

Blockchain Technology

# What blockchain is and how businesses can take advantage.



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# Blockchain – a new reality for business

Blockchain offers businesses the opportunity to trust each other more easily. Proponents claim it will:

- Lower banking fees
- Improve access to finance
- Make asset tracking easier
- Enhance accountability and corporate governance
- Improve data security

At a high level, blockchain represents the opportunity to create what one commentator has called a “distributed consensus”<sup>1</sup> about reality – a collective agreement about the history of anything.

This report:

1. Considers the merits of the technology.
2. Demystifies the technology by investigating tangible examples - where available - of how blockchain is used by businesses.
3. Provides examples of future uses of the technology.

This report is not intended to add to technical discussions, but instead to communicate the principles that make blockchain an exciting prospect for now, and for the future.

## A health warning

There is a large amount of hype surrounding blockchain. But be warned: the technology is early stage, like the internet in the 1990s.

A number of use cases exist that can save businesses money, including money transfer, remittances and asset tracking. There are other efficiency benefits too. This report explains how blockchain works, why it is revolutionary and what businesses can do to take advantage. Being a pioneer need not be expensive and the dividends today and going forward are worthwhile.

Understanding this context without getting caught up in the hype is critical. Most thinking about blockchain remains in the imagination phase and does not relate to ways businesses can utilise the technology. In short, this technology is at the ‘early adoption’ phase with limited suppliers of a usable service and only pioneers as customers. This report aims to offer a practical guide and introduction to how and where opportunities exist.

We advise understanding the technology and considering if current use cases are applicable to your business. Appreciating the capability of the technology is vital. Blockchain could significantly improve the way trust is established between parties in business.



# What is Blockchain?

A blockchain is a distributed ledger. The ledger can be entirely public, or limited to a certain number of participants. The ledger can track the ownership history of anything, such as a house, or stocks and shares.

Each time something changes on the ledger, a new block is added to the chain, and the history of the chain remains in place – a “write once, read many” database. A blockchain can be a database of anything: who owns land, where a diamond came from, equity owners in a company, a person's health record.

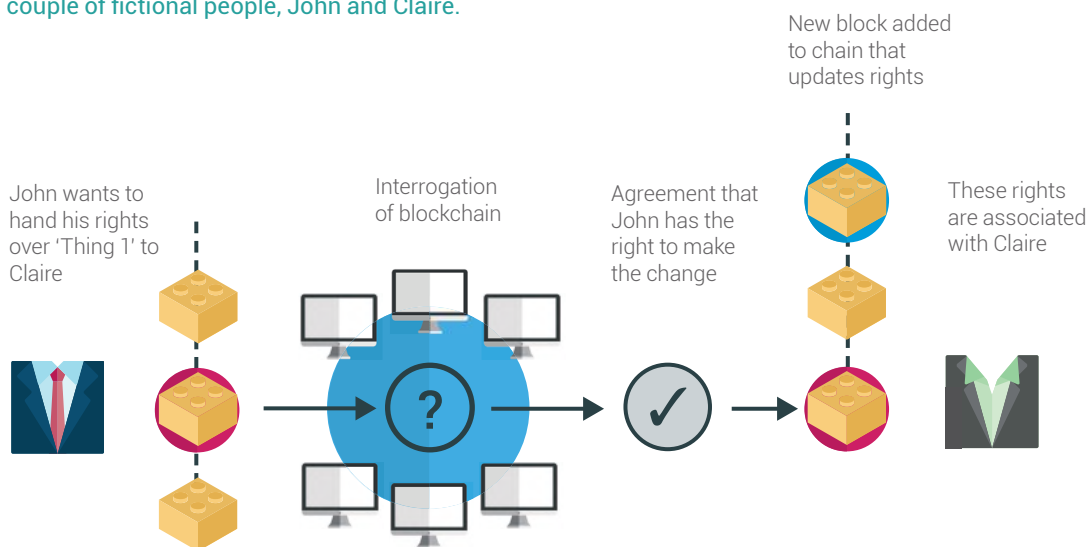
If alterations need to be made, these create new blocks on the chain – no historic changes are permitted. Blockchains thus keep a record of what belongs to whom at any given point in time. They also capture the history of every version of reality that came before. A land registry is one good example of something that could be recorded on a blockchain.

When a change is proposed, the entire history of the chain is investigated by every computer plugged into the blockchain network. This investigation verifies that the person proposing an alteration actually has the rights to make that change. The question being asked is: 'does the history of the blockchain show that 'Person X' has the right to transfer 'Thing 1'. This process prevents against double spending of rights, like capital, in the digital space.

If this were a land registry, then the rights over the land will now have been transferred. Greece, Nicaragua, Georgia, Honduras and Sweden have all explored the possibility of putting their land registries on a blockchain.

To incentivise the interrogation required to make the change, those who own the computers (known as 'miners') which are plugged into the blockchain networks are offered a small reward.

The below diagram demonstrates this with a couple of fictional people, John and Claire.



Greece, Nicaragua, Georgia, Honduras and Sweden have all explored the possibility of putting their land registries on a blockchain.

That reward could be a very small right over something that the blockchain is tracking. This is true of the Bitcoin blockchain. Bitcoin is a virtual currency, sometimes referred to as a cryptocurrency, and those who have the right to Bitcoins are tracked by a blockchain. To incentivise the computers for policing the Bitcoin blockchain a reward is offered, in this case new Bitcoin. This is how new Bitcoins are minted. Any person who owns a computer can interrogate a public blockchain, like that which tracks the ownership of Bitcoins. Therefore, anybody can help with the administration and policing of the blockchain. These reward systems mean the running costs of a blockchain are very low.

Any person or entity can check a blockchain, and all entities must agree on one version of the truth before updating the blockchain, this underpins the value and legitimacy of the chain. Encouraging a vast number of distributed miners to check the work of each other before any changes can be made aims to maintain the operational integrity of the blockchain. When taken together, this creates trust.

Business cannot exist without trust. Critical decisions are taken every day based on the ability of the decision maker to trust evidence, and the others with which they are doing business (this could be their credit worthiness, asset ownership, identity etc.).

Trust enables contracting and exchange to take place between parties. If there is no prior relationship, authenticity and confidence is provided by the 'Trust Industry' – a web of insurers, lawyers, accountants, credit agencies, financial institutions and regulators. This web can be cumbersome and dominated by a few big players - especially at the international level. Transaction fees, particularly those that are cross-border, are one example of how the need to establish and communicate trust about the credit worthiness of different parties, all leads to cost. These costs are passed to consumers and create opportunities for error and/or exploitation.

Efficiencies and the ability to circumvent the existing trust industry reduce cost to users.



# Benefits of Blockchain technology

The benefits of blockchain are derived from the following key facts:

1. They embody a collective consensus about reality – about where we are today and how we got here.
2. This reality is openly shared, either publicly, or amongst all the participants in a limited private blockchain.

Below we explore the four primary benefits that result from these facts.

## 1: Efficiency and productivity

Because the blockchain embodies a collective consensus it streamlines decision making between participants. As the facts of the matter are pre-established, participants can skip straight to doing business.

Renowned for complex back-office IT infrastructure, financial services are, as Forbes has put it, “drowning in their own complexity”.<sup>2</sup> Myriad instruments, a mixture of paper and digital, shuffled in with proprietary ownership of in-house software developed using enormous budgets, has bred a mind-set of protected systems and natural conservatism. Together with the silos that tend to evolve when organisations

become very large, this has reinforced a culture of preservation and protection when it comes to redesigning ‘critical infrastructure’ or business process. A distributed ledger technology for agreeing truths represents a way for financial institutions and their conduits to speak to one another with greater ease. As a result, Santander estimated that blockchain-enabled technologies for payments, capital markets, trade services and so on could save up to \$20 billion per year by 2022.<sup>3</sup> Such savings could be passed to customers.

Systemic inefficiencies do not just apply to financial services. They are a by-product of the way databases have evolved since the 1980s and can affect any organisation. Almost all databases, are centralised ‘relational databases’ (SQL, for instance). Connections are made in and out of the database, if there is slight change to the way the data is held – the foundation of the architecture – this can cause a bug that affects all of the software built on top of it, causing the IT to crash. Bugs break IT architecture, in turn damaging productivity. These bugs can be a significant drain on company resource both during repair and preventative phases. In addition, centralising data makes it an attractive target for theft.

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Connecting the IT architecture with an entity outside of that ecosystem causes yet more potential problems.<sup>4</sup>

A distributed ledger – vis-à-vis blockchain – can provide a database of information that is not maintained by one single entity and is trusted as a consensus since it constitutes 'shared facts'. There is therefore no need to authenticate because everything on the ledger has already been authenticated as 'truth'. For example, a company's own view of its accounts is a centralised reality, this must then be audited by a certified accountant to become a reality accepted by a tax authority or another party (say if the value of the company is being assessed by a third party).

First of all there needs to be trust, which tends to be established today by using protocols and intermediaries, which again require resource to maintain. As private and public bodies have evolved their IT infrastructure over the years they have also, as a by-product, instituted their own ecosystems. Getting these ecosystems to speak with one another is possible, but it can be tricky, time-consuming and expensive. Interfacing the ecosystems can also lead to bugs.

Cloud computing has succeeded in creating more collaboration between ecosystems, but has also created large clouds of data held by centralised entities, like Google. These entities thus accrue incrementally more commercial power as their user list increases, but they are also increasingly becoming targets for data theft.

## 2: Access to finance

Blockchains can:

1. Speed up access to capital, especially cross-border. Most of the leaders in the blockchain industry are in the 'money transfer' business, offering greater speed and lower cost than traditional financial institutions. It is possible to sum up their service as 'money by email' or 'money by text'.

2. Provide access to capital, including micro-finance, to those without access to a bank or the credentials to obtain credit.

Access to capital promotes business growth and enables people to take action. Transaction efficiency, as discussed above, quickens transfer of capital. There are also benefits at the microfinance level.

### Peer-to-Peer lending and microfinance

Peer-to-Peer (P2P) lending platforms offer access to finance to individuals and businesses that may traditionally be excluded from financial systems, due to poor credit risk profiles for example. A P2P platform reduces or removes the reliance on informal loans which otherwise might have led to them being open to exploitation.

Blockchain enabled lending platforms could solve a lack of liquidity by connecting lenders directly to those that need credit. This P2P lending structure is an excellent fit with blockchain because it can facilitate greater trust in the risk profile of the borrower. These profiles can be established by any third party because of the availability of every historic piece of lending data. Those that facilitate P2P lending today may not make such data public, whilst blockchain enabled platforms would. Doing so could widen participation on the lending side, increasing the liquidity in the microfinance space.

The main limitation on P2P platforms has been the default rate, especially in China where there were reports of more than 2,400 such defaults.<sup>5</sup> Blockchain enabling could create the trust that these lending marketplaces require.

Because of the removal of intermediaries, blockchain can also be used for money transfer in the developing world and for remittance transfers, as well as taking advantage of the mobile payments revolution. In an interview with us, Brit Yonge from Lightyear, was keen to underline how "imagination is getting ahead of the [blockchain] tech" and that remittances are, one use-case that is present and proven today.



"That is a great use case", he commented "because it allows those that pay the most for global transactions, who happen to be the poorest, to not be burdened in that way anymore."

Remittances are for small dollar value equivalents. The goal for global payment systems developed on Stellar is getting larger volumes. "If we get more users on the

network, you get more transactions; if you get more transactions you get greater depth of book, if you get greater depth of book you can support more flow." This means that larger payments, such as those that SMEs expanding into new territories would like to make, can be supported.

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### How blockchain can create efficiencies

- **Appraising a mortgage application:** this requires a number of steps from ratifying identity, checking credit worthiness, ensuring land records are in place, and then processing any transfer of credit and asset. A distributed consensus about an applicant and the land registry, taken together, could enable the process to be far quicker.
- **Land registries:** these have vast paper trails and have been a focus for blockchain enabling. The World Trade Organisation (WTO) states that 70% of the world's population has no access to a land registry. Kairos Future (an international research and management consulting firm) has stated that over \$100 million could be saved in Sweden if the land registry was put on a blockchain.
- **Customer due diligence:** in professional services for example, the necessary due diligence can delay the delivery of advice, services or products to customers as KYC (Know Your Customer), AML (Anti Money Laundering) and FACTA (Foreign Account Transparency Act) checks need to be performed. Effort applied to deliver these checks is duplicated by every entity because a distributed consensus does not exist.
- **Insurance:** the processing of claims requires the coordination of a number of different entities – customer, claimant, insurer, claim agent, those delivering the service/product for the claimant. Sharing one blockchain showing the status of a case and its progress will make it easier to process claims and could lower the amount of manual checks required at each step.
- **Traditional bank transactions:** each bank maintains its own internal ledger of customer data. When a request to transfer capital or another asset is made, the bank confirms with various counterparties that the transaction is approved. This process is open to errors as each party communicates with one another. The reporting of these transactions along with associated broker fees can therefore accrue audit and compliance costs. Blockchain removes the administrative costs associated with all of these steps.
- **In the UK,** it is argued we are suffering from a productivity crisis and stagnation of earnings growth. Efficiency savings such as those above, by sharing and maintaining blockchains, could begin to play a role at the macro-level improving productivity.
- **Simply put:** lower bank, legal, insurance and accountancy costs mean lower fees for entrepreneurs and SMEs.

### Crowdfunding

Blockchain is also a logical complement to crowdfunding

When the chain is started, shareholder rights are associated with the initial holders of the equity in the company. The blockchain then tracks any transfer of equity related to the company.

As such, it introduces increased transparency to crowdfunding. Theoretically, this should also increase investor participation and in turn liquidity as each company would have its own blockchain and a floating value. Fees currently obtained by those that administer the crowd fund, like Kickstarter, could also be greatly reduced.<sup>6</sup>

After the initial fundraise, a situation is created wherein the fledging company is incentivised to report their progress, just like if it was publicly listed.

Companies geared around enabling this blockchain based crowdfunding include:

- Starbase
- FundYourselfNow
- The Korean Stock Exchange recently launched its start-up market on top of blockchain technology Blocko.

### 3: Corporate governance and transparency

Blockchain technology can make it easier for companies to meet their objectives and responsibilities by facilitating greater transparency and more data analytics. As such, the technology can become a central part of a company's corporate governance.

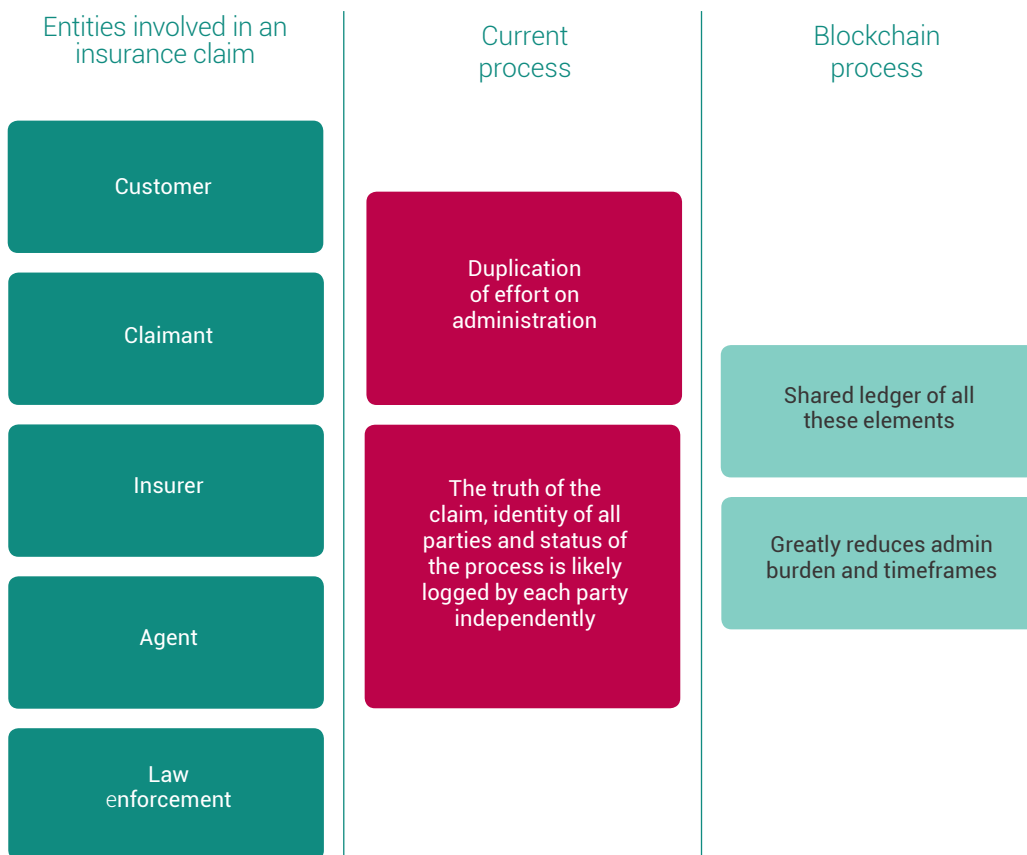
### Checks required prior to finance/professional advice

Requirements	Method	Process	Result
Checks required prior to finance/professional advice	Today	Each professional entity performs checks, every single time	Inefficiency
Know Your Customer (KYC)			Slows down transactions, advice and general commerce
Anti-Money Laundering (AML)			High cost paid to 'trust agents', eg credit checking agencies
Foreign Account Transparency Act (FACTA)	With blockchain	Ratify by checking a blockchain. Therefore effort of checking shared. Checks only need to be completed at set intervals.	Shared effort. Created by trust.

Effective corporate governance requires that company stakeholders, both internal and external, keep a track of progress. One application of blockchain is to tag and track assets. As an asset moves through a supply chain, either internally or publicly, any changes to its location, status or ownership could be tracked on a blockchain.

- Everledger has been using the technology to digitally stamp diamonds; today more than one million diamonds are logged.
- Like a public stock exchange, any blockchain based crowdfunding should also drive companies toward tracking and sharing more data about themselves.

### Blockchain and insurance claims





The use of blockchain to stamp diamonds could easily apply to other resources that companies use, or even to track their carbon footprint. Corporate social responsibility can now encompass the investment portfolio (there have been many morality discussions around so-called 'sin stocks') or ethical resource consumption. Blockchains would make it easier for third parties to track and analyse the lifetime CO<sub>2</sub> emissions of a company.

Initiatives like the Extractive Industries Transparency Initiative (EITI), which was created to ensure cash from resource extraction made its way into the hands of civil society, have struggled because of compliance costs and tracking capabilities. As the diamond example shows, blockchains offer one way of combating forgery; but also, with the participation of the main buyers/traders, provide a paper trail for a wide range of resources.

#### 4: Data security

Centralisation of data creates a target. Criminals, seeking payment or identity information, can probe for weaknesses protecting that centralised store of information. The very nature of a blockchain – the fact that the data it tracks only exists because of a distributed consensus – means there is no centralised point to target.<sup>8</sup>

The main weakness of blockchain is authentication – ensuring that the rights holder over the asset on the chain, like Bitcoin, is indeed the correct individual or company. Digital impersonation by criminals may be a problem, but it is a lot easier to flag unusual behaviour if all participants on a blockchain have to agree to a change before it is made.

Also, the unchangeable history of the chain means that tracking and policing should become easier. Instead of relying on the IT team at one company to keep critical information safe, a whole network can be relied upon.

#### Diamond tracking using blockchain



# Blockchain barriers: hype and energy

Despite all the hype, blockchain technologies remain in their infancy and are mostly of interest to the financial services community.

Practical uses for entrepreneurial businesses are limited to interactions with cryptocurrency, like Bitcoin, and the cross-border transaction fee benefits that this offers. Another concern for blockchains is the energy consumed validating transactions.

Asking how ambitious businesses can take advantage of a blockchain serves to showcase the current infancy of the technology.

## Can ambitious businesses take advantage of a Blockchain?

Commerce is based on the trust created as a result of multiple interactions between centralised and complex databases. It is therefore not surprising that there is a great deal of excitement surrounding blockchain, as the technology does represent a more efficient, trustworthy and accessible way of tracking for example, assets and capital.

However, it is worth pausing amongst this hype to consider what steps businesses could take today to take advantage of a blockchain.

Participation in a blockchain technology still requires businesses to be pioneers.

With that caveat in mind, what could be adopted now?

### 1: Use cryptocurrency

The best established blockchain technologies are cryptocurrencies like Bitcoin.

Today, it is relatively simple for a company to accept a cryptocurrency for products or services. Coinbase offers a service where, once you receive Bitcoin from a customer, you can hold it in your 'Bitcoin wallet' or convert it to your native currency. The company also provides merchant tools to make sure you can accept Bitcoin.<sup>9</sup>

There are also money transfer options available from providers like Ripple that will greatly reduce cross-border fees. Becoming enabled to accept cryptocurrency could allow for secure global trade with vastly reduced transaction fees.

### 2: Buy/sell equity in a blockchain enabled environment

There are a number of blockchain enabled crowdfunding environments on the horizon such as Starbase and FundYourselfNow, however these are not yet fully functioning available services.

These organisations aim to offer the opportunity to raise capital in environments that are likely to be the future of crowdfunding.

### Blockchain services

#### Companies offering services utilising blockchains

#### Remittances

Coins.ph

Bridge21

#### Transactions

Coinbase

Ripple

#### Crowdfunding environments

Starbase

FundYourself  
Now

One application of blockchains is to tag and track assets. As an asset moves through a supply chain either internally or publicly, any changes to its location, status or ownership could be tracked on a blockchain.

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### 3: Begin to blockchain an asset trail

Immutable Asset tracking – the ability to use a blockchain to track the authenticated provenance of assets – is beginning to come to the fore. One company that has started doing it is Everledger, a leading global emerging technology enterprise.

Everledger believes there are unrealistic expectations currently being placed on the blockchain. In comments to Price Bailey, they said "The issue faced by all companies is the expectation from industry of what is possible through the technology. There is a current narrative around blockchain being the solution for all the world's problems. We never allow ourselves to get carried away with industry dialogues and instead focus on building the architecture for our proposed solution faster and better than anyone else."

Unlike crowdfunders that are still developing their offering, Everledger is already tracking a number of high-value assets, including diamonds, coloured gemstones, fine art and fine wine. The aim is to expand to all markets where provenance matters, such as luxury goods. Several partnerships have been formed across various industries including Gübelin Gem Lab, Brilliant Earth, Singapore Diamond Investment Exchange (SDiX), Vastari and SAP Ariba, where asset tracking engages all participants across the supply chains. This is a clear example of blockchain use today, albeit on a private network.

Of all the benefits of asset tracking, Everledger concentrated on two whilst talking to us: (1) enabling transparency across global supply chains to build trust and (2) mitigation of risk and fraud.

Blockchain enables transparency and builds trust amongst stakeholders along the supply chain. Establishing the authenticated provenance of an asset and tracking the asset helps reduce the risk of fraud in the

industry. This also drives next-generation practices for global markets from a trade and sustainability perspective.

We are of the view that, for SMEs, asset tracking represents a notable near-term opportunity.

### Blockchain energy consumption

Before a block can be added to the chain 'miners' solve puzzles related to its history. As the volume of changes proposed goes up, and the length of the blockchain increases, the collective energy applied by the computers to find the solution increases.

In 2013, it was estimated that miners for the Bitcoin blockchain consumed 23.5 GWh of power during 24 hours.<sup>11</sup> This would provide electricity for almost 6,000 homes in the UK for an entire year.<sup>12</sup>

The protocols on which blockchains are based are in their adolescence. It appears that they will require iteration if they are to scale – otherwise power demands will become unsustainable.<sup>13</sup>

### Blockchain asset tracking

Everledger today	Asset tracking tomorrow
Diamonds	All luxury goods
Fine Wine	White goods
Fine Art	



# What is the future of blockchain?

Blockchain has moved from a 'first stage use' reality in cryptocurrencies and money transfer. As a result, use of the technology is dominated by the financial services community, which is extremely interested in using it to find efficiency savings.

Crowdfunding and asset tracking look set to be the next applications to become well established on blockchains.

## Moving past stage one

Moving on from stage one will require platforms to be built on top of blockchains that track other 'histories' of assets, resources and physical goods. This could be land, hydrocarbons, energy, rare earths, white goods etc.

For this to succeed there needs to be coordination between governments, businesses and software developers. Logging and tracking resources on a blockchain would be a good place to start, and then applications could be built on top, for example:

- Track energy production from source to generation, through distribution to user; facilitating 'ethical' purchasing decisions, demand side management and more reactive purchasing decisions by power traders. Such an ecosystem could involve network operators, utilities consumers, and smart devices connected to the internet like dishwashers that only turn on when electricity is inexpensive.
- Track white goods from component through assembly, through lifecycle emission cost, to wholesaler to user. Establish trust in component authenticity, quality and ethic.
- Keep anonymised health records that can be trusted by patients, doctors and insurers. This would reduce clerical error and improve data security.

- Estonia is looking to do this for one million patient records, having announced a deal with Guardtime in 2016.<sup>14</sup> Dubai is doing similar.<sup>15</sup>

The next step would be 'smart contracts' – self-executing contracts. For example, a payment being triggered once a white good is shown to have arrived at certain GPS coordinates ('delivered'). This could represent a move toward automated 'last-mile' delivery systems (the final step of delivering a parcel, usually carried out by your typical postman). The blockchain would validate the GPS on one chain and then validate the existence of a smart contract that states this as the location of the entity (person/company) that requested the delivery. Once this is confirmed, the smart contract is triggered and a transfer of cryptocurrency, on another chain can take place.

## In the meantime: private blockchains

Two types of blockchain are emerging: public and private. The public ones, like Bitcoin, are well known. Private blockchains, meanwhile, are growing in popularity and are validated by the entities allowed into the network in the first place. This is similar to the early days of the internet, when private intranets dominated.

Private blockchains undermine many of the fundamental benefits of the technology. Foremost of which is that the consensus and data is distributed amongst the provider(s) of the private network, rather than being publicly confirmed.

Becoming enabled to accept cryptocurrency could allow for secure global trade with vastly reduced transaction fees.

Managed by a limited number of institutions/ organisations, these networks look set to be the testing ground for most new applications, like self-executing smart contracts or proxy voting.<sup>17</sup> NASDAQ's private LINQ service is a great example, providing a market for pre Initial Public Offering (IPO) companies/a blockchain based management platform tool for trading shares in private companies.

However, private blockchains undermine many of the fundamental benefits of the technology. Foremost of which is that the consensus and data is distributed amongst the provider(s) of the private network, rather than being publicly confirmed.

Private networks also promote path dependency that can be exploited. "Everyone knows how this business works", Brit Yonge from Lightyear notes, "they sign you up and, once a dependency is created, very high fees are levied upon the users. People know how the centralised model plays out."

### In conclusion: still a Fintech party

Blockchains are distributed consensus about reality. Today they offer an opportunity to undermine the trust industry – credit agencies, insurers, etc. – by providing agreement about the history of a ledger that can be publicly accepted.

However, viable current use cases are limited – money transfer and reduced transaction fees. Some other applications, like crowdfunding, are on the cusp of becoming available from easy-to-use websites. But, as Yonge noted, "we are still in the part of the lifecycle where imagination is getting ahead of the tech".

Going forward, there are many exciting applications for blockchain beyond the movement of capital. But, for now, they are a Fintech party.

### Further opportunities for blockchain

#### Applications that could be built on top of a blockchain

Track energy production from source to generation, through distribution to user; facilitating 'ethical' purchasing decisions, demand side management and more reactive purchasing decisions by power traders.

Track white goods from component through assembly, through lifecycle emission cost, to wholesaler to user.

Keep anonymised health records that can be trusted by patients, doctors and insurers.

Such an ecosystem could involve network operators, utilities consumers, and smart devices connected to the internet like dishwashers that only turn on when electricity is inexpensive.

Establish trust in component authenticity, quality and ethic.

This would reduce clerical error and improve data security. Estonia is looking to do this for one million patient records, having announced a deal with Guardtime in 2016. Dubai is doing similar.

# End notes

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- <sup>5</sup> 'China P2P lenders braced for regulatory crackdown', The Financial Times, Don Weinland, January 9 2017; <https://www.ft.com/content/41e706f4-d631-11e6-944b-e7eb37a6aa8e> (accessed 4 September 2017)
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- <sup>11</sup> In 2015, average electricity consumption in the UK was 3,938 KWh. [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/573269/ECUK\\_November\\_2016.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/573269/ECUK_November_2016.pdf)
- <sup>12</sup> This is an excellent site detailing the energy Bitcoin consumes: 'Bitcoin Energy Consumption Index' <http://digiconomist.net/Bitcoin-energy-consumption> (accessed August 30 2017)
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