchain to shorten payment verification time from months and days to milliseconds.<sup>[3]</sup>

In New York, the National Association Securities Dealers Automated Quotations (NASDAQ) has begun work on its Linq system for experimenting on blockchain technologies. Linq, in its infancy, is an attempt to build a blockchain system for trading stocks in a handful of companies such as Chain.com, ChangeTip, PeerNova, Synack, Tango and Vera. <sup>[4]</sup> Although many of these companies are already involved with bitcoin or related industries, the focus of Linq is on blockchain itself. Other exchanges such as the New York Stock Exchange are primarily concerned with integrating cryptocurrencies into existing purchasing systems.

Around the world, other exchanges have been investigating and prototyping blockchain technologies. These exchanges include The Australian Securities Exchange, CME Group, Deutsche Börse, Dubai Multi Commodities Centre, Japan Exchange Group (JPX), London Stock Exchange (LSE), and The TMX Group. <sup>[5]</sup> As we enter 2017, blockchain is primed to disrupt the transference of stocks. Although the activity surrounding the large management firms and exchanges raises eyebrows, there is one company looking to rebuild the entire equities market itself using blockchain as a core technology.

## Overstock and T0

At the end of 2015, the Securities Exchange Commission approved the company Overstock.com to issue stock over the Internet opening the door for the company to begin creating an entire exchange out of blockchain technology. In September 2016, the technology subsidiary of Overstock, T0 announced a partnership with brokerage firm, Keystone Capital to form an entirely digital Wallstreet based on blockchain ledger technology. <sup>[6]</sup>

According to Overstock CEO, Patrick M. Byrne, Overstock hopes to create a system for issuance and tracking of equities of traded company stock. They began this process in 2016 by issuing a security of Overstock equity stock. The stated goal for this project is the bringing of greater efficiency and transparency to capital markets. On the project website, T0 claims it will bring greater regulatory compliance, transparency, and allow full proof of ownership. A Proof of ownership solution has the potential of leveraging the blockchain as the underwriting mechanism, replacing such groups as The Depository Trust & Clearing Corporation (DTCC) and Cede & Company (C&C) allowing for actual stocks to be issued and traded rather than the current system of trading snapshots of paper. Byrne has been quite vocal about the intent of Overstock to completely rewrite the way equities and trading operate. <sup>[7][8]</sup>

# OUTLOOKS ON THE FINANCE SECTOR AND HOW THAT AFFECTS NON- FINANCIAL INSTITUTIONS

## Overview

Blockchain is expanding past finance and money transactions as large pharmaceutical companies such as Merck begin to research usages for blockchain in their processes. At the Medcity Converge conference in Philadelphia on July 12th 2016, Merck's Associate Director of Applied Technology, Nishan Kulatilaka, stated that Merck will begin heavily researching blockchain technologies stating his enthusiasm about the capabilities of blockchain for transparency and verification. He went on to surmise that pharmaceuticals could become the second biggest industry to begin integrating blockchain technologies [1\*].

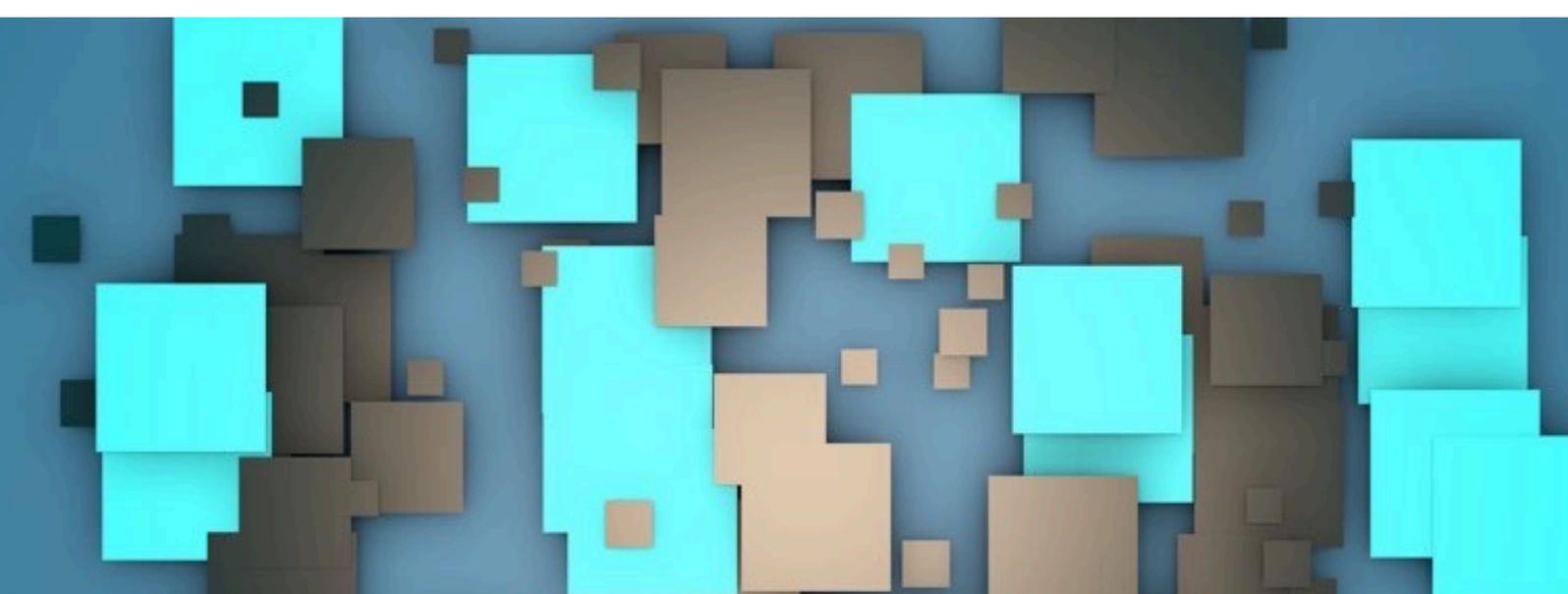
[2\*] Airbus has joined the Hyperledger project as a premier member in hopes of expanding the project beyond finance use-cases. They are joining other premier members such as IBM, Fujitsu, R3CEV, J.P. Morgan, Deutsche Borse Group, Digital Asset Holdings, Accenture, Hitachi, CME Group, DTCC and Intel. The Hyperledger project has graciously welcomed airbus onboard with Hyperledger Executive Director, Brian Behlendorf saying, "It's very gratifying to see leading organizations like Airbus join the project, as it shows the immense interest in blockchain technology and that it has the potential to make an impact beyond just the typical financial and healthcare applications."

## Impact

[3\*]In 2015 a report released by the UK Government Chief Scientific Adviser, numerous contributors outlined potential use cases for blockchain in preventing fraud and diamond laundering. One such case included a use of a particular blockchain known as Everledger:

*“The diamond industry is highly susceptible to criminal activity. Gems are small and easy to transport in a covert manner, transactions tend to be confidential, and diamonds retain their value for many years. As such, diamonds are involved in money laundering and terrorist financing on a global scale. Efforts to stem this illicit activity have included tracking diamonds with paper documents to certify their provenance. But document tampering is widespread — indeed, documents are sometimes created to cover up illegal transactions — and several countries with a major diamond trade still have insufficient legislation to guard against these crimes. To combat this, the diamond industry is beginning to implement a system called Everledger, based on blockchain technology, which establishes a digital ‘passport’ for each diamond.”*

Similar to the above attempts to prevent fraud in diamond exchange and contracting. Business strategist Peter Fisk surmises that blockchain could be a powerful tool for protecting intellectual property and transforming how brands work [4\*][5\*].



# SHIPPING, RETAIL, SUPPLY CHAIN & BLOCKCHAIN

## Regulation

Regulations such as the Sarbanes-Oxley Act in the U.S., The European Directive on Non-Financial Reporting, or the UK Modern Slavery Act have begun putting more and more pressure on logistics, manufacturing and distribution corporations to disclose their business footprint around the world. Additionally, the past 5 years have seen a massive rise in consumer concern about product origin, placing additional pressure on retailers.

## Social Awareness & Technology

These phenomena, paired with the advent of blockchain technology, have created new opportunity for firms such as Skuchain and other tech startups to begin building products focused on tracking items from manufacturing to distributors, from distributors to networks/retailers, and finally from networks/retailers onward to consumers. There are many projects underway such as the project proposed by Provenance that are demonstrating how smart contract enabled blockchains can transform supply chain transparency.

2016 saw the world's largest mining corporation adopt blockchain technology for the tracking and inventory management. Furthermore, Barclays completed the first ever smart contract based trade financing deal on the blockchain.

One of the world's largest shopping companies, Hong Kong based Marine Shipping, began tracking freight and materials using blockchain technology to lower costs and create greater convenience in verifying the origin status and destination of products.

To assist these efforts, IBM began investing heavily into blockchain technology with a large emphasis in supply chain transparency. In October 2016 IBM teamed up with a startup to track items stored in lockers awaiting pickup by consumers. The United Arab Emirates has been exploring means to leverage blockchain to depress the growth of companies engaging

in the illicit sale of diamonds and other precious minerals (so called blood diamonds) from Areas of conflict.

In 2017, blockchain represents a way to verify the authenticity of date of records while overseeing organizations and lowering costs in doing so. However, the costs associated with implementing blockchain technology is various and a new line item for requirements that must be carefully considered by companies.

Given the cost savings that can associated with lowering the price of auditing, validating most records on the blockchain could save potentially millions of dollars a day as in many cases. For example, a walmart investigation into compliance practices and shipping methods cost the organization \$1.2 million (USD) per day according to a source from the FBI.

In summary, blockchain implementation can be perceived as a way to improve public image and boost public relations associated with consumer facing brands. Regarding the savings on auditing during investigations and supply chain misconduct prevention, results have yet to be seen. However, the potential for cost saving is high. 2017 is likely to yield insight into these areas.

An aerial night photograph of a city, likely New York City, showing a dense grid of streets and buildings illuminated by warm yellow and orange lights. The lights create a complex pattern of lines and dots against the dark background of the city and surrounding areas. The text 'SERVICES AND PRODUCTS' is overlaid in white, bold, sans-serif font in the upper center of the image.

# SERVICES AND PRODUCTS

# INTERNET OF THINGS AND BLOCKCHAIN

## Overview

Shared ledger technology, when combined with simple mobile user interfaces, potentially moves much of the complexity in managing security into the background. Institutions choosing to adopt these technologies will need to win the confidence of the public, and early trials and implementations will be helpful in achieving this.

Pertaining to Industrial Equipment (a linked 'Internet of Things'), It can be difficult to gather accurate real-time data about industrial equipment across many sectors, including transport, utilities and agriculture.

With the advent of the Internet of Things (IoT), some of these difficulties are being addressed with low-cost commodity hardware, but these solutions are potentially vulnerable to attack.

## Impact

According to a recent report from the IBM Institute for Business Value:

*“The result: a proliferation of hundreds of billions of devices that will be no more expensive than their dumb counterparts, yet able to operate and act as part of complex, integrated systems. In a network of the scale of the IoT, trust can be very hard to engineer and expensive, if not impossible, to guarantee. For widespread adoption of the ever-expanding IoT, however, privacy and anonymity must be integrated into its design by giving users control of their own privacy. Current security models based on closed source approaches (often described as “security through obscurity”) are obsolete and must be replaced by a newer approach – security through transparency.”*

The report continues to outline a framework for transaction processing systems.

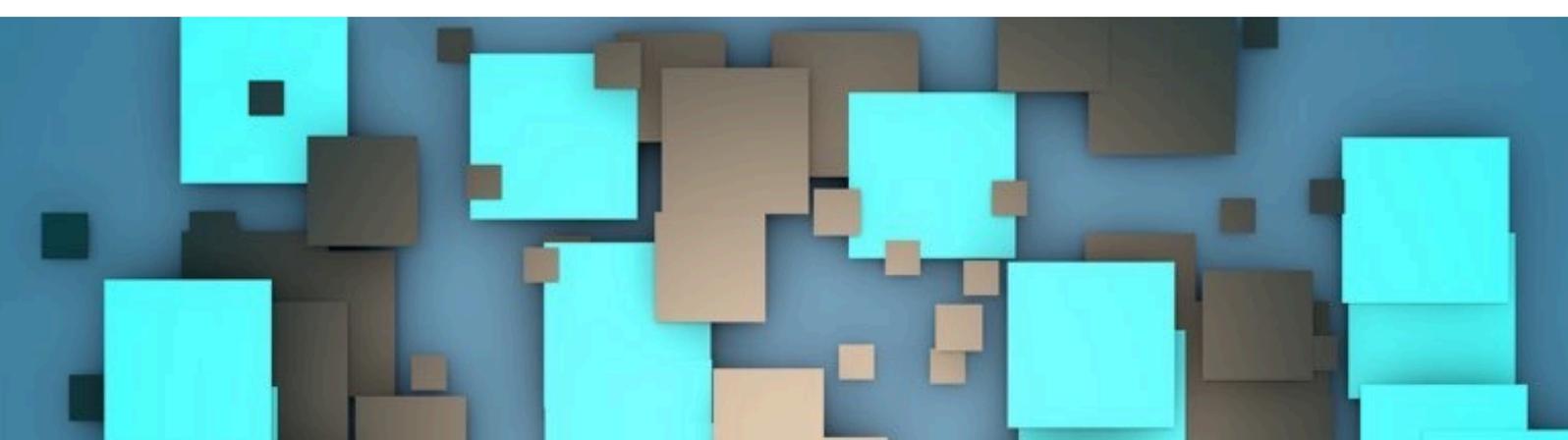
*“In our vision of a decentralized IoT, the blockchain is the framework facilitating transaction processing and coordination among interacting devices. Each manages its own roles and behavior, resulting in an “Internet of Decentralized, Autonomous Things” – and thus the democratization of the digital world”*

*In short, if each device functions both as an autonomous agent, and a part of the whole, there is no central point of failure. In this use case, institutions would apply IoT devices and gain many of the benefits associated with real time data and connectivity as outlined in the recent Government Office for Science report on the IoT.*

*The report contends that Shared ledger and blockchain technology provide new business and technology models for higher security implementation of IoT. For example, A tractor that operates as an autonomous unit can authorise access to multiple farmers in an area, enabling a pay per use model. It has the ability to discover and pay for climate data, and communicate with its manufacturer for maintenance and repairs.*

*In another example, industrial equipment can be empowered to order new parts, as long as there is certainty that that device is genuine and has the authority to do so. This may also lead to new ways of financing such equipment, and new marketplaces based on the equipment’s performance or efficiency.*

As IOT mechanisms continue to be integrated into homes, businesses, and entire industries, the shared ledger has vast implications regarding the security outcomes of IoT integrations.



# LEGAL SERVICES AND SMART-CONTRACTS

## Overview

Ethereum and other decentralized application platforms have created a huge surge of interest in smart contracts and resulted in many new potential applications coming up to light, in particular in the domain of law and legal services. This resulted in many suggesting smart contracts would disrupt, threaten or even replace legal firms <sup>[2]</sup>.

## Impact Of Smart Contracts On Legal Services

Smart contracts are essentially a set of instructions which are resolved deterministically. They are deployed on a blockchain and can control any aspect of the distributed ledger. These instructions are not necessarily legal (meaning anything can be encoded in a smart contract) nor intended (meaning anyone can potentially hack this contract or the contract could hold loopholes).

According to a document written by DLA Piper, the third largest law firm in the world, the EU passed a regulation on the 1<sup>st</sup> of July stating that the digital signing of contracts had the same legal status as handwritten signatures. They write: *“The introduction of the EU Electronic Identification Regulation 1 which came into effect on 1 July 2016 recognises ‘qualified electronic signatures’ as having expressly the same legal status as handwritten signatures.”* The firm then goes on to express their enthusiasm for the technology stating: *“This new cryptographic approach to finance and law, further powered via blockchain, creates numerous potentials for innovation for business within finance.”*

Although smart-contracts have not yet entered the daily lives of most legal services and law firms, some, such as Hong-Kong based company King & Wood Mallesons, have already started either hiring developers or teaching smart-contract programming to their lawyers.

In contrast to smart contracts, legal contracts can hold terms, statements and conditions which are not deterministic and would require human assessment. They may be inextricably complex in terms of languages, may require abstract reasoning and provide a poor language for translation in terms of code, or may require human interactions or actions which can not be completed digitally.<sup>[4]</sup>

Multinationals such as Microsoft and IBM as well as specialized firms such as Monax (formerly known as Eris) are collaborating and launching their own smart-contract platforms which leads to thinking that smart-contract are on the verge of becoming a global force in the sector.

It is quite certain that firms will find a large number of use cases in this sector and that smart contracts will facilitate many legal transactions and agreements. However, there are also many unrealistic expectations regarding smart contracts and have a fair bit of further development before having the potential to replace legal agreements.<sup>[3]</sup>

According to DLA Piper partner Martin Bartlam, there are four core legal and regulatory issues that need to be addressed before large scale integration of Blockchain in the legal field. The first is Jurisdictional application of the law which pertains to the need for blockchain to appropriately implement the law while also taking to account that, in law, “these principles differ across jurisdictions and therefore identifying the appropriate governing law is key to both contract and property rights.” Secondly, Bartlam states the challenges of Decentralized Autonomous Organizations. The third issue needing to be addressed is the enforceability of Smart Contracts. Finally, he raises concerns about the transparency and privacy of blockchain tools, noting that anonymity can be a hindrance to regulators.

It appears that in their current development state, smart contracts have the potential to disrupt the law and legal services sector by replacing relatively simple and deterministic agreements such as M&A’s and escrow mechanisms<sup>[5]</sup>. A common vision for the future of smart contracts is that they will complement real-world legal contracts to provide a simpler overall execution. The major issue is the implementation and the lack of experience with blockchain technology in these firms. The whole infrastructure needs to be updated, protocols need to be developed and decision-makers of this sector have to be convinced. Despite this, smart-contracts will most likely become a vital tool for legal industries in the upcoming years.<sup>[1]</sup>

# INSURANCE AND BLOCKCHAIN

## Overview

According to the FBI, insurance fraud in the United States accounts for up to \$80 billion USD in losses for insurance companies from the \$1 trillion USD done in business per year. They also connect this loss to a raising of premiums on citizens and state that they are currently attempting to curb insurance fraud through investigatory proceedings.<sup>[1]</sup> Many speculate that blockchain holds the solution for this enormous problem with its ability to verify transactions, store them securely, and run special computer code (smart contracts) to legislate claims.



Figure 4 : P&C Claims Process ( Source : World Economic Forum Report - Reconstruction)

## Impact Of Smart Contracts On The Insurance Sector

In a report released in July 2016 consulting firm, McKinsey&Company wrote that blockchain could be used “To more effectively detect identity fraud, falsified injury or damage reports, etc., blockchain can be used as a cross-industry, distributed registry with external and customer data.” They then highlight certain key areas where blockchain implementations can help including validating the authenticity of goods and documents, checking police theft reports/claims history and detect patterns of fraudulent behavior related to a specific identity, verifying purchase dates, and confirming subsequent ownership and exchanges<sup>[2]</sup>

The report also highlights some key value creators that a blockchain solution could bring to the insurance industry paying special attention to the savings brought about by reducing administrative costs. In this area, accounting firm, Deloitte, an international accounting firm, agrees. It writes in a 2016 memo:

*“Adopting a common blockchain across the sector could create a step-change in value in the insurance industry: claims-handling could become more efficient and streamlined, resulting in an improved customer experience.”<sup>[3]</sup>*

The Deloitte report also remarks on the capabilities of smart contracts while also assuaging fears about maintaining competitiveness stating, *“A common claims-handling platform would still make it possible for individual insurers to compete for customers, offering a range of products and prices by virtue of the smart contracts they set up.”<sup>[3]</sup>*

McKinsey also highlights the potential to transform the compliance issues of the insurance industry, stating that “shaping a stimulating regulatory environment” should be a challenge and a goal of any blockchain implementer.

Although these reports focus more on the future and the possibilities of blockchain, they also take into account the hurdles facing any future implementation of distributed ledger technology. Deloitte preambles the issues writing, “If transactions involve only a limited number of parties – or do not require an intermediary – or if a well-established, trusted intermediary already exists, insurance players may be well advised to continue working under their current transaction models.”

The other possible challenges facing blockchain technology integration into the insurance industry highlighted by Deloitte and McKinsey involve its problems with scaling, issues with hacking, and the need for blockchain to standardize. In this interest, a few firms have begun tackling these challenges by creating proof of concepts and entire products for applying blockchain. In October of 2016, Techcrunch highlighted 5 firms currently building out technologies to mitigate the problems listed above.<sup>[4]</sup>

In order to address privacy and security concerns, the product, ‘Enigma’ promises to enable parties to store and run computations in private. Another product, Dynamis, has already begun testing a peer-to-peer DAO insurance company built on Ethereum and enabled by smart contracts on an ‘audited ledger’. In the smart contract space, companies such as Rainvow and Factom have created ‘parametric insurance’ policies which would trigger payments upon certain events streamlining payouts and making life more convenient for customers. Finally, Italian start-up, Helperbit, has placed microinsurance on the blockchain allowing philanthropists to donate to remote areas stricken by crisis while reducing fraud exposure.<sup>[4]</sup>

Finally, moving the space forward, developers Christoph Mussenbrock and Stephen Karpischek have produced the Ethereum application, FlightDelay, which deploys insurance policies for airplane tickets.<sup>[5]</sup> On their site, they describe the function of their flight insurance application as “If the flight is delayed or cancelled [sic], you get an automated, instant payout.”<sup>[6]</sup>

In 2017, many of these projects will begin to come into fruition however it may be much longer before some of them reach full maturity. Financial strategists predict that the insurance industry will continue to investigate the technology by forming consortia as well as building a regulatory environment prepared for blockchain integration. McKinsey postulates that it may take up to 5 years but acknowledges a significant potential for blockchain in insurance stating “Considering all of this, now is the best time for the insurance sector as a whole and for individual insurance players to further investigate the blockchain technology and its potential.”



# PERSONAL AND CORPORATE IDENTITY ON BLOCKCHAIN

## Digital Identity

Everything around us is becoming increasingly digital, leading to the movement of identity digitalization to secure our identities and make daily lives easier. The uses of digital identities are numerous and currently processed via online login systems protected passwords. Each platform requires a different authentication and each individual is, to a certain extent, responsible for the amount of security he dedicates to protect his online identity. Although new technologies and processes such a double-factor authentication have recently been introduced, managing personal identities remains a huge challenge today that many people tend to overlook. Different blockchain technologies provides a secure platform to record and store private information.

## Current Experiments And Future Applications

Applications involving managing identities via blockchain are become slowly but increasingly popular. Governments, companies and startup working on the applications in this sector are working on both bitcoin-style blockchain and shared ledgers blockchains although the latter ones are generally preferred due to the need for permissions.

Estonia recently introduced the concepts of e-residents. Estonian e-residents can perform various actions such storing and encrypting documents and files, claim ownership and digitally sign these documents or found an online company based in Estonia <sup>[3]</sup>. The largest Korean banking firm Kookmin Bank (KB) is currently in the process of integrating a blockchain identity device along with the credit card they provide. <sup>[4]</sup> uPort and Microsoft are presently working on a sovereign identity system based on blockchain technology. Finally, another big name in the field of digital identity is Bitnation, the first Decentralized Borderless Voluntary Nation.

Bitnation is focused on providing the same type of assistance that geographical states traditionally provide, which includes digital and secure identity and reputation systems but also security, insurance and different type of services through local contractors. Every

person on the planet can register has a citizen of Bitnation and is then provided with a citizenship ID. The reputation system is the basis of every individual ability to perform Bitnation-related acts such as marriages or land deeds.

Bitnation has received relatively large coverage in the media and is the the blockchain-based service to partner up with a state (Estonia) allowing for digital notarization of documents on the Blockchain.

## Pros, Cons, Challenges, Opportunities, Barriers

Digital identities are currently scattered around different systems that require online, offline authentication or document submissions. Using blockchains based on private shared ledger technologies would enable an individual for daily actions or life events such as birth certificates, wedding certificates, bank account openings and transfers, tax payment etc <sup>[1]</sup>.

The immutability of the blockchain ensures that the information stored on the blockchain is authentic and the time-stamp for each block allows for allowed individuals and authorities to verify or audit the recorded information and events. According to a report released by the World Economic Forum, blockchain would allow for “Faster and accurate anti-money laundering (AML) and KYC processes.”

While the proof-of-concepts seem promising, the real-world implementation remains complex. Although the complexity does not lie in the blockchain itself, but rather in finding an appropriate common standard, setting up a legal framework and scaling. Several problems also arise with the immutability of the blockchain. Thus any data entered can theoretically not be removed which represents a problem if false data is entered by mistake and might interfere with the right to oblivion.<sup>[2]</sup>

# INTELLECTUAL PROPERTY & BLOCKCHAIN

## Overview

While content creators, inventors and artists traditionally protect their work by filing a copyright claim at the Copyright Office, the internet and the arrival and multiplication of non-physical content has led to new challenges in this domain. The common example is the domain of music where it is very difficult for an artist to enforce the rights on his properties because of the digital nature of the content.

## Intellectual Property & Blockchain

Numerous firms and startups have jumped on this opportunity and understand that shared-ledgers based on blockchain are the perfect technology for this use-case<sup>[1]</sup>. The tamper-proof time-stamped registry entries are an unquestionable proof that someone created and registered an object. Tracking ownership is another area in which blockchain proves to be clearly efficient, in particular in case the content is owned by different people or changes ownership over time<sup>[2]</sup>

The most influential startups in this regard include websites like Blockai, Pixsy, TinEye, Ascribe, Mediachain and Proof of Existence, which all more or less at recording and maintaining proof of ownerships. They tackle one of the most problematic issues facing centralized services, which is that even if the company is shut down, the record of ownership still exists somewhere on a blockchain and can be retrieved virtually forever<sup>[3]</sup>.

However, here again, there is no legal support for blockchain protection of copyrights. While content creation can be recorded, this currently does not provide any legal protection. For instance, writing in a journal or diary will not protect your copyright. Likewise, In the U.S., enforcing copyright requires a registration at the U.S Copyright Office and other institutions or party are virtually of no use in this process. Therefore, blockchains cannot protect copyright in the current state of technology and legislation<sup>[4]</sup>.

# BLOCKCHAIN FOR DEVELOPING COUNTRIES

## Overview

Blockchain supporters have begun to recognize the technology will be useful in fighting corruption in third-world and developing countries.

The first obvious application of blockchain is to use the shared-ledger technology to track every financial transaction. In particular, encrypting additional data about the transaction in each block would result in a strong record of transactions that could be used as evidence as well as for audits and official use.<sup>[1]</sup>

Another major problem in these countries is maintaining or establishing democracy. Voting systems are often manipulated by participants and governments or do not ensure the proper recording of each vote. A blockchain implementation as a publicly-accessible shared ledger could be implemented first as a way to promote online voting and secondly to secure and protect the democratic voting process. Brazilian start-up Democracy Earth has recently unveiled its open source voting software DemocracyOS and is developing products to improve the democratic process through Blockchain.<sup>[2]</sup>

## Economic Development

Legal infrastructure in these countries is often limited and citizens often face challenges documenting and providing evidence of identity, ownership and any financial transactions or economic activity. 'Dead capital' (assets without any official or legal existence) is a major burden for developing economies which could lead to substantial economic growth if it was reduced<sup>[3]</sup>. Here again, the shared-ledger technology allows for a secure record of citizen activities which will help giving an official frame to economic activities. Smart-contracts are another tool that could help individuals and businesses make their economy more formal. Blockchain contracts would enable citizens to receive access to land titles, have legal rights to perform various business related actions.

The challenges are the same as for all blockchain applications, which is that implementation is difficult. This problem is even more acute in this case as developing countries have limited infrastructure and Internet access is often far from perfect and the boundary of legality are often blurry. However, this could also represent a chance. As there is currently no system to replace, the blockchain standard could be easily defined and implemented without having to comply to an existing standard.

# GLOSSARY

**Audit:** An audit is the inspection of the documents, financial statements, account and books of a corporation or an individual by an independent party to determine whether the entity is in accordance with specified criteria. The audit can be performed internally or externally as well as by regulatory entities.

**Bitcoin:** Bitcoin is the name of a crypto-currency as well as the associated system invented by a mysterious programmer known under the name of Satoshi Nakamoto but never identified. Bitcoin was officially created on 31 October 2008. The crypto-currency is based on peer-to-peer transactions which can not be administered by a central identity. The transactions recorded in a distributed database. Although the distributed database on which the bitcoin technology is based is called blockchain, the blockchain represents a different technology with wider applications than Bitcoin.

**Blockchain:** A blockchain is a particular type of distributed ledger consisting of an ever growing list of entries which are commonly named blocks. Each of these entries is time-stamped and is linked to a previous block. In addition to traditional shared databases, blockchain implement different set of rules tied to the block itself.

**Brokerage companies:** A brokerage firm is a company or an institution that serves as an intermediary for selling and buying financial securities.

**Central Bank Digital Currencies (CBDC):** A cryptocurrency issued by a nation's central bank.

**Compliance:** Compliance is the act of complying to a law, a policy or a set of specific set of rules. Regulatory compliance is the act for a company to ensure that they conform with the current and relevant set of laws and regulations.

**Consensus Process:** The ledger has to be identical for all the participants. Therefore, whenever an entry is made on the ledger, a group of peers participates on a consensus process. If the data is validated (meaning a consensus is reached), the entry is added and the ledger is updated for all participants.

**Cryptocurrency:** Crypto-currencies are intermediaries used for trading based on cryptography to perform transactions and create units of currency.

**Distributed Ledger:** A distributed ledger is a type of database that is divided and shared among different participants or locations. The database is decentralized which eliminates the need for a central authority that validates, controls or could potentially censor transactions. Each record is recorded after a validating vote and is provided with a crypto-signature to ensure it's validity on the blockchain.

**Ethereum:** Ethereum is a blockchain-driven distributed computing platform which implements smart contract functionalities. Ethereum is running on a decentralized virtual machine, the EVM (Ethereum Virtual Machine) that allows for the execution of contracts with a crypto-currency.

**Hyperledger** : Hyperledger is a collaborative open-source project backed by a consortium of major companies aimed at building and developing blockchain-based distributed ledgers.

**Multi-factor Authentication** : multi-factor authentication is a method of authentication in which the the person who desires to gain access has to provide multiple pieces of evidence of his identity.

**Immutability of the Nlockchain** : the immutability of the blockchain refers to the property of the blockchain that prevents data which has been input on the blockchain to be removed. Every entry on the blockchain is linked to the following block by the means of a hash which makes it un

**Internet of Things (IoT)** : The network of physical and electronic apparatus and devices which are also often referred to as connected devices. These objects retrieve data from their surrounding environment which can later be used for economic benefit or analyzing information.

**Permissioned Blockchain** : (See Permissioned Distributed Ledger)

**Permissioned Distributed Ledger** : A permissioned shared ledger is a distributed ledger in which the consensus is reached through a limited number of participants. This is in opposition of permissionless shared ledger where the consensus includes every participant to a public network.

**Permissionless blockchain** : (See Distributed Ledger)

**Peer** : In the context of blockchain technology, an actor is an individual that participates in the consensus process (see below) to validate entries and maintain the integrity of the ledger.

**Participant** : In the context of blockchains and shared ledgers, a participant is an individual, a corporation, institution or any entity that can read or write entries on the ledger.

**Remittance** : A remittance is a sum of money sent by an immigrant or foreign worker to a person in his native country.

**Right to oblivion** : the right to be forgotten or right to oblivion is a recent concept which states that after a certain period of time, past actions should be forgotten and not be regarded when considering further official and legal actions or for example when seeking employment or insurance.

**Sabes-Oxley Act** : The 2002 Sabes-Oxley Act (SOX) resulted top executives having individually certify the accuracy of financial information. The act also increased the penalties for fraudulent activities and required more independence on the institutions who perform financial audits for these corporations.

**Securities Exchange Commission** : The U.S Securities and Exchange Commission is an office under the responsibility of the United States federal government that focuses on enforcing federal rules and laws regarding securities, stock and options exchanges.

**Smart-contract** : Smart contracts are computer programs that are aimed at replacing, facilitating or complementing real-world legal contracts. They consist in a succession of computer code statements that emulate the structure of a legal document. They intend to provide an increased security and an objective trustless execution.

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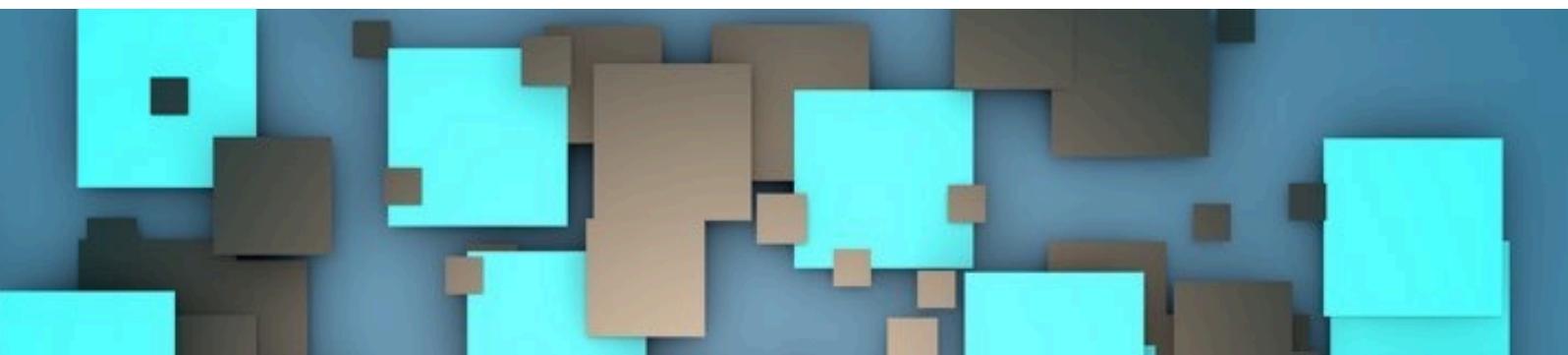
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**Authors :**

Mike De'Shazer

Tai Kersten

David Van Isacker