Blockchain in action
Embracing the potential

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Executive summary

Over the last few years, blockchain has been one of the most hyped technologies, generating vast sums of venture capital and many pages of overblown newspaper headlines. We were told that blockchain and distributed ledger technology (DLT) would change the world, as we know it, within a very short time. Yet this has not occurred and so we have seen the hype sink away. Instead, commentators are now asking: ‘If blockchain is so good, why are we not seeing more of it?’

In this paper, techUK seeks answers to two questions:

1. Why is it that blockchain is taking longer to take off than the hype had promised?

2. What should be done to unleash its full potential?

Our first answer is clearly that hype is hype and not realistic. Most new technologies take time to evolve to a useable stage, to be understood and to be deployed by companies and organisations which are averse to business changes. This is the stage at which we see DLT.

But our second answer is that there are some truly revolutionary examples out there of blockchain in action. Part one of this paper demonstrates this through summaries of solutions designed by techUK members in a number of different market segments. We invite you to read techUK members’ own words as they describe how they are using blockchain to solve fundamental problems.

Part two of this paper shows that entrepreneurs are also wrestling with a diverse set of barriers and roadblocks which stand in their way. Some of these relate to a lack of understanding of the technology and a conflation in the minds of companies of blockchain and bitcoin, leading to fears around fraud, the ‘dark web’ and the scandals which have surrounded cryptocurrency trading. Other problems relate to current legal frameworks, which were not designed with blockchain or digital assets in mind. It is not that we need a ‘regulatory system’ for blockchain, but that there is a need to update a number of key laws to allow DLT solutions to operate.
Part three contains our conclusion and key recommendations. Blockchain has huge benefits to offer but many key changes need to occur to make this happen.

Crucial in this respect will be a commitment by the UK Government to deliver on the recommendations of the two reports on blockchain technology by Walport in 2015 and Lord Holmes in 2017. The Government needs to make the required legislative changes; provide clarity on the application of current legislation where there are industry concerns over using DLT and to actively promote the development of distributed ledger technology in this country.

The Government is alert to the impact of this technology, although there has been a lack of ministerial cohesion, with responsibility scattered across Cabinet, Government Digital Service, and the Department of Digital, Culture, Media and Sport (DCMS). In last year’s budget, Chancellor Philip Hammond announced a £500 million investment in tech to drive innovation in the UK through infrastructure, skills and R&D funding. He wants Britain to be a world leader in new technologies – including blockchain – and realise the benefits of the digital economy.

We understand that this will take time, but the time to start is now. It is not that blockchain has had its day – far from it – it may have fallen out of favour with the headline writers, but the technology is growing, use-cases are being explored and, as we will demonstrate in this paper, its value, now and for the future, is indisputable.
Part one | Examples of blockchain in use

techUK has a thriving community of distributed ledger technology experts and entrepreneurs, who, convinced of the great value of blockchain, have designed solutions across a wide range of different sectors. In this section, we showcase these solutions, grouped together by sector and by type of blockchain used: public (permissionless) or private (permissioned).

Among techUK members, we find a larger number of examples of private, permissioned ledgers than public, permissionless ledgers. The reasons for this are clear: permissioned ledgers involve, generally, fewer parties who have come together in a consortium or other agreement, to use blockchain to share data and facilitate a common collaborative end. Each participant has ‘permission’ to join and any new participant would require permission from the other parties; rules of collaboration can be agreed and funding can be joint. Such solutions are far easier to get off the ground, to build and to manage than open public blockchain solutions.
A. Private, permissioned ledgers

The following examples have been grouped into sectoral areas, but are not in any order of scale or criteria.

1. Identity and e-signatures

Cygnetise

Cygnetise was founded in May 2016 and, to this day, is one of the few blockchain utility applications that are live. Cygnetise has been adopted by dozens of entities across 12 jurisdictions.

Cygnetise is a decentralised application that makes the process of managing authorised signatory lists efficient and secure. By using this technology, organisations including PwC, Ogier, Vistra and others, can significantly mitigate the risk of fraud and save over 90 per cent of the time and cost of administration.

Signatory lists are lists of individuals with the authority to sign off invoice payments, bank transactions, contracts and other legal documents on behalf of their department or organisation as a whole. Almost all organisations are required to maintain an authorised signatory list in some guise, and depending on the nature of the business, such lists can include bank mandates, delegated authorities, incumbency certificates or authorised trader lists.

Over-zealous ambitions of blockchain use will only delay adoption. Rather than trying to revolutionise industries, focus should be more on the evolution of specific processes. This way adoption and acceptance of the technology will be far quicker.

Steve Pomfret
CEO, Cygnetise

The current process of managing signatory lists is manual and paper based, costing organisations thousands of man hours. For every refresh of a list, there is a rewrite and a redistribution. To better understand the magnitude of the problem, consider that every registered business in the UK must have a business bank account, and every account must have a signatory list. Due to the labour-intensive nature of the process, the majority of organisations have out-of-date signature lists, including employees who have left the company, which exposes them to a significant fraud risk.

Cygnetise has designed a solution to this problem by creating a distributed ledger of authorised signatory lists. Using blockchain technology, Cygnetise acts as a data processor (not a controller – the user is in control) to reduce the number of required parties in the authorised signatory management process and eliminate the need for intermediaries to maintain and verify a copy of a signatory list. This therefore makes the process more efficient and secure.
2. Financial services

(i). Retail banking

DXC Technology

DXC was faced with a challenge in the South African retail banking market. A large bank wanted to offer digital banking services to the underbanked in South Africa. They therefore needed an identity verification service that would work in emerging markets to efficiently address KYC (Know Your Customer) regulatory requirements. They also wanted to provide new customer vault services to prove authenticity of documents such as degree certificates.

The DXC team overcame several challenges in working with nascent blockchain technology. The bank’s preferred distributed ledger platform was CORDA and the team designed an innovative solution that provides identity and document verification services through bank kiosks. In the process, DXC developed industry leading expertise on the CORDA platform and was also able to scale up to deliver the project at an astonishing speed.

DXC therefore created the first commercial blockchain solution in South Africa and the first product solution on R3’s financial grade distributed ledger, CORDA to be in production anywhere in the world. The solution has been further applied in other jurisdictions spanning Bangalore, Chennai, Manila, Sydney and Vietnam.

(ii). Wholesale banking

we.trade

we.trade focusses on the barriers which tend to discourage financial companies from trading internationally. It was formed to tackle the numerous legal, financial and cultural risks associated with entering into financial trading relationships with a foreign partner which tend to discourage companies from trading internationally.

The company, a joint venture between twelve leading European banks – CaixaBank, Deutsche Bank, Erste Group, HSBC, KBC, Natixis, Nordea, Rabobank, Santander, Société Générale, UBS and UniCredit – aims to make cross-border transactions more efficient and secure, and open up trade finance to a wider pool of companies. All users of the we.trade platform have already gone through international KYC processes to ensure they comply with applicable anti money-laundering regulations, mitigating risks considerably.

Blockchain was used as it serves as a secure, shared database that cannot be controlled by any single entity and has no single point of failure. Every entry on a blockchain is given a timestamp and a unique cryptographic signature. All relevant parties have access to the same information regarding trade deals at the same time, and no single party has control over this data. If Company A makes a change to the terms of its trading agreement with Company B, then this will alter the cryptographic hash in the blockchain: Company B, and all other parties, banks and intermediaries, will be alerted to the change immediately.

Often, companies have found that a barrier to trading with businesses in other countries is guaranteeing that a contract will be enforced. Any delay to a payment or a delivery can be very damaging, as cashflow may rely on the timely fulfilment of the trade contract. The blockchain platform developed by we.trade and IBM has two main features that help empower enterprises of all sizes to take part in international trade: distributed ledger technology and smart contracts.
Blockchain requires people who are willing to create a minimum viable product with a minimum platform, which is accepted by a decent number of counterparts. Blockchain now really requires a short time frame.

You can’t build something thinking you will deliver five years from now. You will not be credible. You need to develop something in one year at the latest. You need to be able to put it on the table.

Roberto Mancone
Chief Operating Officer, we.trade
IBM World Wire

IBM World Wire seeks to reduce the cost and delay of sending money across borders by using blockchain. The solution enables clearing and settlement with finality in near real-time. Digital assets, which serve as an agreed-upon store of value exchanged between parties, are used to settle transactions and payment instruction messages are integrated within the process. It all means funds can be transferred at a fraction of the cost and time of traditional correspondent banking.

IBM World Wire uses blockchain technology and the Stellar protocol to make it possible for financial institutions to clear and settle cross-border payments in seconds. Two financial institutions transacting together agree to use a stable coin, central bank digital currency or other digital asset as the bridge asset between any two fiat currencies. The digital asset facilitates the trade and supplies important settlement instructions. The institutions use their existing payment systems – seamlessly connected to World Wire’s APIs – to convert the first fiat currency into the digital asset. World Wire then simultaneously converts the digital asset into the second fiat currency, completing the transaction. All transaction details are recorded onto an immutable blockchain for clearing.

(iii). Insurance

Distlytics - Blocksure

techUK member, Distlytics has worked with Blocksure to develop a blockchain-based platform as the foundation for a policy administration system in the insurance sector. The company was founded in 2016 and is currently live and being used by Covea Insurance. The key reasons for using a blockchain-based platform was the connectivity, segregation and security that it provides parties that require trust. With conventional technology or a database system, all parties have to be part of the same system. Distributed ledger technology allows parties to operate independently whilst transacting on a common infrastructure and delivers the following benefits:

- Reduces expense in an insurer’s internal operating model: It removes or reduces the need for processing in transfers between intermediaries and insurers. As intermediaries can still deliver existing levels of profitability at a lower level of cost, insurers pay lower commission levels and all parties benefit. Certain processes are removed (e.g. client money, premium reconciliation, bordereau), and others are made much easier (e.g. KYC and Anti Money Laundering (AML) checking).
- Allows underwriting authorisation levels to be built into smart contracts so they cannot be abused and also controls reinsurance arrangements via smart contracts.
- Smart claims that pay out automatically in line with policy terms.
- Smart settlement across the claims supply change facilitated by smart contracts. All parties involved in a claim, e.g. claimant, insurers, suppliers and loss adjusters, are automatically paid (including cash settlement) once the claimant digitally signs the claim settlement letter.
- New products: As blockchain radically drives down the base cost of issuing a policy, insurers can consider new and exciting product solutions in areas such as IoT (Internet of Things), the sharing economy, micro insurance etc.
- Improves cash management: Cash transfers become quicker and eventually insurers should receive all premiums directly from a customer, even in intermediated business. Intermediaries only receive their brokerage and insurers will be paid risk premiums direct. Also, insurers will not need to provide loss adjuster with claims float as they will be able to settle all claims directly due to the functionality of smart contracts. This means that all insurers should have larger cash balances to invest and increase their investment income.
3. Supply chain

(i). Shipping

TradeLens

TradeLens is the result of a collaboration agreement between Maersk and IBM and tackles the extensive data-sharing needs of the international cargo-shipping ecosystem. It uses blockchain for its ability to handle tracking and visibility across multiple parties with trust and security guarantees and because the shared, immutable ledger can provide accountability while still respecting privacy requirements.

TradeLens brings together all parties in the supply chain — including shippers/BCOs, freight forwarders, inland transportation, ports and terminals, ocean carriers, customs and other government authorities, and more — onto a blockchain-based platform with a secure permission and identity framework.

It is an open and neutral industry solution underpinned by blockchain technology, supported by major industry players. The platform promotes a more efficient, predictable and secure exchange of information in order to foster greater collaboration and trust across the global supply chain.

"We believe blockchain can play an important role in digitising global shipping, an area of the global economy that moves four trillion dollars of goods every year."

Bridget van Kralingen
Senior Vice President, IBM Global Industries, Solutions and Blockchain

The TradeLens platform provides:

- Near real-time shipping milestones from a diverse network of ecosystem participants that offers finer-grained visibility than traditional track-and-trace approaches.
- Structured and unstructured document sharing in the context of a shipment that is integrated with milestone events.
- Permissioned information sharing. Client and shipper visibility to shipment milestones and documents is controlled by platform defaults but can be overridden by the Transport Services Buyer.
- Opportunity to lower IT setup and maintenance costs. Information is exchanged through a common connection instead of numerous point-to-point integrations.

This initiative can generate tremendous savings for the industry over time while enhancing global supply chain security. It shows how blockchain can play an important role in digitising global shipping, an area of the global economy that moves four trillion dollars of goods every year, and bring transparency, trust and collaboration to the incredibly complex global trade system.
(ii). Waste management:

**Atlas City**

In the waste management supply chain based in Africa, Atlas City manages the waste and recyclables for off-shore oil drillings. The platform identity layer is used to ensure contracts and documentation has the necessary authority and authenticity. The distributed ledger technology is being used by the waste disposal company to share data with the regulator and other stakeholders. Current paper and ink processes are being replaced with IoT devices (temperature, weight, location and time) to capture trusted data real-time. Later phases will include the management of health checks, minimum working age and working hours screening.

(iii). Food supply

**IBM Food Trust**

IBM Food Trust aims to improve transparency, accountability and safety in the food supply chain. It creates a secure, shared, and permissioned record of transactions which offers participating retailers, suppliers, growers and food industry providers data from across the food ecosystem to enable greater traceability, transparency and efficiency. Current members of the network include Walmart, Carrefour, Golden State Foods, Nestlé, Dole and more.

The IBM solution stores digitised records in a decentralised and immutable manner, creating a permanent record and end-to-end traceability. This minimises the opportunities for fraud by enabling real-time traceability of culprits and creating accountability.

The shared ecosystem easily identifies process inefficiencies, eliminates bottlenecks, and optimises supply chains for continuous growth. All food system participants know the provenance, real-time location, and status of their food products so that they can develop more accurate supply and demand forecasting models, localise the sourcing of ingredients, and restructure contracts.

In addition, farmers, producers, and other food actors can automatically digitise and easily share audits, certificates, and other records proving that they utilise and promote sustainable and ethical practices.
(iii). Food supply

**AgriLedger**

AgriLedger is a distributed ledger technology system provider focused on agricultural supply chains. Addressing the challenges of growing populations and global food supply, AgriLedger demonstrates how blockchain technology can revolutionise food safety and food security. AgriLedger uses distributed ledger technology for the gathering and analysis of information on small-holder farms, determining crop yields, establishing provenance, and facilitating payments and governance, with transparent end-to-end record-keeping.

Backed by the World Bank, AgriLedger and information science establishment École Supérieure d’Infotronique d’Haïti (ESIH), in collaboration with the Ministry of Commerce and Industry (Haïti), are piloting a solution for mango, avocado and pineapple farmer supply chains that could be extended to the cacao, coffee and apparel supply chains in Haïti. By improving conditions and global market connection for the country’s small-scale agricultural producers, and by strategically embedding global innovations in information technology, AgriLedger could reshape Haïti’s economic outlook and to create societal stability. AgriLedger together with DAMIFAN Technology R&D in China, are piloting a similar project in the Heilongjiang province in the Northeast, within a designated rice supply chain.

AgriLedger is tackling the weaknesses in infrastructure and distribution channels through the use of mobile technologies, artificial intelligence and machine learning and secure online data solutions such as blockchain and distributed ledger technology. It thus supports a high standard of integrity within the agricultural value chain by improving transparency and information flows. Each step of the supply chain is verified - from checking the digital identity of all participants to confirming final purchases. The solution enables farmers to sell in more efficient markets where the spot price for their produce is determined by supply and demand rather than by the power of negotiation.

These technologies allow farmers, citizen scientists, distributors, logistics providers, markets and customers to collaborate on the blockchain, making it possible to discover, test and implement smarter food systems much sooner.
(iv). Travel sector

Tata Consultancy Services - Travelport

Travelport is a travel content distribution platform, taking travel content from over 450 airlines, 650,000 hotel properties and 80 plus car hire companies, collating it, enhancing it and distributing it to over 68,000 travel agencies, travel management companies and on-line travel sites worldwide. The travel market is currently evolving, as travellers look for unique experiences and personalised offers from suppliers.

In the future, Travelport believes that the customer experience will be underpinned by blockchain-inspired technologies that provide the capability to link multiple content sources in the travel supply chain in a secure and transparent fashion, simplifying the booking and management experiences for agents and travellers.

Travelport sees an opportunity to partner with organisations that are developing blockchain-based travel capabilities to continue to develop its thinking on, and implementation of, blockchain technology. Travelport believes that many of the initial implementations of blockchain-based systems in the travel industry will be based on private permissioned distributed ledger technology. This will help to build knowledge and assess the technological suitability of blockchain-based systems. With technology partners Tata Consultancy Services, Travelport has created a proof of concept called the ‘Digital Traveller Wallet’ which can securely store and transact blockchain and non-blockchain-based reservations. The Digital Traveller Wallet mobile app allows the traveller to securely manage, transfer, redeem and modify their travel booking, regardless of the source.

The Digital Traveller Wallet deploys a travel manager application running on several nodes, which could be hosted by Travelport or by travel agencies. The travel manager application can interact with multiple distributed ledger and blockchain systems operated by airlines, hotels and other travel suppliers. Through a certificate exchange mechanism and public key cryptography, the travel manager retrieves reservations from the different ledgers and digitally signs them on behalf of the traveller. This creates a new transaction on the originating chain that assigns and guarantees the reservation to a traveller, who can then store them in their mobile wallet app. From their mobile device travellers can then view their itineraries, change reservations, transfer travel assets to other trusted travellers, and redeem them face-to-face using a secure key transfer mechanism that guarantees their identity.
4. Healthcare

(i) Data-sharing and consent

Dovetail Lab

Dovetail Lab sought to solve one of the significant problems associated with the sharing of healthcare data i.e. the essential requirement to be able to manage the entire consent lifecycle for any data-sharing event: creation, action, augmentation and withdrawal. In addition, any solution must be automated, accessible and interoperable.

The Dovetail product is a consent solution that puts the patient, as data subject, firmly in control of all data-sharing relationships. It enables the patient to grant or revoke consent for data about them to be shared between organisations of their choice involved in their healthcare. A network of healthcare apps, health and wellness providers, and clinical organisations, using Dovetail's patented software, are able to share specific patient data with patients’ explicit informed consent. Practitioners are able to retain their existing electronic healthcare records, but can also send requests to access patient data from other sources, or allow important data to be shared from their system, with the assurance that their patients have understood and agreed to the data sharing.

The solution uses distributed ledgers as the underlying audit and triggering functionality. When a patient creates a consent item (permission for some data about them to be transferred from one organisation to another), this is recorded to the blockchain. This triggers the sharing of the information as the sharing party picks up the consent from the blockchain and actions it, then delivers the data to the receiving party.

If the patient later wants to change or withdraw their consent, they can login to one of the partnered portals, view their consents and make the changes. These changes get added to the distributed ledger so that they are fully auditable and accountable in the future.

What the distributed ledger technology allows over a traditional audit database is a ‘smart’ and real-time audit function. While the traditional database can store and preserve data about past events, a blockchain can store and preserve events as they happen and provide independent computation of present actions. This means that when patient consent is created and stored on the ledger, the sharing party can query the record (on the blockchain) and send the information, in real time, without relying on a third party and also automatically creating a continued audit trail of actions.
We certainly do not believe blockchain is a panacea, but where patients want to share their health data for a good reason to benefit themselves or others, we can enable that and give full transparency of data usage to patients, practitioners and healthcare providers. In this instance, blockchain provides the ideal technology to ensure that patient data is never lost, altered or delayed.

Moving away from descriptions of distributed ledger technology, smart contracts, public and private keys to a focused conversation on the value proposition and specific benefits for different users is essential to make the shift from proof of concept to enterprise technology.

Alexandra Eavis
CEO, Dovetail Lab
Atlas City

In the health sector, Atlas City is collaborating with GPs and consultants in designing a FIDO2-compliant safe and secure private wallet (passport) to enable patient data to be shared in a hospital environment. FIDO2 is the minimum standard for NHS Digital interoperability and data compliance; it requires a higher level of security than a password system and therefore uses biometric identification. The Atlas City solution will enable knowledge on mental health, addiction and vulnerability to be learned and managed with data intelligence.

(ii) Cancer screening

Distlytics - Lancor

Lancor, working with Distlytics, has linked together clever science, AI and blockchain to enable a screening service that can find and treat cancers at a very early stage.

The Lancor blockchain platform allows patient data to be analysed and stored securely. It lets patients and regional, national and international organisations access the right data at the right time. Lancor is launching a ‘Medici Token’ to improve access to cancer screening programmes around the world. It is a utility token that allows payment for tests, validates the credentials of the cancer screening devices and provides secure access to results.

5. Energy

Renewable energy: Atlas City

In the energy renewables sector Atlas City is helping the second largest CO₂ emissions cleaning company in the world, that captures and cleans carbon for recycled products. The company is using distributed ledger technology to better track and distribute the carbon credits to a wider global market. Better visibility is essential to measure and secure the benefits that justify government funding. This collaboration is on target to reduce the cleaning and distribution costs by over 50 per cent.

6. Legal Sector

Access to justice: Atlas City

In the legal sector, Atlas City uses its distributed ledger technology platform to advance access to justice initiatives. The new technologies allow sensitive data, captured using natural language processing, to be analysed. The currently under-served will get their plight scrutinised and potentially supported through charitable donation and crowdfunding – a well-known high street bank is planning to offer the service to customers. The onboarding (data screening) and disbursements are managed using digital tokenisation to improve audit and cost. Society benefits and the lawyers can focus on law and not data risk and operations.
B. Public, permissionless ledgers

The following examples have been grouped into sectoral areas, but are not in any order of scale or criteria.

1. Identity and e-signature

Distributed ledger technology can be used to create digital identity systems which are secure and trustworthy. Identity systems, housed on a blockchain, cannot be forged and enable identity to be tracked and tied to other information and registration systems such as titles and deeds, whilst ensuring that the individual provides consent for their information to be shared. Algorithms offer a superior way to verify facts and can be done in a private manner through the utilisation of zero-knowledge proofs. Distributed ledger technology, in combination with a joint identity validation system, may also eliminate the need for repeat KYC and AML checks. In addition, there is no centralised point of data which can be attacked with a distributed ledger, meaning the chances of data breaches are greatly reduced.

AliasLab – Scytale – SignChain

SignChain aims to be the next generation of eSigning solutions which overcome some of the limitations and flaws in traditional Public Key Infrastructure (PKI)/Certification Authority model.

The SignChain solution was developed by a research laboratory called Scytale which grew out of AliasLab, a company with 15 years of expertise in the PKI/digital signature arena. Scytale’s mission was to become a centre of competence on cryptography, blockchain and distributed ledger technology.

SignChain is an eIDAS-compliant advanced blockchain electronic signature solution, that uniquely links a cryptographic identity to a set of private keys with which users can electronically sign digital documents, in a simple, secure, legally valid manner. It overcomes problems recently encountered by well-known certification authorities, where, due either to cyber-attacks or operational errors, unauthorised certificates were created. Also, certification authorities are based on a centralised model in which the certification authority is the holder of all the keys and therefore an obvious single point of failure.

In SignChain, proofs of identity and of signature are stored in the blockchain, transforming it into the trusted third party. Also signature keys are decentralised, are under the direct control of the user, and are not stored anywhere centrally. These features secure requirements such as ‘sole control’ of the signature generation and uniquely linking the signature to the signer, which are fundamental for signatures with a high level of assurance. Also, the disadvantage of a user being able to lose his keys in the signature world is virtually eliminated, as all signatures produced before the loss are still valid and will continue to be so. KYC is also a fundamental component of the platform: neither a key nor a signature can be created if a user has not undergone KYC.

Blockchain provides the perfect security backbone to build cross-jurisdiction compliant solutions, as more and more countries are recognising the ‘immutable’ value of data written on blockchains.

SignChain is being used in the EU and UAE in both private and public sectors.
Gradbase

Gradbase offers a GDPR-compliant blockchain platform which enables anyone, anywhere to instantly and effortlessly check academic and professional qualifications. It also allows professionals to keep all their career qualifications in one place. Gradbase has partnered with several UK, EU and UAE universities, professional institutions and recruitment companies to build an ecosystem that will enable worldwide social mobility and bring fairness and efficiency back to the job market.

At the moment, verifying academic and professional qualifications, two key attributes in the job market, is very inefficient and costly. It can take up to a month and cost hundreds of pounds. Also, qualifications are subject to fraud which can lead to serious consequences. Gradbase’s platform will help tackle fraud but also significantly reduce the cost and time associated with the verification process of personal credentials.

At the heart of Gradbase’s solution lies a portable smart QR code, Gradcode, which is branded with the logo of the institution and can be integrated in any professional medium, such as a CV or LinkedIn profile. When scanned, the Gradcode will redirect the user to the qualification as it was issued by the genuine institution. With just a smartphone and an internet connection, any qualification check can become instantaneous and simple.

2. Music

Nexus

Nexus uses blockchain technology in the music sector to improve the efficiency of royalty payments, licensing agreements and digital rights management.

The Nexus blockchain allows artists to receive precise and quick payments, feel more connected to their fans and followers, and to fight fraud and piracy. The solution uses parallel processing which can achieve scale whilst also providing immutability and security. For businesses, Nexus has adapted its technical architecture to provide a hybrid blockchain solution, whereby the independent benefits of both a private and a public blockchain can be harnessed simultaneously.

Nexus sees instant remuneration through cryptocurrency as the solution to the current complex and inefficient payment processes in the music industry. The use of blockchain technology will transfer power into the hands of the artists, creating a much fairer environment, allowing them to get paid as soon as their songs are streamed, for example.

Nexus sees huge potential in the music industry for blockchain use and believes, given music is the universal language of the world, this is the route through which blockchain will become a mainstream technology.
Part two | The problems and barriers

Blockchain has been a fast-developing technology and there are a number of areas where companies have hit barriers in bringing their solutions to the wider market.

In their businesses, techUK members have encountered problems in three main areas: legal and regulatory; scalability and technological.
A. General challenges

There are a number of barriers which are encountered by all types of blockchain.

These can be split roughly into two groups:

1. practical barriers
2. legal and regulatory barriers.

1. Practical barriers

These relate in large part to the ‘bad name’ that still hangs around the technology and difficulties around cost, scalability and identifying the appropriate use-cases.

• Lack of understanding: Where blockchain solves real problems at a much cheaper price, businesses are often reluctant to try because of fear of damage to their reputation. This is mostly due to a lack of understanding. There is a lack of awareness of the broader applicability of blockchain, plus negative publicity about abuse through unethical practices of bad actors. Businesses also struggle with the cyber security aspect associated with blockchain, and the fear that decentralisation is equivalent to a lack of control and responsibility.

There are two further consequences of the lack of understanding:

• Mistrust of distributed ledger technology: Blockchain in general is still widely equated with Bitcoin and therefore associated with the fraud, scandals and the volatility in the cryptocurrency market. Blockchain companies and consultants often have to explain the differences from scratch and have difficulty overcoming widespread mistrust by association. The rise of Initial Coin Offerings (ICOs) has brought further complications as the mind-boggling amounts of money thus raised has naturally attracted fraudsters. Regulators have reacted differently across jurisdictions with bans or strict limitations being imposed in China, Russia and South Korea.

• Lack of insurance provision: In the insurance market, there is a general lack of understanding among brokers and underwriters of blockchain technologies, the risks involved or how to assess them. The technology does not fit into the currently defined categories of risk and therefore distributed ledger technology companies seeking cover can find themselves shunted from pillar to post between IT policies, which are not in fact appropriate and financial services policies which are far too costly for small start-ups. The insurance industry needs to improve its understanding of new technologies to appropriately assess risk and provide suitable insurance products.
• **High cost of replacing existing technology**: Where existing technology is already in place, a solid business case is needed to change it for a blockchain-based solution, as the cost can be significant. For example, in share trading, clearing, settlement and payments, where technology has been embedded over the last 30 years, the cost and time of replacement by many parties is simply not currently feasible. There also needs to be a belief that replacing what is there and working well with something new and relatively unproven is worth doing. It can also be difficult to estimate the cost of any distributed ledger technology projects beforehand.

• **Requires mass adoption**: Many use cases require lots of participants to join a new community in order to obtain the full advantages of a blockchain. An example of this could be within a supply chain management or for multi-party approvals. In a supply chain, banks, suppliers, distributors, buyers and sellers all need to participate for it to become fully effective. In such cases, we see that most have the attitude of ‘I won’t join until all the others join’. Collaboration is an underdeveloped business model in free-market economies and will require time and fundamental changes in perspective to be widely accepted.

• **Due diligence**: IT procurement teams tend to use standard due diligence forms which do not apply to distributed ledger technology solutions – it is difficult to get them to understand that traditional forms cannot be used.

2. Legal and regulatory barriers

In general, regulators maintain a ‘neutral’ stance when it comes to new technologies, an approach with which techUK agrees. However, it is clear that existing legislation in a number of areas is causing uncertainty and is acting as a hurdle to widespread adoption:

• **Legal viability of smart contracts**: Contracting engines or smart contracts allow for unbiased and automatic contract execution. As it stands there is little understanding of whether these contracts will be legally binding. However, regulation will determine the future of this functionality.

Contracts are used extensively every day, from joint venture agreements to the acceptance of a company’s latest terms and conditions update. The main benefit here is that the trust engendered by distributed ledger technology-based solutions and platforms is enhanced thanks to the to the way the data is accepted, stored and communicated. In some cases, intermediaries will become unnecessary, costs will be reduced, and overall efficiency boosted.

• **Jurisdictional uncertainty**: Some blockchains will de facto not operate in one jurisdiction only and have no ‘home-base’, as nodes may be located in different parts of the world. Laws, however, are geographical in scope and, if there is a dispute, it will be complex to determine which legal system has jurisdiction. There is therefore a need for international cooperation to understand and clarify this uncertainty.

• **Barriers in capital markets**: There are a number of requirements under the Companies Act and HMRC rules regarding validity of share certificates and the transfer of shares which mandate physical processes. This means that share certificates generated and stored entirely electronically using blockchain would not have equal status under the law as a certificate that has been physically created and stamped, and so it could not be used to create good title for a shareholder or a subsequent purchaser of those shares.
B. Challenges specific to public/unpermissioned blockchains

- **Fear around immutability and GDPR:** For some businesses, the idea of never being able to revoke or remove a transaction brings concerns about how to alter possible errors and also about infringements under the General Data Protection Regulation which carries a right for every individual to require that data held about them is erased - ‘the right to be forgotten’. There is a lack of legal certainty around GDPR, which needs to be clarified by proper guidance from the regulators.

- **Liability and accountability:** Given their distributed nature and lack of centralised control, pinpointing accountability and liability in a blockchain is problematic. There is a need for regulators to devise frameworks to establish accountability in the blockchain sphere.

- **Fear of dealing with personal data:** This fear stems largely from the fact that people do not understand how cryptography works. The term ‘public’ blockchain causes concern as it is assumed the data held is accessible to everyone and anyone. We must enhance understanding of the fact that the encryption i.e. the use of cryptography, makes the data safer and more secure, especially when it is combined with appropriate control and governance around the platforms.

- **Data hosting restrictions:** Variations in international data protection legislation mean that the hosting of certain types of data, outside of the jurisdiction where the data is domiciled, can sometimes be restricted. This causes a problem where nodes are hosted in various international cloud regions.

- **Issues in opening bank accounts:** Companies which work with crypto-currencies in the UK face great difficulties opening bank accounts: banks cite risks of money-laundering. In a report from October 2017, the FCA criticises banks for ‘a denial of banking services for firms wishing to leverage distributed ledger technology, become payment institutions, or become electronic money institutions.’ The FCA therefore should step up and take positive action against banks which continue to deny services to distributed ledger technology companies and thus block innovation and competition.

- **Interoperability:** If distributed ledger technology technology is to be used at scale, the issue of whether a number of blockchains can interoperate with each-other arises. Some progress is being made in this area, but as yet there are no widely applicable solutions as to how different ledgers can interoperate with one another.
C. Challenges specific to private/permissioned blockchains

- **Legal issues around distributed ledger technology consortia:** The primary advantage of distributed ledger technology is that it connects together a network of players which operate in a common field. Private, permissioned blockchains, by definition, operate by rules, generally set by the founders of the consortia. The idea that distinct companies may work together is well-known in law, but current categories do not fit with what blockchain require:
  
  - Consortia generally exist for a defined period to carry out a distinct project.
  - Joint ventures are created to execute a business which is distinct from the business of the parent companies.

These current categories do not fit with what blockchain requires. Distributed ledger technology consortia would be established as a long-lasting permanent collaboration to carry on the core business of all participants. They may start off with a few companies and grow to include further players. This brings up the following problems:

- What is the legal basis of this cooperative agreement – what are the rules of governance, of entry and of leaving?

- Who owns the intellectual property? Is it just the founding members? What happens if new members contribute to and develop the IP? What happens if a founder member leaves the group?

- Access: who determines whether new companies can join the consortium and on what basis? If access is restricted, this could lead to competition problems, with the consortium effectively acting as a cartel.

**We would argue that work needs to be undertaken to examine and resolve these issues for the long term by establishing intellectual property and competition rules for distributed ledger technology consortia.**

- **Data privacy:** There is often an issue in permissioned ledgers where the parties wish to definitively protect commercially sensitive data. Companies, therefore, may insist on bilateral data privacy contracts as a way to segregate this data, which contradicts and complicates the structural set-up of the blockchain.
Blockchain in action | Embracing the potential
In this paper, we have sought to outline the realities of the blockchain market. What we have found is that there are a significant number of successful solutions already working well in the marketplace. We have listed a number of these according to sector to demonstrate that blockchain can and does solve real-world problems. Given time and resources for research and development, the technology will grow and thrive.

The industry also needs to develop standards which allow applications to scale and to interoperate with each other. But work is already underway: in October last year, the Ethereum Enterprise Alliance and Hyperledger began collaboration on cross-community standards to be completed in the second half of 2019. The Institute of Electrical and Electronics Engineers and China’s Information and Software Department have also released or plan to release blockchain standards in 2019.

Nevertheless, government action is still required to help remove a number of the barriers listed above and to help promote the development of the technology. techUK calls for a concerted UK Government recognition of the potential value of blockchain to UK industry and recommends a number of specific actions the Government should take.
techUK recommends the following actions to the UK Government:

1. Launch a publicly-backed strategy to help foster and develop the technology. This aim could be achieved in the following ways:
   - Assist with the understanding of distributed ledger technology as a whole through research, promotion, and communication initiatives.
   - Establish a cross-sector, cross-departmental blockchain working group.
   - Invest in the blockchain talent pipeline through schools and universities.

2. Assist with the understanding and development of the technology and its capacity to scale. Specific actions could be:
   - Embed blockchain technology in the Industrial Strategy and provide a distributed ledger technology ‘sector deal’.
   - Establish blockchain innovation hubs around the UK.
   - Consider the adoption of blockchain technology across government departments.

3. Clarify/change specific areas of law which hold distributed ledger technology back through the following:
   - Examine existing areas of law and regulation which create barriers to adoption of distributed ledger technology and work to revise these accordingly.
   - Publish clear guidelines on the treatment of ICOs, cryptocurrencies and tokens.
   - Extend the FCA sandbox programme to include tokens and industries beyond fintech.
   - Issue guidance on the effects of GDPR on blockchain.
   - Create a world-leading legal and regulatory structure that spurs innovation through adequate, but light touch, regulation to promote market transparency plus consumer and investor protection.
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