BLOCKCHAIN

Building trust in a complex world

Blockchain is perhaps one of the most exciting and talked about, yet least understood, technologies of recent years.

It is best described as a new kind of database and internet infrastructure which enables sharing, collaboration and builds trust in transactions. Developed by Satoshi Nakamoto in 2008 and first implemented in the Bitcoin cryptocurrency, blockchain removes the need for a single trusted institution, such as a bank or a legal firm, to oversee and verify transactions. Instead, those involved agree on a set of information to be stored (such as legal agreements, financial transactions, health records) and then the transparency of the blockchain technology means they can be confident that this data will remain available for as long as it is required. This then provides a digital, tamper proof record of the transaction.

The technology

Blockchain is a distributed database or ledger that stores records of transactions in blocks. Each new block has a unique encrypted fingerprint and is linked to the previous block. This ensures the blockchain cannot be changed retrospectively. As new blocks are written, the updated blockchain is continually replicated across other copies. The process also ensures that conflicts (where more than one block is created at the same time) do not arise across the multiple copies of the ledger.

The potential

Netscape co-founder Marc Andreessen said blockchain "gives us, for the first time, a way for one internet user to transfer a unique piece of digital property to another internet user, such that the transfer is guaranteed to be safe and secure, everyone knows that the transfer has taken place, and nobody can challenge the legitimacy of the transfer. The consequences of this breakthrough are hard to overstate."

Currently the most common blockchain applications are cryptocurrencies. But blockchain offers a trusted, tamper-proof way of recording transactions for any digital asset. It could transform property and land rights, medical records, intellectual property, identity, and validation of provenance and ownership of goods and assets.
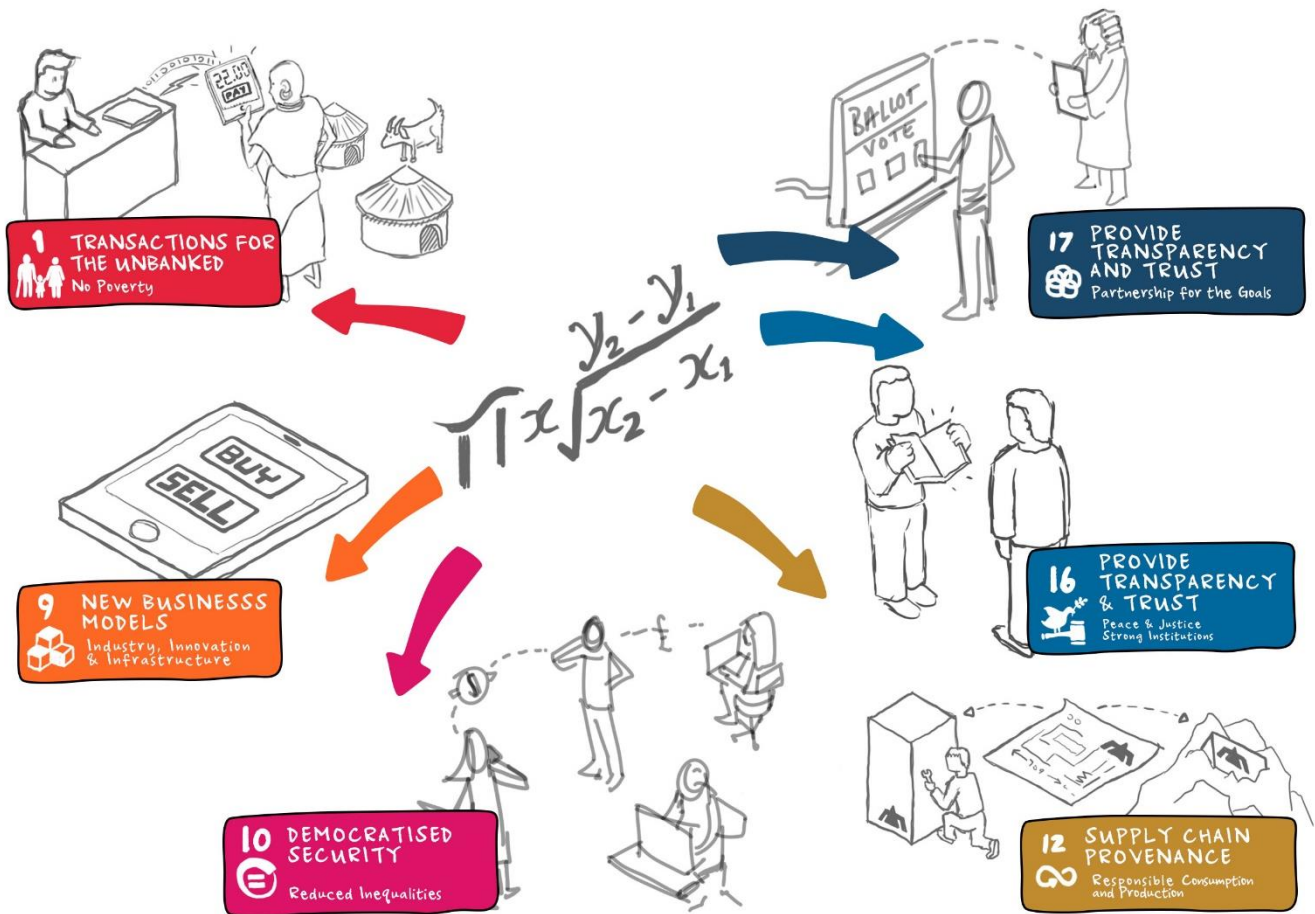
The risks

Like all immature technology, blockchain still needs further development to deliver on its promise. In particular, given its potential to provide secure and tamper-proof records, the security of the associated applications and infrastructure will be critical. The regulatory and legal framework will also need to evolve to reflect the issues raised by blockchain.

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Some Example Applications...

Managing the land registry with blockchain

The republic of Georgia is piloting a blockchain solution to validate property transactions. Developed in partnership with Bitfury, the national government are planning to expand the service into registration, purchase and sale of land titles. They are one of a number of governments, including Honduras and Sweden, exploring how blockchain can help provide a transparent and secure way of managing property and land rights.

Identity management for refugees

With an estimated 20% of the world's population not having a legal identity, proof of identity is a significant barrier, particularly for refugees, to accessing financial and government services. BanQu has piloted a blockchain based scheme in the Dadaab refugee camp in Kenya, helping displaced Somalis create economic identities. Additionally, initiatives such as ID2020 are bringing together technology companies, development agencies, and think tanks to help the one billion individuals without a legal identity, seeking to develop a solution by 2020 using technologies such as blockchain, and have it implemented by 2030.

International money transfers in Africa

Based in Nairobi, BitPesa provides international payment services between Africa and the rest of the world. Using Bitcoin, the most popular blockchain based cryptocurrency, BitPesa provides a cheaper alternative to international money transfers, enabling import and export from African countries, and the remittance of money from abroad.

Supply chain transparency

Connecting fisherman, global retailer and consumer, a pilot by British tech company Provenance has successfully tracked tuna fish through South East Asian supply chains - proving blockchain's role in improving transparency and sustainable practices in the sector.

Key Numbers

$2.3 bn
Estimated market size in 2021

Source: Statista

$135 mn
Estimated value of transactions on the Bitcoin blockchain

Source: Blockchain Info

34 mn
Number of blockchain wallet users worldwide

Source: Statista

Advancing the Sustainable Development Goals (SDGs)

$$\Pi x \sqrt{\frac{y_2 - y_1}{x_2 - x_1}}$$

1 TRANSACTIONS FOR THE UNBANKED — No Poverty

17 PROVIDE TRANSPARENCY AND TRUST — Partnership for the Goals

9 NEW BUSINESSS MODELS — Industry, Innovation & Infrastructure

16 PROVIDE TRANSPARENCY & TRUST — Peace & Justice Strong Institutions

10 DEMOCRATISED SECURITY — Reduced Inequalities

12 SUPPLY CHAIN PROVENANCE — Responsible Consumption and Production

Blockchain has the potential to advance many of the SDGs. Below are some examples of areas of application across a wide variety of sectors.

■ SDG 1 No poverty
- Rapidly open up the ability to trade and enable transactions for the world's unbanked. Blockchain and cryptocurrency-based initiatives such as BitPesa and CariCoin are already gaining traction.

■ SDG 9 Industry innovation and infrastructure
- Create an infrastructure to build trust, reduce friction and increase transparency and efficiency across supply chains.
- Remove friction from value chains.
- Improve the efficiency, and reduce the cost, of transactions.
- Enable traceability of the provenance of products across the supply chain.

■ SDG 10 Reduced inequalities
- Giving those without access to banking an opportunity to trade.
- Enable new webs of value exchange between all the connected Internet of Things devices.

■ SDG 12 Responsible production and consumption
- Reduce waste from manufacturing, and from shorter and more responsive supply chains.
- Track the provenance of products and their constituent components across the supply chain and their lifetime, so that they can be more easily reused and recycled, supporting circular economy models.

■ SDG16 Peace, justice and strong institutions
- Provide transparency and trust.
- Transform democracy by providing a mechanism for establishing identity, and casting votes.
- Provide open and trusted mechanisms for processes such as registering property and assets, paying taxes, and accessing state welfare.

■ SDG17 Partnership for the goals
- Provide transparency and trust.

Potential Negative Impacts and Barriers

Blockchain could revolutionise how business is done across many sectors, but this revolution will only happen if costs can be reduced, a supply of skilled expertise can be found and risks are managed effectively.

Impact on existing centralised trust systems
A shift from a centralised trust system could lead to a loss of income/work for those organisations such as banks, the legal profession and governments.

Technical skill shortages
Highly skilled blockchain expertise is in short supply but it is possible for organisations to begin to experiment with blockchain using existing open blockchain platforms such as Ethereum, Factom or even the Bitcoin blockchain without significant capital outlay. There is also a wealth of start-up activity providing opportunities for partnership, acquisition or other ventures.

Co-option
It is possible that established organisations may wish to co-opt blockchain technologies within their existing business models. For example R3 is a distributed database company that leads a consortium of more than 70 of the world biggest financial institutions in research and development of blockchain usage in the financial system.

Regulatory and legal regime
There is considerable regulatory and legal ambiguity around Distributed Autonomous Organisations (where a virtual organisation operates autonomously following rules determined in smart contract software without requiring human managerial direction) and how blockchain technology fits more widely within regulatory regimes and legal frameworks.

Energy consumption
The cryptographic underpinning that makes blockchain secure requires significant computing power to solve mathematical problems, particularly for the bitcoin protocol. Whilst measuring energy consumption is difficult, some estimates of the amount of power required for this activity are extremely high, and this demand will continue to grow. However, alternative, more energy efficient mechanisms are now being developed.

Technical Considerations

Like all immature technology, blockchain still needs further development to make it a rapid, reliable and affordable system.

Performance
Resolving issues such as transactional speed and throughput, the verification process, security, and data block limits will be crucial to the mainstream adoption of blockchain.

Computing power
Blockchains that use 'proof of work' (solving complex mathematical problems) as a mechanism for authenticating transactions require a lot of energy due to the computing power needed. This cost is coming down and efficiency is improving but it is not yet at a point where it has mass market viability.

Integration
Blockchain applications can be challenging to integrate with existing systems and will often demand complete replacement, making it costly and time consuming and this can delay its adoption.

Interoperability
There are many approaches to blockchain adoption with multiple choices of models and technology –public, private, hybrid, etc. Different systems and implementations can have varying levels of security, privacy and control and the market as a whole will need to work to gain widespread trust in the options.

Governance
Governance and ownership of technical standards will also be an important issue. The challenge can be seen in the fact that, to date, developers have been unable to agree changes to the underlying technology of Bitcoin to improve performance and throughput.

Trust
The fundamental blockchain architecture puts trust and security at its heart. But implementation will only be as good as the smart contracts, software code, networks and infrastructure they run on. The DAO, a blockchain based venture capital fund which raised $150 million in 2016 was drained of $50 million of funds by an investor who gamed the smart contract.

As the value and importance of applications underpinned by blockchain increases, there will be more attempts to find ways of compromising them and a need to defend the system against these attacks.

Enabling New Business Models

There has been considerable hype around the disruptive impact of blockchain technologies on business models with some commentators describing it as being as disruptive as the internet itself.

Blockchains have the potential to be applied in many sectors wherever there are transactions and record-keeping. The key benefit lies in the way transparency reinforces trust in all transactions. This can be cheaper and more accurate than using centralised institutions and its transparency can also remove conflicts of interest from ownership. It also can dramatically reduce the high initial cost/benefit ratio for participants in transactions, and its naturally distributed design frees a central organisation from costly and error-prone administrative duties.

Blockchain is an open and accessible technology that can be used to drive innovation by both incumbents and startups. Different models exist, depending on whether the blockchain is publicly accessible, private, or a hybrid of the two. Public blockchains are being offered on a pay-as-you-go basis, which reduces infrastructure costs. Its tendency to use openly available technology also reduces the need for new entrants to build trust with customers.

The greatest potential impact will be on those who act as trusted authorities today e.g. banks and law firms. Interestingly, the financial services industry has been a driver of blockchain innovation, often using private blockchains to increase the efficiency of internal transactions.

The open source nature of some blockchains make this technology easily accessible as a platform for innovation. This means the advantages can be felt by consumers and citizens across the world and not just in advanced economies or highly technical industries.

Another possible business model is the Distributed Autonomous Organisation (DAO). This is where a virtual organisation operates autonomously following rules determined in smart contract software, without requiring human managerial direction.

Blockchain will enable a number of the disruptive business model levers identified in the Project Breakthrough website, specifically:

A closed-loop process
Blockchain can enforce the transparency, security, authenticity, and auditability necessary to make tracing the chain of custody and attributes of products possible, which in turn enables reuse, refurbishment and recycling.

Asset sharing
Blockchain can potentially create a (currently missing) trusted universal infrastructure where assets and their use can be transparently and securely tracked.

Usage based pricing
Blockchain can enable usage based pricing by providing a verifiable record of transactions.

Collaborative ecosytem
Blockchain has great potential as a technology for connecting and sharing information and verifying transactions across value and supply chains.

United Nations Global Compact

The United Nations Global Compact is a call to companies everywhere to align their operations and strategies with ten universally accepted principles in the areas of human rights, labour, environment and anti-corruption, and to take action in support of UN goals and issues embodied in the Sustainable Development Goals.

The UN Global Compact is a leadership platform for the development, implementation and disclosure of responsible corporate practices. It is the largest corporate sustainability initiative in the world, with more than 9,000 companies and 3,000 non-business signatories globally.

Project Breakthrough

Project Breakthrough – a collaboration between UN Global Compact, Volans and partners – spotlights the best thinking in sustainable innovation. It showcases innovators across mainstream companies and next generation entrepreneurs who are developing solutions with the potential to achieve exponential impact. It features analysis and resources designed to help leaders understand the new business models and technologies that will be crucial in achieving the SDGs, catalysing action amongst today's businesses to meet the needs of tomorrow's world.

The Disruptive Technology Executive Briefs are produced in collaboration with PA Consulting Group, combining cross sector technology, innovation and business design expertise. The briefs are intended as an easy to digest introduction to disruptive technologies, to help organisations understand how they could advance the Sustainable Development Goals and business performance. These overviews explore key features, examples of applications, potential positive and negative impacts, and how they may enable the new business models.

Visit www.projectbreakthrough.io for more information, or contact projectbreakthrough@unglobalcompact.org