

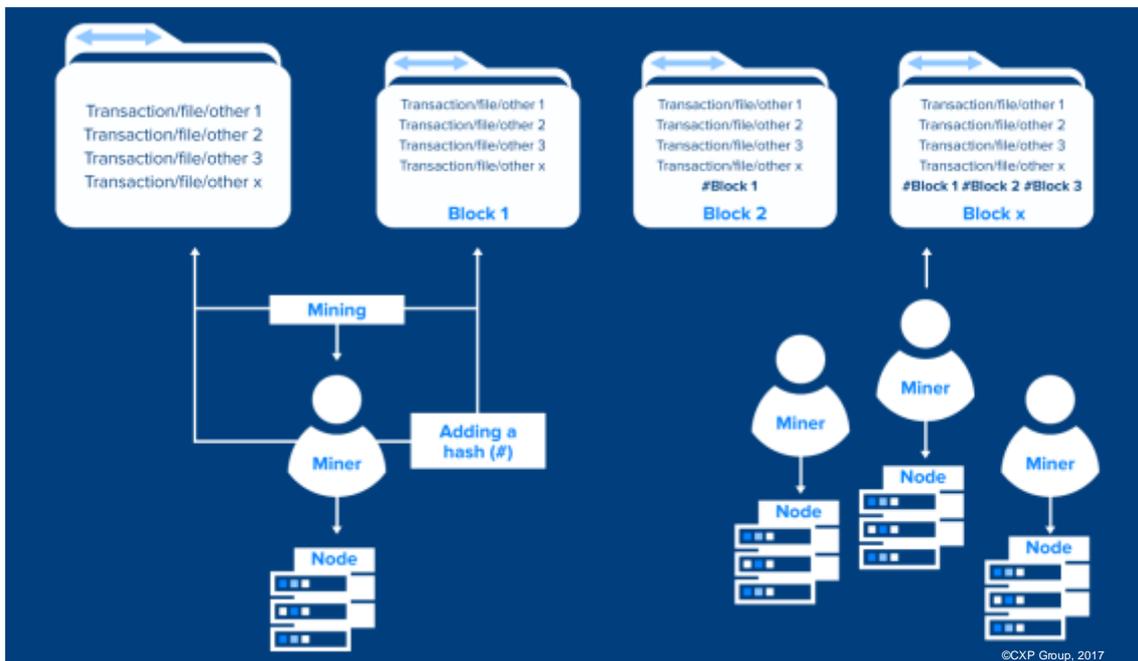
Blockchain - the opportunity beyond the hype

- NOVEMBER 2017 -



INTRODUCTION: WHAT IS BLOCKCHAIN? WHAT IS DLT?

Blockchain and Distributed Ledger Technology (DLT) carries the potential to revolutionize the way that businesses transact with their customers and with each other. By enhancing the speed, security and flexibility at which enterprises transfer, store and manage virtual goods, companies across a wide range of industry sectors can dramatically improve the efficiency and experience of their current processes, while enabling the creation of new business models. The financial services sector has been the first to test the possibilities of blockchain and DLT, and banks and insurers are at the forefront of shaping standards and best practice in technology platforms and implementation. And while there are many challenges to overcome in gaining full value from investment in the technology, the industry has already reached the stage where those organisations that have yet to assess how they can leverage blockchain and DLT as part of their strategies, already run the risk of getting left behind. In this White Paper, we look at how blockchain works, and how enterprises are building the business case for successful adoption.



WHAT IS BLOCKCHAIN?

Distribution Ledger Technology (DLT): Blockchain is at its core, a database infrastructure. What makes this technology special is that every item of data is multiplied and stored across a network of nodes. Data distribution is the foundation and strength of blockchain technology as it enables trusted information storage without a central controlling body or "authority" by means of a network of computers. New transactions are sent to the blockchain where they are encrypted before being sent to every node for validation before being stored in blockchain building blocks. Every new block is linked by cryptography (hash tree) to the previous block, which, in turn, is securely attached to its predecessor block. This makes the chain immutable: every change in one block drives change in every subsequent block on every node.

Blockchain is designed to provide trustworthiness like traditional ledgers. Therefore, it is usually termed as "Distribution Ledger Technology" (DLT). However, buyers and strategy leaders are currently faced with many different approaches and flavours of the technology, which we detail in the section below:

Private versus public blockchain: Public blockchain implementations such as Bitcoin, Dash, Ethereum, Litecoin and Ripple use PoS and PoW for the consensus process, because anybody is allowed to participate. They use a **permissionless** mode of operation. The opposition is a **permissioned** mode of operation where participants know each other. Access to these "private blockchains" is limited to selected parties. Hyperledger Fabric and Corda are the most prominent solutions for permissioned, private blockchains in the finance industry.

Hyperledger Fabric is an open-source project that was originally contributed by IBM and is backed by many other large organisations such as Fujitsu. It has been designed for private blockchains, supports better modularity and scalability, and reduces transactional effort through less complex consensus processes.

Corda is another open-source blockchain implementation by the R3 consortium and the most important initiative around blockchain in banking in terms of number of participants and investment. Participation in Corda blockchains is limited to involved parties. The main difference between Hyperledger Fabric and Corda is that the latter is designed for financial industries and provides preconfigured use cases while the former is designed for general use.

Smart Contracts are coded instructions (typically event driven) on the ledger that execute the specific terms and conditions that exist in contracts between parties. Under typical (current) circumstances these parties will usually be individuals, corporations, governmental agencies or other entities with a clear legal personality. It is however possible to create sophisticated code that is much more automated and self-executing by creating even smarter contracts. As we have already observed in some emerging endeavors, we may see the creation of autonomous parties (Decentralized Autonomous Organization; DAO) including even IoT (Internet of Things) devices executing into Smart Contracts without human intervention.

Proof-of-Work (PoW) versus Proof-of-Stake (PoS)

Before information is stored, blocks have to be created, verified and attested to be valid. Currently, two concepts of consensus are most common next to many others such as Proof of Activity, Proof of Burn, Proof of Capacity, etc. :

- **Block-building according to PoW (e.g. used by cryptocurrency Bitcoin) requires a huge amount of computing power.** So-called "miners" have to resolve a cryptographic task before creating a new block. Validation has been passed when the majority of nodes (51%) agree. The difficulty of the mining process is constantly adjusted to the available computing power within the blockchain network. The more computing power is added, the more complex the mining process becomes. On the one hand, this makes an attack on 51% of the nodes very unlikely, but causes very high energy consumption on the other hand.
- **PoS relies on the self-interest of the parties involved instead of computing power.** It is generally agreed that those parties with the highest amount of shares in the blockchain organisation are most likely to be chosen to create a new block. Although POS has not been widely implemented until now, it is an important concept, not least because Ethereum, one of the most used blockchain platforms, is currently considering a switch to PoS. Ethereum is also known for the activities around Smart Contracts and Decentralized Autonomous Organisations (DAO)



BUILDING THE USE CASE – KEY BENEFITS FOR BANKS

At a first glance, blockchain seems to present a threat to traditional business models in the financial services sector. It was originally developed as the technical layer supporting the virtual currency Bitcoin which allows financial transactions without intermediaries such as banks. But a closer look reveals a broad range of opportunities for banks to leverage DLT to drive business process efficiency and simplicity as well supporting the development of new customer services:

 Accessibility	Every blockchain solution, whether public or private, offers a high degree of accessibility due to its decentralized nature. As multiple nodes store the whole history of a transaction, access to key information is guaranteed at any time.
 Transparency	Due to the widespread distribution of information, no single organisation can control access to data, which significantly increases transparency. Nevertheless, not every participant can view all the information. Put simply, public blockchains provide transparency at a transaction level while participants are anonymous, while private blockchains reveal participants and hide transactions. DLT will significantly increase transparency between market participants.
 Data privacy	Blockchain solutions use cryptography to secure information. This is usually a public key infrastructure. Private blockchain Corda also applies partial data visibility, which means that transactions are not broadcast globally as in public blockchains.
 Security/trustworthiness	From the outset, blockchain has been designed to meet the highest security standards, based on the general assumption that untrustworthy participants will attempt to join the network. Public key infrastructures, hash pointers (that link blocks to each other), decentralisation and consensus models are important means for data security. DDoS or similar attacks are unlikely as no single point of attack exists. The fact that every node stores part of any transaction guarantees reliability of data, which inevitably leads to a high degree in trust in information stored in a blockchain.

There are many potential benefits to blockchain and DLT. Although only a few blockchain solutions are currently up and running in daily banking business, blockchain looks set to drive fundamental changes in the finance industry, forcing many institutions to rethink their traditional business models and practices.

- ▶ **Faster processing and simplicity:** Transaction processing speeds vary wildly across the financial services industry. While share transactions are processed within fractions of a second, payments can take days due to the involvement of multiple banks and clearinghouses that have to undertake several validation processes and store many copies of the same transaction. This often leads to errors, delays and risks, and entails additional costs. Blockchain eliminates the need for intermediaries and momentum is building across the sector, taking it from local pilot engagements and on to global initiatives. The Society for Worldwide Interbank Financial Telecommunication (SWIFT) has announced its intention to explore whether DLT can be used in international payments.
- ▶ **Streamline internal processes:** The majority of banks currently store and manage their customer information across multiple sites. This is both expensive and complex, and DLT can help to ease this pain. Several providers and banks are already working on DLT-based solutions for KYC (know your customer) requirements, partly in order to meet regulatory requirements.
- ▶ **Cost cutting:** Simplifying and accelerating business processes inevitably leads to cost savings as fewer resources are needed. The strong disintermediation leads to fewer failures and less risk which, in turn, helps financial organisations to save money too.
- ▶ **New services:** DLT can help organisations to create and introduce new services more rapidly on the basis of consistent immutable data stored in a DLT environment, such as wealth management dashboards. For example, BNP Paribas is cooperating with French startup SmartAngels to create a crowdfunding tool for small businesses.
- ▶ **Asset and Transaction Tokenization:** DLT tokenizes individual assets (e.g. property, claims, funds, bonds, etc.) on a ledger and proves its provenance. DLT limits risk by providing visibility into assets and related liabilities based on an accessible but immutable transactional record. For example, limited transparency currently exists on how frequently an asset has been loaned or pledged.
- ▶ **Compliance efficiency improvement:** Tamper-proof distributed data enables an end-to-end environment in which trust is not an issue and it allows counterparties to operate based on a single truth. Additionally, it enables audits and compliancy checks allowing data on assets and transactions to be recorded sequentially. This reduces the potential for disputes and drives automated compliancy recording.



CHALLENGES –INTERNAL TASKS AND EXTERNAL SHORTFALLS

There is a major obstacle to blockchain adoption in almost every financial services organization. Some 90% of traditional banks still have a large number of (30-year-old) mainframes and several layers of BPM for managing daily operations. This is typically a siloed way of working and exactly the opposite of what using blockchain technology is about. DLT integration in legacy environments is a major challenge.

Change management is another potential stumbling block. Blockchain solutions require major changes in business processes, and employees and management will need to adapt to the new workflows. Change also requires the reallocation of resources and budgets. Only if DLT projects are backed by appropriate budgets, trained personnel and the support of management, can successful integration take place.

The **emergence of Blockchain**, DAOs and smart contracts raise significant legal questions and many regulators are looking to lay down some ground rules and recommendations. The Financial Industry Regulatory Authority (FINRA) in the US released its "Report on Distributed Ledger Technology" report in January 2017, which contained guidance on best practice. The UK Government's 'Distributed ledger technology: beyond block chain' offers similar guidance, while the European Commission is also setting out a number of rulings on virtual currencies while assessing the larger implications for different industries. The impact of these agencies should not be underestimated as new regulation can significantly impact future requirements for blockchain and DLT initiatives.

Skills and experience in blockchain technology are currently limited, which makes project staffing a major challenge. Only a few banks have already started to build up internal teams of DLT-trained resources, with the majority requiring the support of external partners. Financial organisations with DLT roadmaps should approach technology partners as soon as possible, since most service providers are suffering from a skills shortage too. IT services providers are important implementation partners for the crucial legacy integration. One element to be careful on

is not to get stuck in a proof of concept stage but create a model that is considering moving to a proof of business.

Cooperation with blockchain-related start-up companies might be a further option to solve the problem of skills shortages. However, the cultural gap between traditional banks (usually aiming for topics such as security, governance, accuracy) and start-ups (aiming for speed, growth, user convenience) is huge. Ultimately, two parties with conflicting priorities need to work towards a common goal.



Even blockchain itself provides some inherent challenges. The technology has sometimes dubious implementations primarily in the permissionless area and has not yet reached maturity whilst performance remains often questionable: even Bitcoin, the most advanced implementation of blockchain, can only process up to eight transactions a second, while credit card processing providers are able to manage several orders of magnitude more transactions in the same time. Energy consumption of PoW consensus hampers usage in nearly every B2B environment. Moreover, standardisation is lacking and legal/regulatory issues remain unsolved or fragile at best. The scalability of blockchain technology is yet to evolve to something sustainable.

It is clear that, next to all possible benefits by forcing a rethinking of existing business processes and models, challenges remain on technical, operational and regulatory level. Blockchain and DLT can do amazing things but it is not a magic bullet. The specific applications will be different for each case, each utilizing the technology in different ways aiming to get a diverse and possibly different range of benefits. Under these conditions, Blockchain and DLT have the capability to form the foundation of next-generation digital services in many industries including the financial sector.

RECOMMENDATIONS – DLT DRIVING DIGITAL CHANGE IN BANKING

In terms of the underlying infrastructure, companies can currently choose between three main options:

Ethereum is most widely used, even in business environments, but not (or hardly) in the financial industry. Ethereum is a public blockchain, thus companies should accurately evaluate whether Ethereum usage is absolutely required or not. It might make sense in some B2C cases, while in most cases Hyperledger Fabric and Corda might be more suitable for financial organisations. PAC clearly recommends the latter two, for the following reasons:

Corda is a platform designed by R3, a distributed database technology company backed by a consortium with members such as BNP Paribas, HSBC, ING, Intesa Sanpaolo, RBS, Scotiabank, SEB and US Bank. R3 is funded with \$100m, which makes the company a reliable business partner for the foreseeable future. Corda's main characteristic remains that DLT is designed to meet the requirements of financial services providers, and the support of many established global banks ensures that further enhancement will be aligned with future demands too. Corda is an attractive option for banks' digital transformation projects.

Hyperledger Fabric is backed by many well-established IT services providers (Fujitsu, IBM, SAP) and user companies (JP Morgan, Daimler, Deutsche Börse, BNP Paribas, Bank of England). It is open source, thus many parties contribute to further enhancement and, in June 2017, production-ready Hyperledger Fabric 1.0 was launched. Many implementations are on the way, with many addressing requirements in transport, logistics, manufacturing and retail, and some parties designing financial solutions as well. Skills and experience around Hyperledger Fabric are expected to grow very fast.

Blockchain and DLT in general have the intrinsic potential to become the most disruptive technology and approach in the next decade. But it is not a catch-all solution. At this stage, the use of Blockchain needs to be carefully validated on a case-by-case basis whilst considering the total cost of a distributed ledger compared to one single ledger and the more immediate benefits of such classic models.

Financial organisations should bear in mind that every solution mentioned above is at an early stage of maturity. Development is gaining pace and will most likely solve many of the technology's current limitations, as many start-ups and large organisations consider DLT as promising technology and are therefore pushing innovations around blockchain. PAC believes that blockchain offers a secure, trusted path to simplifying and accelerating transaction processing.

Companies should not underestimate the power and speed of technology development. Experience from the past teaches us that technology developments move through new standards and trends at a much higher pace than companies are able to adapt their internal skill sets, processes and business models.

Against this background, PAC recommends that financial services providers ramp up internal skills and resources and continue to make internal budgets available. In times of fast-changing business requirements, companies should also strive for appropriate ecosystems that contain start-ups (e.g. for innovation), IT services providers (integration), business consultants (processes) and research organisations (future-proof solutions). Companies such as Fujitsu are working actively in this co-creation model.

Above all, companies should assess the impact of DLT-driven digital transformation on their own business model soon in order to work out both an appropriate strategy/business case and a clear roadmap, most likely with different lanes. As the current experience levels are generally low in the financial industry and developments are largely still in the pilot phase, a timely entry into the topic of blockchain is advisable and currently still possible whilst trying to avoid the pitfall of remaining in pilot phase and stepping into a real proof of business. The prospective benefits could be remarkable when DLTs are combined, for example, with mobility, RPA (robotic process automation), analytics, cognitive computing and smart contracts.

" It [blockchain] has the potential to redefine transactions and the back office of a multitude of different industries. From banking and payments to notaries to voting systems to vehicle registrations to wire fees to gun checks to academic records to trade settlement to cataloguing ownership of works of art, a distributed shared ledger has the potential to make interactions quicker, less expensive and safer. "

Robert D. Boroujerdi, Analyst at Goldman Sachs on [businessinsider.com](https://www.businessinsider.com)

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What makes blockchain and DLT such a thrilling/disruptive new technology?

DLT is based on a principle that is entirely new both in the technological world and the financial industry. Its components in themselves are not a new technology, but the way they are combined brings something new and innovative. Financial institutions have traditionally been required to base their entire business processes on one or several central bodies of control, and they have been following this approach. DLT is now challenging and overturning this idea, bringing along some significant potential advantages for the industry in terms of flexibility and cost savings. DLT is a blueprint for the automated, secure and immutable settlement of transactions based on pure transactions, digitized assets or their fingerprints. Similar to how, in the 1990s, the World Wide Web revolutionized the sharing of content and paved the way for new ways of doing business, blockchain has the same disruptive potential when it comes to financial transactions. The fact that DLT is already working – at least partially – is surely tempting. Now it is all about bringing the technology to maturity and making it work for the various stakeholders in such models.

Banks and financial institutions are now at the center of the business ecosystem and DLT seems to threaten their current status as intermediaries. How can banks/financial institutions leverage DLT to maintain and strengthen their positioning?

In our fast-paced world, client expectations are flying high: ever faster and cheaper services, convenient client interfaces and personalized offerings are just a few examples of the demands banks have to deal with. Satisfying those needs requires a high level of adaptability, which, in turn, may call for substantial investments in the technological landscape. Furthermore, banks are not only facing increasing competition from fintechs, but also from GAFA (Google, Amazon, Facebook, Apple) and NATU (Netflix, Airbnb, Tesla, Uber). They are thus struggling to position themselves as the financial services provider of choice and trust. Change is necessary to remain relevant. This is where blockchain and DLT come into play as they offer traditional banks the opportunity to optimize their internal processes and develop new, adaptable customer services. From a technical point of view, the role of banks may thus shift from a business process owner to an organizer/provider.

Are any relevant blockchain initiatives with an ROI available on the market yet?

So far, no full ROI figures have been published for the various blockchain and DLT initiatives. In general, most banks and companies in other sectors tend to remain silent about their initiatives in this area.

There are rough estimates of possible savings; however, many banks that are currently investing in blockchain and DLT do not have ROI as their primary objective. They believe they have to be at the forefront of innovation to be able to achieve a good ROI when the technology is sufficiently mature. The picture on ROI figures is bound to become clearer as the focus is about to shift from proof of concept to proof of business.

Is the future permissioned or permissionless (public)?

There is no standard answer to this question, as the choice depends on the specific use case. However, in the financial world, all current blockchain initiatives are focused on permissioned, with a few exceptions, as we all want as much discretion as possible when it comes to financial matters. Moreover, financial institutions are often still in the proof-of-concept phase with regard to the blockchain technology. They are only just beginning to find out how to manage DLT internally, which is why in PAC's view, the near future of blockchain and DLT will be permissioned. For instance, J.P. Morgan Chase is currently experimenting with Quorum, a permissioned blockchain built on top of Ethereum.

What about the link to digital transformation in the banking sector?

The banking sector has been undergoing major changes for some years now. Client expectations have been changing dramatically and are now highly technology-driven. Digital transformation in financial institutions requires drastic changes in infrastructure and application management to be able to meet these expectations. In this context, blockchain and DLT can contribute to a more agile IT environment and give banks more options by providing the technological background for new offerings, as is the case with the Digital Trade Chain Consortium, for instance.

Blockchain and DLT have great potential to drive simplicity and efficiency. However, this technology is not a

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fix-it-all, but should rather be viewed as one of many technologies that form the foundation of digital transformation.

In your opinion, what are the issues blockchain and DLT will not solve?

In PAC's view, there are two important aspects that people often forget about. As of today, DLT does not allow the actual transfer of money. Transferring financial assets is only possible via cryptocurrencies, tokenized assets and asset/transaction fingerprints. Also, blockchain itself will not solve the big cultural issues financial institutions are facing today. DLT is not a panacea; it should be considered as one of many technologies that will form the future financial services infrastructure.

Many digital initiatives actually fail due to internal resistance, an issue blockchain cannot solve. There are also performance problems linked to this technology, in particular with high-volume transactions. Moreover, public blockchains are controlled by communities; further developments often cannot be planned and there have been significant issues with misconduct. And most of the time, the business case is not entirely clear. Besides, as permissionless DLTs charge a fee for each transaction, using them for low-value transactions or high volumes does not make sense from an economic point of view.

Will it stay focused on the financial sector or become much more broadly used?

Information, asset and data sharing is relevant in many different industries. This is why blockchain has already spread to other sectors. In the public sector, we see projects aiming to use blockchain as a cadastre, whereas the food industry is using DLT to track the provenance of goods ('chain of custody'). In manufacturing, blockchain might help detect counterfeit goods. Logistics providers store their shipping documents on distributed nodes to gain transparency over the entire delivery process. In the far – or even near – future we can even imagine financial institutions using blockchain to build a permanent connection with their clients.

How can DLT help to solve regulation issues, e.g. with regard to data privacy?

In terms of data privacy, the GDPR (EU General Data Protection Regulation) plays an important role. According to the GDPR, personal data is to be adequate, relevant and limited to what is necessary in relation to the purposes for which it is processed (data minimization). In a public blockchain, data is kept on each and every node of the network and is publicly accessible to anyone, regardless of the original purpose of its collection and processing. However, as the data is encrypted, it is data protection by 'design and default'. Currently, there is no direct link between a specific regulation like the GDPR and blockchain; there are, however, initiatives emerging in various countries.

What are the factors to consider when implementing blockchain?

There are four main factors to consider in general:



Use case: Make sure there is an actual use case and only apply blockchain if it is truly useful. DLT is not the solution to everything, and traditional technology may also do the job – at less risk. It is important to note that business cases vary, each leveraging the technology in different ways, with a diverse range of benefits.



Try to develop a financial business case to the best possible extent. Actively involve business process owners in this endeavor.



Take into account your internal culture – you will need to invest in change management. It is often helpful to get support from a third party, which is unlikely to be influenced by internal reservations.



Try to avoid working in isolation: Blockchain and DLT are by default enablers of co-creation. Co-creation will expose you to innovative ideas and options from other companies that you might not have thought of yourself.

How should financial sector companies address the end-to-end operational risk?

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To start with, financial institutions should carefully test blockchain in a sandbox environment and select a representative process for which it makes sense to use blockchain (deposit and lending, capital raising, investment management, claims processing, etc.). Once the first tests have been successful, financial institutions can extend the scope and open other technical environments. Also, they should make sure to have skilled resources to manage such an initiative. Financial institutions often have the reflex to manage technology internally although better resources may be found outside the organization.

How to avoid the pitfall of staying in proof-of-concept mode?

Right now, most initiatives are at that stage. There are several reasons for this, amongst other things the fear of risk-taking, regulatory constraints or technical problems. Financial institutions only have limited influence over regulations (via lobbying and communications), and this is a very slow process. Luckily, we have been seeing more and more initiatives, for example by FINRA, Bank of England, ECB, the EU Parliament and others, reflecting the raised awareness among regulatory authorities and governments. In any case, having a strong internal sponsor and paying close attention to the use case helps to overcome the fear of risk-taking; additionally, organizations can actively prevent technical problems by involving skilled staff in blockchain initiatives. It is worth mentioning, though, that real expertise and creativity have proven difficult to find in the market.



About the consultant

Katharina is group lead for the Banking/Fintech vertical expertise and is a specialist for blockchain. Furthermore, she leads the M&A practice and intervenes on a group level as a project manager for strategic consulting projects. Her geographical focus includes France, Germany and the UK.

HOW FUJITSU HELPS LEVERAGING BLOCKCHAIN FOR YOUR BUSINESS USE

Content provided by Fujitsu

DLT AND BLOCKCHAIN: WHY WE BELIEVE IT IS RELEVANT TO YOU

Blockchain and Distributed Ledger Technology (DLT) are heralding creative potential and seem to be driving exceptional levels of innovation. The technology has the capacity to deliver a new kind of trust implementation to a wide range of services in our financial market supply chains, consumer and business-to-business services, publicly-held registers and the Internet of Things.

In the financial industry, mutualising cost and creating new agile applications via DLT-driven financial systems are feeding new models that help reduce clutter, improve efficiencies and in the end reduce the cost of the numerous complex business processes that exist today. Fujitsu understands and knows there will be challenges, as the distributed ledgers technology matures further and keep on disrupting how we think about and store data.

DISTRIBUTED LEDGER TECHNOLOGY: WHY FUJITSU IS CAPABLE TO DRIVE IMPLEMENTATION

Following the recognition of DLT as one of the most important technologies of the future, Fujitsu has started to make significant investments and conduct investigations in order to leverage the usage of blockchain in financial organisations. Our related ecosystems consisting of public and private sector stakeholders ensure access to sufficient information in the market.

Our goal is to help customers in this challenging transformational journey towards DLT usage, in the financial services sector but also in areas where we have seen blockchain and DLT venture beyond its original intent and purpose (e.g. IoT, AI, RPA, Smart Cities, Public Ledgers, Chain of Custody, Voting, Digital ID / Self-Sovereign Identity, etc.).

For Fujitsu, blockchain and DLT are enabling, but also forcing us all to question conventions that are fundamental to today's business models, in all sectors for that matter. These technologies are co-creation by design and fit right into the Fujitsu human centric and digital model.

BLOCKCHAIN POTENTIAL: HOW DO WE MAKE IT RELEVANT TO YOU?

WE FOCUS ON USE CASES

There is a possibility (and opportunity) to radically ameliorate the existing financial system. However, it is not limited simply to financial systems themselves.

In every discussion with customers, authorities, regulators and co-creators, Fujitsu places the focus on working on genuine business cases in the actual sector that also make sense. It is for the same reason that Fujitsu believes the focus of the industry should be on permissioned blockchain (consortium or full private) where consensus is reached and transactions are validated and processed by those who are already recognized by the ledger (e.g. Hyperledger, JPMorganChase, etc.). This is certainly valid when considering the current obligations related to anti-money laundering and 'Know Your Customer' processes that exist in the financial services.

A number of grouped financial services use cases that can reasonably be considered valid, such as:

- 
1. Automated post-trade settlement for loans, derivatives, equities, etc
- 
2. International payments
- 
3. Asset registering and tracking
- 
4. Operational risk management
- 
5. Data registers and reference databases
- 
6. Audit trail and automated compliance for regulatory reasons
- 
7. Digital identity/GDPR/customer applications/data protection

WE HAVE A BLUEPRINT

Fujitsu has a standardised approach to evaluate the blockchain potential for organisations and to setup and start a project. Within our methodology, we analyse questions such as:

1. **Is there a relevant use case that brings sufficient benefits (operational or financial) where all stakeholders buy-in?**
2. **Is there a business case over a reasonable period including any modifications to existing systems and processes?**
3. **Are all stakeholders on board (in- and outside the company) and is the right governance in place?**
4. **What are the standards the projects will adhere to and has the risk of evolving standards been mitigated?**
5. **Are the technical, business and operational scalability and performance under control?**
6. **How will regulatory and compliancy issues be addressed?**
7. **Are there any fundamental legal risks that occur when conducting the project?**
8. **How are security and trust handled and what are the protocols that are put in place?**

WE KNOW THE BLOCKCHAIN ECOSYSTEM

In our opinion, the basic technology of blockchain or DLT by itself actually doesn't even matter as it will only fully reach potential if it's combined with Smart Contracts ('Chaincode' in Hyperledger) and possible automation (AI, RPA, etc.). However, this may lead to regulatory problems or riskier operations and predictability (e.g. decentralised autonomous organisation failure). We at Fujitsu understand that compliancy and regulatory requirements are an essential component of the economic and financial fabric, hence we focus on permissioned blockchains and DLT.

Consortium and private blockchains (permissioned) are the expected norm, especially in financial services. It is clear that this will be the case for the foreseeable future for a number of reasons including but not limited to manageability, regulation and compliance, ALM, KYC, scalability and performance. The

incremental refinement of the technology will broaden its applicability where the value comes from forcing a rethink based on a distributed consensus model. problems to tackle before the full potential of this and related technologies will materialise. Analysts predict that this will take another 5 to 10 years. However, Fujitsu is conscious of the fast paced blockchain environment and significant acceleration in adoption and trials that are ongoing. Therefore, we aim for our approach to be systematically adopted and adapt it to be the most suitable to our client's needs.

YOUR BLOCKCHAIN INITIATIVE: WHY CHOOSE FUJITSU TO SUPPORT YOU

WE WANT TO MAKE IT REAL

Fujitsu and Fujitsu Laboratories can look back on several years of experience when it comes to blockchain technology. As with most of the current players, we start off with proofs of concept and of course we keep going. However, we consider that this is not enough. Our role is to accompany customers on their journey and not just provide the technology vehicle to get there.

This is illustrated with key ambitious initiatives in Fujitsu Spain, Fujitsu UK and Fujitsu Belgium and Luxembourg where, for example, a project has started on setting up the necessary methods to help customers move business processes. This will ensure customers don't get stuck in a proof of concept mode, allowing them to quickly progress to a proof of business mode. Part of this is an R&D study on the applicability in Smart Cities including the links with financial transactions.

Furthermore, Fujitsu and Mizuho Bank conducted their successful joint operational trial of blockchain based cross-border securities transactions solution in March 2016. The solution helps combat transaction history tampering, and reduces the processing time from three days to same-day. Consumers stand to benefit from this collaboration too, as the risks – such as price fluctuations – associated with cross-border securities transactions will be reduced. The trial ran between December 2015 and February 2016 and the result was as expected: post-trade process times were reduced significantly.

WE KEEP INVESTING IN INNOVATION

At Fujitsu, we believe that the success of blockchain projects is based on a strong collaboration with the ecosystem. We are a premier partner and sponsor of the Hyperledger Project - a collaborative effort created to advance blockchain technology by identifying and addressing important features for a cross-industry open standard for distributed ledgers that can transform the way business transactions are conducted globally.

Fujitsu has also reached an agreement with Mizuho Financial Group, Inc., Sumitomo Mitsui Financial Group, Inc. and Mitsubishi UFJ Financial Group, Inc. to conduct a joint field trial of a person-to-person money transfer service using blockchain technology. The trial will be conducted from January 2018 and last for about three months. Fujitsu has already started developing the trial system.

For this field trial, Fujitsu will develop a cloud-based blockchain platform for money transfers between individuals that can be jointly used by these three major banks, as well as a smartphone application that allows users to easily handle the different steps for sending money and making deposits and withdrawals.

WE HAVE THE RELEVANT SKILLS

We have strategic consultants actively working to find out the best use cases and to understand how blockchain can solve customers' problems in different countries in Europe including UK, Spain, France, Finland, Germany and Belgium. Furthermore, our core technical team in Japan is enhancing the

technology in a combined effort between Fujitsu Labs and Fujitsu Financial Services. Our blockchain Centre of Excellence based in Spain takes advantage of the comprehensive knowledge in banking systems within one of the most advanced IT scenarios for banking in Europe, enabling replication for all Fujitsu clients.

We at Fujitsu are confident that blockchain technology will accelerate disruptive change, not only in the financial industry, but also in many other industries where it will be put to active use. If you would like to conduct an early trial, develop a pilot or just want to have a conversation about how blockchain and distributed ledger technology can work for you, please contact your Fujitsu representative.

ABOUT FUJITSU

Fujitsu is the leading Japanese information and communication technology (ICT) company, offering a full range of technology products, solutions, and services. Approximately 155,000 Fujitsu staff support customers in more than 100 countries. We use our experience and the power of ICT to shape the future of society with our customers. Fujitsu Limited (TSE: 6702) reported consolidated revenue of JPY 4.5 trillion (USD 40 billion) for the fiscal year that ended March 31, 2017. In a typical year, Fujitsu invests over USD 2B in research and development technologies and services and tracks external developments and their application for customers. The results inform Fujitsu's roadmap which covers a spectrum of technologies and services and their likely lifespan.

For more information, please see www.fujitsu.com

ABOUT THE CXP GROUP

The CXP Group is the leading independent European research and consulting firm for the software, IT services and digital transformation industry. It offers its customers a comprehensive support service for the evaluation, selection and optimization of their software solutions and accompanies them in their digital transformation journey. The CXP Group's expertise covers a wide range of topics, such as BI, content management, ERP, finance, HRIS, CRM, BPM, IT management, cyber security, etc. Moreover, the CXP Group supports ITC decision makers in evaluating and selecting IT services providers and accompanies them in optimising their sourcing and investment strategies. Further, the CXP Group assists software and IT services providers in optimizing their strategies and go-to-market approaches with quantitative and qualitative analyses as well as operational and strategic consulting services. Public organisations and institutions equally base the development of their IT policies on our reports. In 2011, after the merger with BARC (Business Application Research Center), a German research and consulting firm specialising in BI and content management, the group has extended its expertise to include analytics and big data and taken on a European dimension. In 2014, the CXP Group continued its growth by joining forces with PAC (Pierre Audoin Consultants), a research and consulting company specialising in the software and IT services industry. Capitalising on 40 years of experience, based in 8 countries (with 17 offices worldwide) and with 140 employees, the CXP Group provides its expertise every year to more than 1,500 ITC decision makers and the operational divisions of large enterprises and mid-market companies and their providers. The CXP Group consists of three subsidiaries: Le CXP, BARC (Business Application Research Center) and PAC (Pierre Audoin Consultants).

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