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Banking and blockchain technology

Over the past few years, blockchain technology has been deployed in a broad range of applications in finance, public health, manufacturing, transport and a number of other industries. **blockchain are attracting ever-growing interest because they are: (i) trustworthy and secure; (ii) efficient and low-cost; (iii) transparent and verifiable; (iv) a potential transmitter of value, and so can be used to digitize assets; and (v) extensible through the inclusion of additional programming capabilities. Given these benefits, blockchain applications will continue to proliferate, especially within the area of banking and finance.** Indeed, EU Blockchain estimates that the value of the blockchain market within the financial sector will expand by 73% annually, growing from USD 1.46 billion in 2021 to USD 22.46 billion by 2026, with growth led by an explosion in interest in smart contracts that will revolutionize the global financial industry.

Within the banking system, blockchain may be used to facilitate payments processing, clearing transactions, raising capital, extending credit, and confirming individual identities. **Krungsri Research thus believes blockchain technology provides an overall benefit to the banking and finance sector, though business functions that will be most affected by the increasing use of blockchain will tend to be those that: (i) rely on intermediaries; (ii) depend on large quantities of centralized data but have many users; (iii) are areas where trustworthiness and transparency are at a premium; and (iv) involve timestamped data.**

From the standpoint of banks, the impacts of increasing uptake of blockchain technology will vary with the context within which this is being deployed, though in general terms, banks will benefit from lower costs, the greater streamlining of business processes, and better risk assessment. Nevertheless, banks will also have to contend with more intense competition and so they will be at risk of seeing their profits and customer bases eroded. It is thus imperative that banks plan better and adjust their playbook to respond fluently to a rapidly changing business environment.

The first hints of the internet revolution came in the 1960s when a small number of US government agencies used proto-internet technologies to communicate at a distance, but it took another 30 years for the world to move from these small beginnings to the full realization of the internet. A major milestone in this transition was the development of the Transfer Control Protocol/Internet Protocol (TCP/IP), a communications standard that allows computers to exchange data at high speeds over large networks and to do so at low cost. The widespread uptake of developments such as TCP/IP then paved the way to the information revolution, which has transformed parts of the economy as diverse as printing, manufacturing, and banking, and profoundly affected consumers' lives worldwide.

The emergence of the internet rapidly fed into the development of the broader digital world, and this quickly came to have an important influence over our lives, but through the past decade, **a second revolution in information exchange has been unfolding with the creation and extension of blockchain technology. This set of technologies was created with the intention of overcoming problems with earlier models of data exchange that depended on intermediaries, duplicated information, and had problems with trust and cost,** and so as these new technologies have been rolled out, we have moved from a world based on the exchange of data to one based on the exchange of value. One outcome of this has been the further fusing of the digital and the real worlds, a clear example of which is the growing ease with which it is possible to move between fiat and virtual currency.

Just as with the initial transition to the widespread use of the internet 30 years ago, **this revolution will also bring with it a profound transformation of the economy, though this will be especially the case for industries that rely on intermediation, that involve high costs, and that are closely connected to the digital world.** Clearly, banks, which have a primary role of acting as intermediaries within the financial sector, are among those businesses that will have to face an increasingly challenging environment, but at the same time, this transformation will present banks with new opportunities if they are able to adjust rapidly and respond with suitable business strategies.

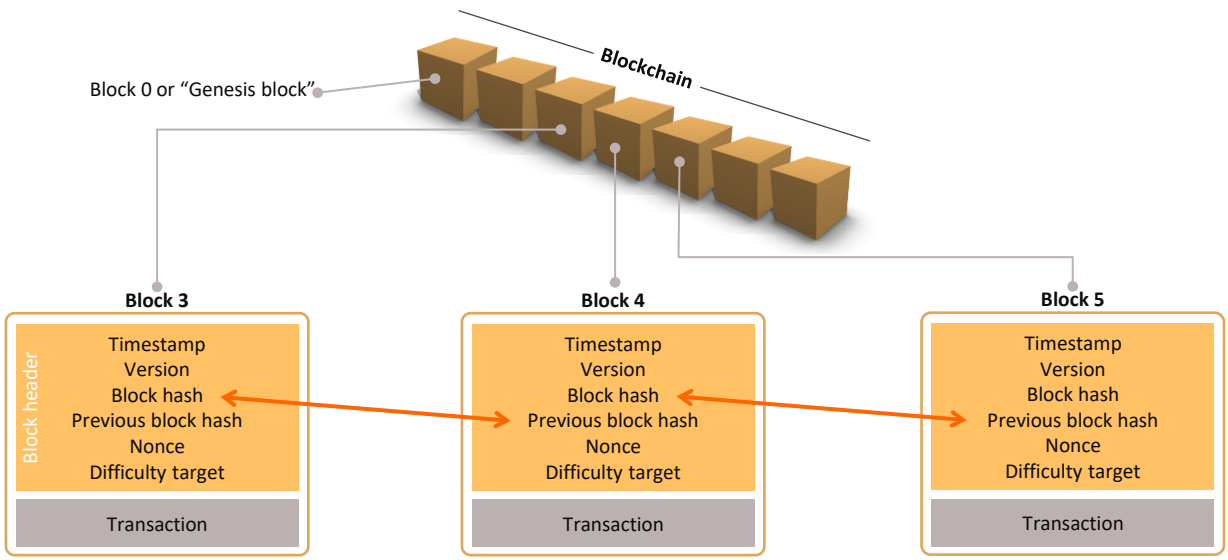
Blockchain technology

- **What are blockchain?**

Blockchain technology can be thought of as a protocol or a method for recording transactions that operates over peer-to-peer networks to store information in digitally distributed ledgers (DLTs). Because everyone in the network has copies of the same data and making changes to this is possible only with the agreement of a significant portion of other network participants, the data is generally immutable, and this does away with the need for intermediaries to store or verify data. In addition, because the ledger is public and so is held by and open to other network participants, it is possible to very quickly verify who has rights to or ownership of particular data. One consequence of this is that transactions carried out on the blockchain cannot be duplicated and so this then helps to generate digital scarcity, which then makes it possible to use blockchain to exchange value.

The name 'blockchain' derives from the fact that transactions are bundled together and stored as 'blocks' that are then digitally linked to one another to form a 'chain'. A variety of information is stored within each block, including the version number, a timestamp indicating its creation date, the block's hash value, the previous block's hash, the nonce (or 'number used only once'), which is the number that miners are solving for, the difficulty target, which specifies the algorithmic complexity of the miners' task, and of course, the details of all the transactions that are being stored in that block.

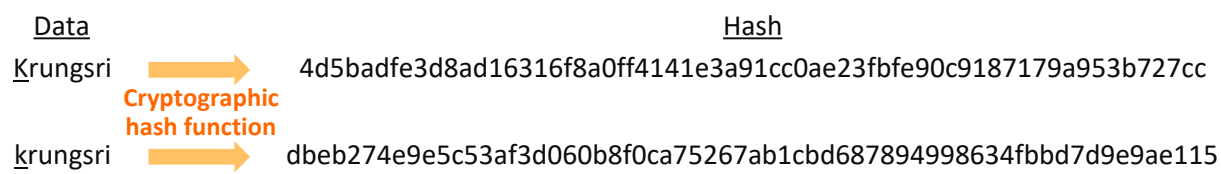
Figure 1: Blockchain structure



Source: Krungsri Research

Each block within the blockchain is linked to the previous block through its 'hash'. Hashing is a one-way mathematical function that provides a unique value (the hash) for any given input, but it does so only in the direction from data to hash, which means that given a particular set of data, you can always produce the same hash but given a hash, you cannot reverse engineer the data. Moreover, changes to even the smallest unit of data will produce an entirely different hash**.** The importance of this is that any unauthorized changes to the underlying data will become instantly obvious in the changed hash (Figure 2), and so it is very difficult or even practically impossible to make changes to the ledger without the agreement of other parties on the blockchain. This data immutability then dramatically increases the trustworthiness of blockchain applications. There are many different types of hashes, though two common ones are SHA256 and Ethash.

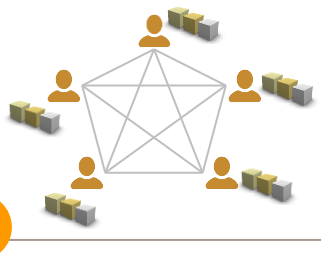
Figure 2: Example of Cryptographic hash function



Source: SHA256, Krungsri Research

- **How does blockchain work?**

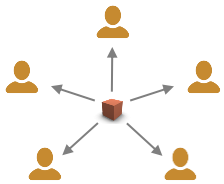
Figure 3: How blockchain work?



1. Before new transactions are recorded, all peers on the network have identical copies of the same ledger.

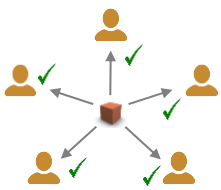


2. When a new transaction takes place, this will be converted into a block. The data stored in this block will share the same format as the previous blocks.



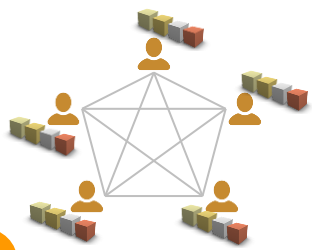
3. Newly-created block is distributed to every peers in the system.

4. Other users will verify the integrity of the new block through the use of a consensus algorithm that allows users to inspect and confirm potential additions to the blockchain. The most widespread of the systems used for this are proof of work and proof of stake mechanisms (Box I).





5. Once the new block is verified, it is written into the blockchain.



6. All users on the network will be notified of the new block.



7. The transaction is completed.

Source: Krungsri Research

Box I: Proof-of-Work Vs Proof-of-Stake

Proof-of-work is a system for encouraging blockchain miners to compete for the right to write a new block by being the first to solve a mathematical problem. To take a much-simplified example, miners might have to identify the two factors of 10,336,613 that are not equal to 1. When the first person identifies 2,903 and 3,571 as factors, other network participants will check to confirm whether or not this is a correct solution to the problem, and when more than 50% of network participants agree that it is, the block will be written and the first miner to submit a correct answer will be given a reward. Because confirmation of a block's integrity requires the agreement of half of the blockchain, proof-of-work protocols ensure that it is very difficult to make unauthorized changes to the blockchain. However, the flip side of this is that proof-of-work protocols require miners to solve mathematical problems that may be of enormous complexity, and the computing power needed to do this consumes a considerable amount of energy. In the example above, solving the initial problem of identifying the two factors is moderately complex, though by comparison, confirming that multiplying 2,903 and 3,571 produces the required answer is a trivial task.

Proof-of-stake mechanisms work somewhat differently in that problems are solved by 'validators' (not miners) that are chosen at random among those who have agreed to stake or lock an amount of money, though the chance of being picked increases in line with the value of the stake and the length of time that this is locked for. If a validator proposes a correct solution, they are rewarded with a payment but if the solution is incorrect, they lose their stake. Because validators do not have to compete against one another, proof-of-stake mechanisms have the advantage of being less energy intensive, but the system is at risk of validators working together to monopolize opportunities to write new blocks, which would then run against the decentralized ethos of blockchain technology.

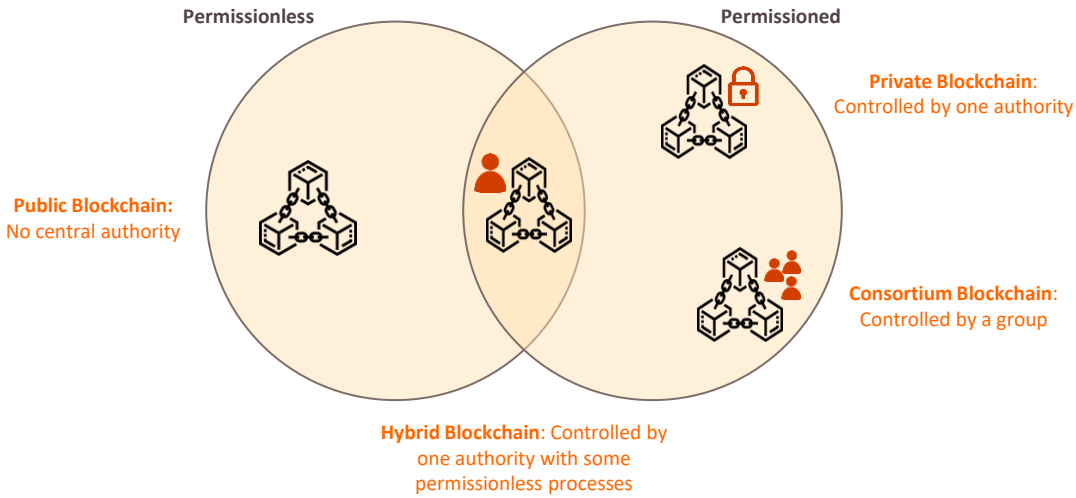
Although both proof-of-work and proof-of-stake mechanisms ensure data integrity, immutability, and verifiability by creating competition to solve mathematical problems that allocate the right to confirm transactions and create a new block, they do so through different means, allocate rewards in different ways, and impose different amount of energy needs.

- **Different types of blockchain**

blockchain have been used in a number of different applications, though these all fall into four main categories.

- **Public blockchain:** These are completely decentralized and permissionless, that is, anyone can participate in the network and all participants operate on an equal footing. The most obvious examples of public blockchain are virtual currencies, though the disadvantage of these is their slow verification process.
- **Private blockchain:** These are managed by a single authority that controls entry to and participation in the blockchain, the level of which may vary between users. Private blockchain are therefore only partially decentralized, but although this may leave them exposed to greater risk of attack, this structure allows for more rapid verification of transactions than is the case with public blockchain, and this may make private blockchain more suitable for applications that are deployed within a single organization, such as a particular government body.
- **Consortium blockchain:** These are also a kind of permissioned blockchain but unlike private blockchain, permissions are managed by a group (or consortium) of individuals. This makes them more decentralized than private blockchain and they enjoy a correspondingly greater level of security. Consortium blockchain are finding uses in applications that rely on the cooperation of a large number of stakeholders since this helps to reduce costs and increase usability. Examples of this include logistics and supply chain management, where a high degree of cooperation is required between players.
- **Hybrid blockchain:** These mix features of both private and public blockchain, with access to the blockchain and to the data it contains granted by a single authority. This helps to maintain high levels of privacy, but because transactions are validated by all blockchain participants, data transparency and trustworthiness is maintained. Moreover, verification of transactions is also quicker on hybrid blockchain than on their public counterparts. These types of blockchain are therefore used in situations that involve sensitive information or where it is important that data integrity is maintained but that also require a high degree of transparency.

Figure 4: Type of blockchain



Source: Kathleen E. Wegrzyn Eugenia Wang

- **Key features of blockchain technology**

The nature of the technology used to create blockchain is such that they exhibit the following features.

- **Trustworthiness and security:** Because data verification is carried out by a large number of participants and is only confirmed with the agreement of a majority of users, data is largely immutable. This makes it extremely difficult to make unauthorized changes to a blockchain, ensuring that the information stored in it is trustworthy and secure.
- **Efficiency and lower costs:** blockchain were designed to obviate the need for costly intermediation when verifying and recording transactions. Reducing the need for middlemen also helps to improve the system's overall efficiency.
- **Transparency and verifiability:** Because blockchain are decentralized systems for storing cryptographically protected information that is digitally linked to previous transactions, it is very difficult to alter data that is already recorded. This then makes the stored data both verifiable and transparent.
- **Value transmission and tokenization:** A further important characteristic of blockchain is that they help to prevent the unlimited digital duplication of information. This then allows them to serve as a vehicle for the transmission of asset values, and so blockchain are being used to transform real-world assets into digital analogues, a process that is referred to as tokenization.
- **Programmability:** blockchain have been extended with the ability to add conditions or rules for the automatic completion of transactions. These are referred to as smart contracts (Box II) since these specify in advance the conditions under which a set of computer instructions will implement itself, thus doing away with another layer of middlemen and reducing unnecessary processes.

- **How are blockchain being used?**

blockchain are now being rolled out in a wide range of applications in industries that include banking and finance, trade, tourism, transportation and distribution, and public health. Analysis by Krungsri Research shows that **the environments most suitable for the employment of blockchain are marked by four main characteristics: (i) transactions pass through an intermediary or middlemen; (ii) data is in a shared repository but involves or is accessed by many users; (iii) significant levels of trust are required; and (iv) the data is timestamped. Examples of these include financial data**, bank accounts, shipping information, employment data, and information relating to treatments and medicines.

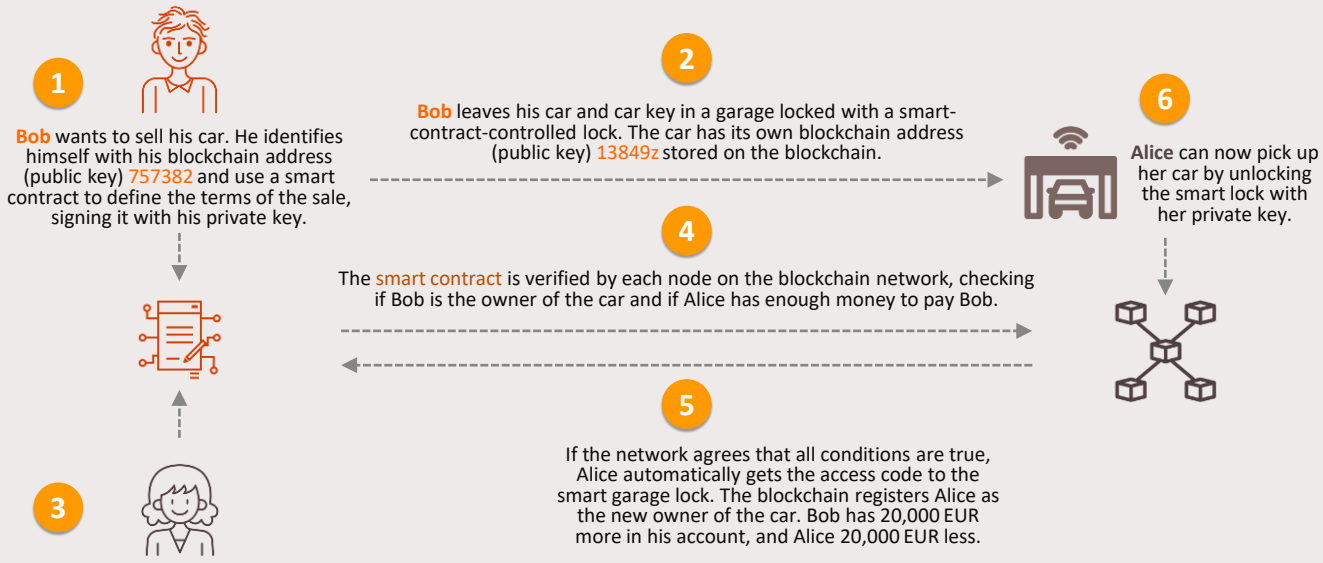
Box II: What are smart contracts?

During the initial period of blockchain development, or what might be called Blockchain 1.0, most uses involved simply recording transactions. The most well-known example of this is the virtual currency, exchanges of which are recorded in the blockchain. However, in 2014 Vitalik Buterin, a Russian-Canadian programmer, extended blockchain by giving them the ability to run code themselves. Thus, in addition to recording data, blockchain are now able to respond to these changes, and this was the origin of the Ethereum blockchain, the creation of which marked the beginning of Blockchain 2.0.

The code that is embedded in blockchain is often referred to as a 'smart contract' since it shares many of the features of the traditional paper contracts agreed between buyers and sellers. However, smart contracts differ in that they are self-implementing under the right conditions, though they also maintain many of the other features of blockchain, that is they are public, verifiable, distributed, disintermediated, and trustless.

To illustrate how this works, consider an example in which Alice wants to buy a secondhand car from Bob. In the pre-blockchain era, the two would have no choice but to use standard contracts that would have to be witnessed by a third party (e.g., a government agency tasked with recording changes of vehicle ownership, or perhaps a bank) that would confirm that money had passed in one direction and ownership of the car had gone in the other. However, the situation would change significantly if they were able to use a smart contract to facilitate the transaction. In this case, other participants or blockchain nodes would be able to inspect the transaction and confirm that Bob is indeed the lawful owner of the car and that Alice has sufficient money to meet Bob's asking price. Moreover, if Bob leaves his car at a site equipped to connect to and process smart contracts, when the transaction is confirmed by the network, the car will be released to Alice automatically, without her having to wait for Bob to deliver it in person. Because this transaction has been recorded on a blockchain, if the car is stolen from Alice in the future, it will be possible for other nodes to check the vehicle's ownership and confirm that Alice is still the legal owner of the vehicle with that chassis number (Figure B1).

B1: A Smart Contract Facilitated Car Sale



Source: BlockchainHub.net, ETDA, Krungsri Research

B2: Examples of Smart Contract Use-Cases

Trade finance: Smart contract can be set up as escrow accounts that 1) monitor an exchange between 2 parties, 2) track the location of the goods, and 3) trigger payment when ownership has been transferred

Security issuance: Securities based on payments and rights and executed according to predefined rules can be written as smart contract e.g. smart bonds and private stock markets.

P2P insurance: By writing insurance policy into a smart contract, insurance firm can automate and enable P2P insurance business model.

Syndicated loans: Smart contract can help reduce the settlement time for syndicated loans and help reduce issuance time and operational risks.

Digital rights management and micropayments: Smart contract can allow access to digital content such as music, images, and videos, with access keys stored on distributed ledgers, and at the same time automates micropayments.

Event-driven Insurance: Connected devices that store data on a distributed ledger help underwrite insurance and automate claim servicing.

Loyalty and rewards: Loyalty and rewards system through smart contract stored on a distributed ledger for e-commerce, retail, and travel companies can ensure interoperability.

Post-trade services: Smart contracts can ensure regulatory compliance and requirements of trades and take corrective steps as needed.

Land registry: Smart contract can store ownership or property on a distributed database and securely update registry when transferring ownership.

Distributed smart power grid: With smart contract and distributed ledger, households can generate power and sell it over the grid through P2P payment and micro-transaction.

Source: Everest Group

Following the introduction of smart contracts and the emergence of Blockchain 2.0, technological development has continued apace and decentralized applications (DApps) are now on the cutting edge of blockchain technology. These are an extension of smart contracts, though DApps allow the limited functionality of smart contracts to flower into full-blown applications, and because these now allow cross-chain interoperability, they mark a further significant step forward for blockchain functionality. In addition, distributed ledger technology (DLT) is being extended to increase the usability of blockchain across a much broader range of use-cases, including in banking, insurance, logistics, real estate, education, healthcare, the arts, and a large number of other areas.

Blockchain technology

As of 2021, the blockchain market was worth USD 6.92 billion but this is forecast to expand at an annual rate of 68%, bringing the market value to a total of USD 94.89 billion by 2026. Growth will be supported by the need to increase data security in industries including finance and banking, telecommunications, public health, and among public-sector bodies. Some examples of blockchain use-cases are given below.

Speeding up transactions and making these more efficient: Data that is recorded on blockchain is protected by high-quality verification systems that make it difficult to make unauthorized changes to the underlying files. Because the system generates high levels of trust, it is no longer necessary to wait for middlemen to inspect and verify transactions, and this makes business processes quicker, safer, and cheaper. A survey by the European Business Review thus found that by 2024, 66% of the world's leading banks intend to use blockchain to improve systems for recording financial transactions.

Confirmation of personal identity: At present, digital confirmation of identity generally requires the use of a username and a password, but these systems are often open to attack and personal data is regularly stolen from these. Instead, it is possible to use blockchain to confirm personal identity and to store personal data, and because this would make it easier to manage access to the latter, the use of blockchain would protect against attack, significantly increase security, and make these systems easier to use. It is expected that using blockchain technology to confirm identity will therefore become widespread in industries including banking and public health, as well as in the public sector.

Recording and storing data: Using blockchain to record data increases trustworthiness and security, especially in situations where many users are accessing that information, such as data related to finances, medical treatments, logistics, and logistics.

Integrating the digital and the real worlds: Using blockchain makes it easier to transfer and to manage ownership of digital value, and this then provides a means of digitalizing real-world assets and business activities, for example within the metaverse[1/] or in the form of NFTs[2/].

Using smart contract-enabled blockchain: Smart contracts are contracts that are embedded in blockchain and that can be used in insurance, to facilitate business transactions, and to protect intellectual property. Smart contracts operate by self-executing if and when transactions are recorded that meet the conditions specified in the contract, though these also preserve the key features of blockchain, which means that one side of the contract cannot unilaterally alter its terms. Given these advantages, smart contracts help to reduce counterparty risk.

Although many observers believe that blockchain technology will become increasingly widespread in the near future, increased uptake will still need to overcome many challenges.

- **Blockchain performance depends on quality of nodes:** The overall quality of a blockchain is highly dependent on the quality of its individual nodes, and so to maintain this, many public blockchain (within which it is not possible to filter or otherwise select network participants) incentivize participation. This may take the form of offering coins or governance tokens that give holders the right to vote on future platform policy.
- **Difficulty scaling:** Because the time taken to confirm and verify blockchain transactions grows in proportion to the number of users, these are difficult to scale. For example, confirming transactions on decentralized value transfer systems that rely on Proof-of-Work consensus mechanisms can take around 10 minutes on average. This duration is generally considered too long for practical, day-to-day payments such as retail purchases. Nevertheless, in some more restricted cases, such delays are acceptable. For example, it typically takes 2-3 days to complete international transfers and so by comparison, Proof-of-Work transactions are very rapid.
- **High energy consumption:** Confirming transactions on blockchain, most obviously when this relies on a proof-of-work mechanism, encourages users to compete against each other to solve extremely complex mathematical problems. This is done using high-end computers that consume tremendous quantities of energy, and it is estimated that on average, recording a single ~~bitcoin~~ transaction uses 1,173 kWh of electricity, which would cover the electricity needs of an average family for 6 weeks. The Cambridge Center for Alternative Finance (CCAF) estimates that in total, recording and confirming Proof-of-Work transactions uses around 110 TWh annually, or 0.55% of global electricity consumption.

1/ The metaverse is a 3-D immersive environment that seamlessly combines the real and the virtual worlds, providing a space within which users may live out their lives. This may be to work, relax, consume entertainment services, play games, socialize, or to engage in activities with others as you do in offline spaces, though in all these cases, entry to the metaverse is dependent on access to the internet and suitable headgear. For more details, please see … The Metaverse: When virtuality becomes reality

2/ NFT is an abbreviation of 'non-fungible token'. These are modern alternative assets that carry with them built-in certificates of authenticity that establish proof of ownership or confirm some other particular kind of right to the NFT. These can take the form of digital content, such as images, photographs, or music, or they may refer to physical assets, such as land. NFTs can thus be thought of as a digital token that confirms ownership or copyright. For more details, please see … The role of banks in the new world of NFTs

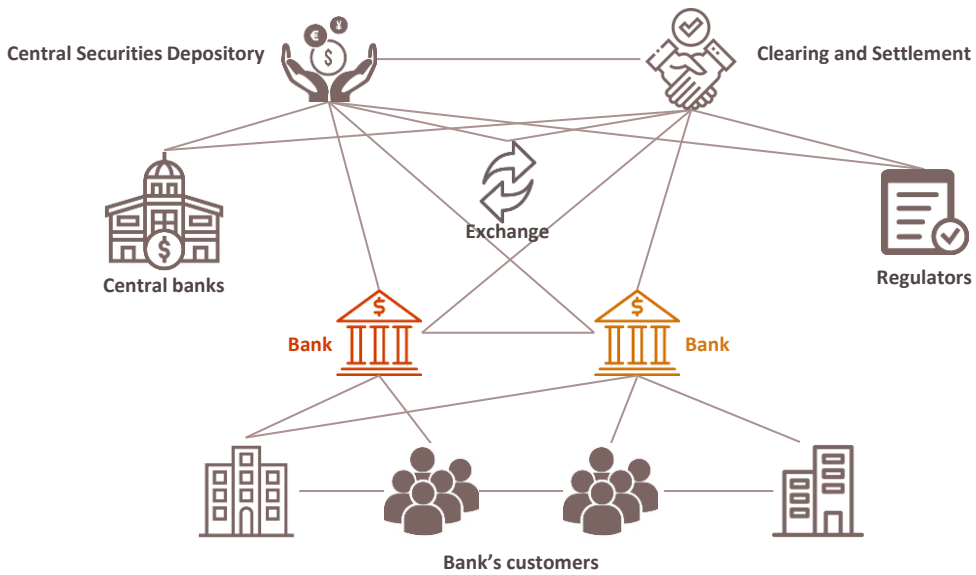
- **Data immutability:** If data is incorrectly recorded, correcting this is extremely difficult. Likewise, it is nearly impossible to remove information once it has been recorded.
- **Large upfront costs:** Organizations wishing to transition to blockchain-based operations will need to invest heavily in changing their existing systems to become blockchain-compatible, with additional costs coming on both the software and hardware sides of the upgrade.
- **Incomplete security:** Although data recorded on blockchain is secure, this security is not 100% foolproof and attacks may still be successful. In the case of a successful hack, losses may be considerable and there is then a risk of repeated attacks, which would severely undermine overall faith in the system's trustworthiness.
- **Access is dependent on private keys:** Private keys are a kind of password that is used to access blockchain data but because blockchain systems are decentralized, losing a private key means that access to the linked data is permanently lost. This differs from systems that rely on middlemen, for example banks, which keep your account data for you, even if you forget your password.
- **Lack of skilled developers:** There is a shortage of individuals with blockchain expertise, and Bloomberg reports that over the past 2-3 years, salaries for blockchain developers have been as much as 50% greater than those for other similarly skilled developers[3/].
- **Lack of interoperability:** At present, connecting different blockchain is dependent on ad hoc cross-chain solutions but if blockchain were able to connect or to communicate with one another natively, this would help significantly in developing the entire blockchain ecosystem. For example, this would allow for the direct exchange of virtual currencies without the need for intermediate exchanges into another currency. Alternatively, it would enable smart contracts to be written that would link different blockchain.

Uses for blockchain technology in banking and finance

It is highly likely that the application of blockchain technology will bring about significant changes to the global banking and finance industry, with the effects of this felt across areas as diverse as payment systems, capital markets, risk assessment, and banking back-office functions. In particular, the World Economic Forum believes that within this sector, there are three main areas where blockchain technology may find a roll in solving problems.

- **The banking industry is heavily intermediated:** It is true that one of banks' central roles is to mediate interactions between its customers, but within the industry, transactions are heavily dependent on middlemen. These include regulators and central banks, but other middlemen can be found in interbank clearing systems, currency exchanges, information storage systems, and credit scoring agencies. These many layers of middlemen then slow transaction times and raise the cost of doing business.

Figure 5: Banking system structure



Source: Ankenbrand, T., & Bieri, D

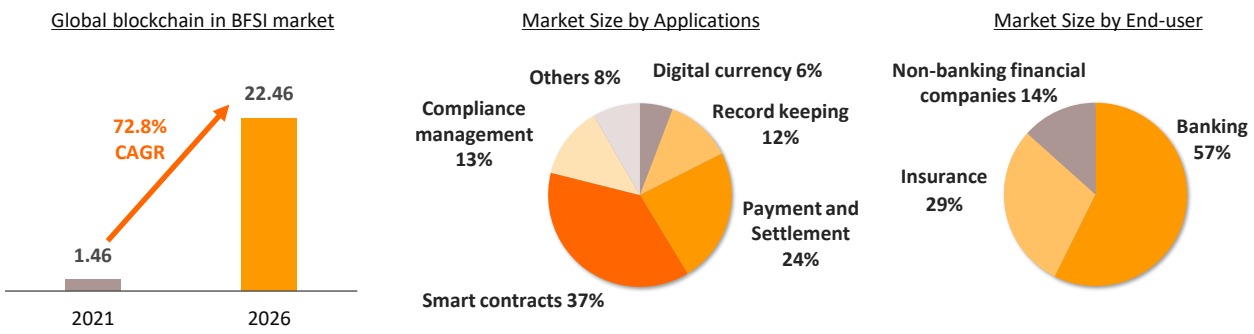
3/ Bloomberg Industry Intelligence (2021) Job report during COVID-19

- **Information is disconnected and siloed:** Data that is held by and swapped between banks may be stored separately by individual banks, which makes it difficult to use and increases the cost of data verification. In addition, because this then requires banks to create and maintain their own data storage systems, this adds unnecessarily to their costs and diverts funds that could be invested in data management. As such, data quality and security is relatively low.
- **Standards proliferate but transparency is lacking:** Trust in the banking system depends on external sources, for example from audits carried out by the bank itself or by external auditors. Many different bodies may be involved in these audits, and the standards used may vary with each organization, which then makes it difficult to verify the trustworthiness of any particular audit.

One of the key features of blockchain is their ability to disintermediate transactions and so **there is potential for this technology to be used to solve problems related to banking information silos and to increase trust in the banking system. It is hoped that in addition to solving these problems, deploying blockchain technology within banks will also open up new revenue streams, cut costs, streamline business operations, reduce risks, and increase customer engagement.**

EU Blockchain estimates that the market for blockchain technology within the financial sector will grow at an average rate of 73% annually in the coming period, taking the total value of the market from USD 1.46 billion in 2021 to USD 22.46 billion by 2026. Within the finance sector, the banking industry is the biggest consumer of blockchain services (57% of the total), followed by insurance (29%), and other financial services (14%). In terms of applications, the most common use is for smart contracts (37%), followed by payment systems (24%), and risk assessment and management (13%).

Figure 6: Market size of blockchain applications in Banking, financial, and insurance sector



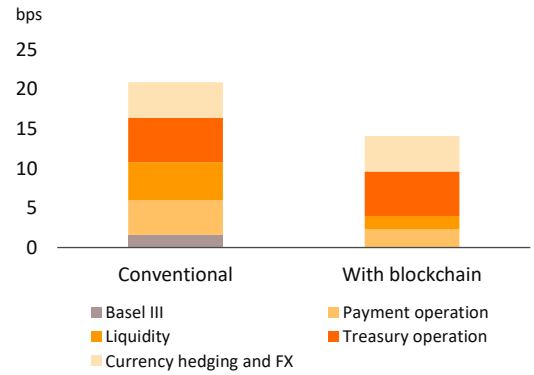
Source: EU Blockchain Forum

As stated above, blockchain technology is best suited for use in situations that are: (i) intermediated; (ii) structured around the centralized storage of data that relates to a large number of users; (iii) dependent to a significant degree on maintaining trustworthiness and transparency; and (iv) ordered around timestamped data. Krungsri Research has identified several use-cases that meet these criteria and that are thus areas where the deployment of blockchain could be of interest to the banking industry.

Payment and clearing houses: blockchain simultaneously reduce the need for middlemen to verify transactions and preserve a system's trustworthiness. Reducing the scale of intermediation within transactions helps to reduce their costs, and within the area of payment processing, it is estimated that the use of blockchain could reduce costs associated with regulatory compliance, operations, and maintaining liquidity by as much as half. This would cut the overall cost of payment and clearing services by up to 35%, which could then be passed on to customers in the form of lower bank charges. These savings are particularly noticeable for international transfers, where the costs of completing a transfer could be cut from the current level of as much as 5-20% of the value of the transaction to a fee in the range of 2-3% of the total. By using blockchain technology, players would also be able to cut the time taken to complete transfers, since a value transfer system that uses a Proof-of-Work consensus mechanism transaction takes an average of around 10 minutes to be verified, while standard international money transfers take hours to days to complete. A further advantage of using blockchain to manage payments and transfers is that the source of the monies being transferred is generally a lot easier to identify than when moving money through intermediated systems. At present, payment systems that are built on blockchain technologies include Ripple, IBM, SatoshiPay, BitPay and R3.

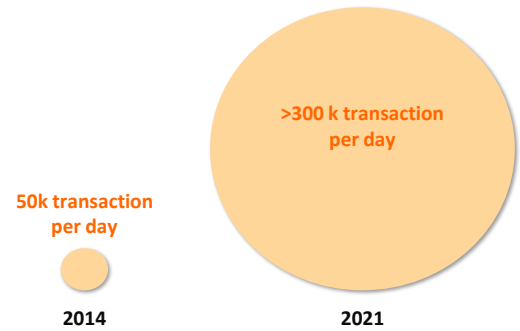
Unfortunately, although using blockchain technology to facilitate these services may help banks to cut their overheads and make transactions simpler, they will also be at risk of income falling and customer engagement worsening. This will be a particular risk for payment services, where in addition to losing income from their fees, banks may also lose customers to new players operating on blockchain-based platforms.

Figure 7: Payment infrastructure costs



Source: the Finadium 2016 Conference

Figure 8: Payments using blockchain platform



Source: blockchain.com

Raising capital and making loans: Using blockchain to raise capital generally takes one of two forms. The first of these involves **issuing a digital token[4/] in what is called an ICO (initial coin offering).** This is similar to raising funds through issuing bonds, though instead of bonds, the company releases digital tokens. Using ICOs to raise funds was particularly popular between 2016 and 2018, when ICOs raised as much as USD 2.4 billion per month. However, a second way of using blockchain in a fund-raising capacity is now becoming more popular. This involves protecting **venture capital through the use of smart contracts,** which then helps to reduce counterparty risk for investors.

Using blockchain to facilitate loans and credit may take many different forms. Borrowers may secure loans against virtual currencies, they may use payments recorded on blockchain to help improve their credit score or as part of the assessment of other risks, or they may manage the loan through a smart contract, which makes the process both quicker and less risky. This is especially popular when raising funds through crowdfunding[5/] or P2P lending.

Examples of companies using blockchain technology in fund raising and loan processes include VentureCapital, Valuation, Sequoia, Andreessen Horowitz, Union Square Ventures, SALT, BLOOM and Dharma Labs.

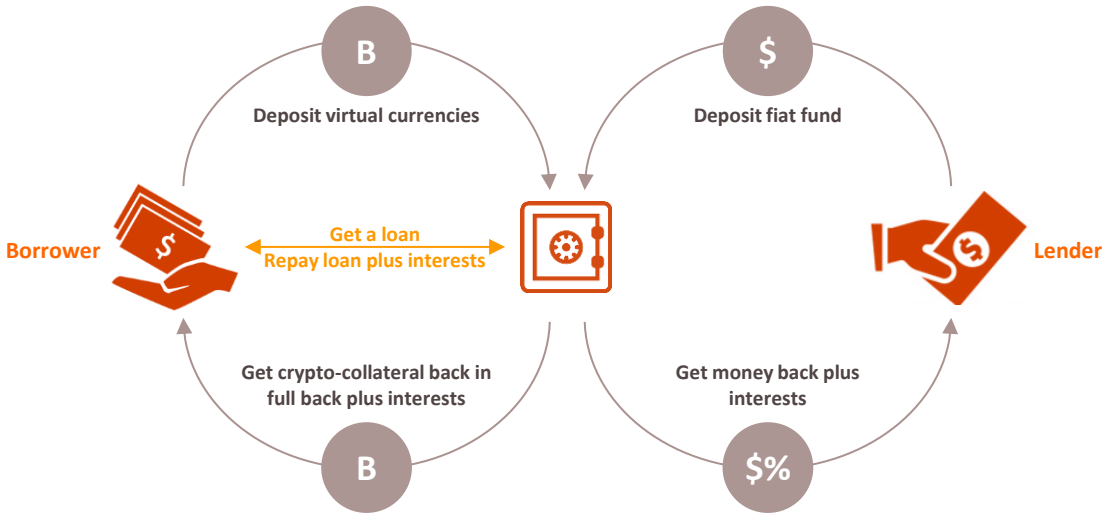
Blockchain technologies can help to cut costs and reduce the complexity of transactions for venture capital operations and for making loans, as well as offering banks a way of improving their customer risk assessment. However, **they may face increasing competition in the market for issuing loans to customers, especially from new low-cost entrants to the market** such as SALT, Celsius, and BlockFi. These players are able to offer P2P loans to borrowers at rates of around 3-10% per year, which is very attractive when set against the 6-20% that banks charge on personal loans[6/]. In light of this, if banks are unable to use blockchain when releasing new credit and loans, they may see their client base shrink, especially among retail customers. However, **the market for venture capital may offer banks a way of developing new sources of income and of connecting to new customer groups.**

4/ A digital token is a unit of digital data that has been created to assign rights to a share of income or of other goods and services, or to assign other rights (i.e., it is a utility token), as specified by the token issuer.

5/ Crowdfunding is a way of raising funds that relies on sourcing money from individuals rather than from banks or other financial institutions. Members of the public are appealed to directly for money to support an activity, a project, or another type of business, with the nature of the returns made to those who have contributed varying according to the type of crowdfunding and the goals of those organizing it (source: https://flowaccount.com/blog/crowdfundingforsmes/).

6/ Forbes

Figure 9: Loan process in blockchain platform

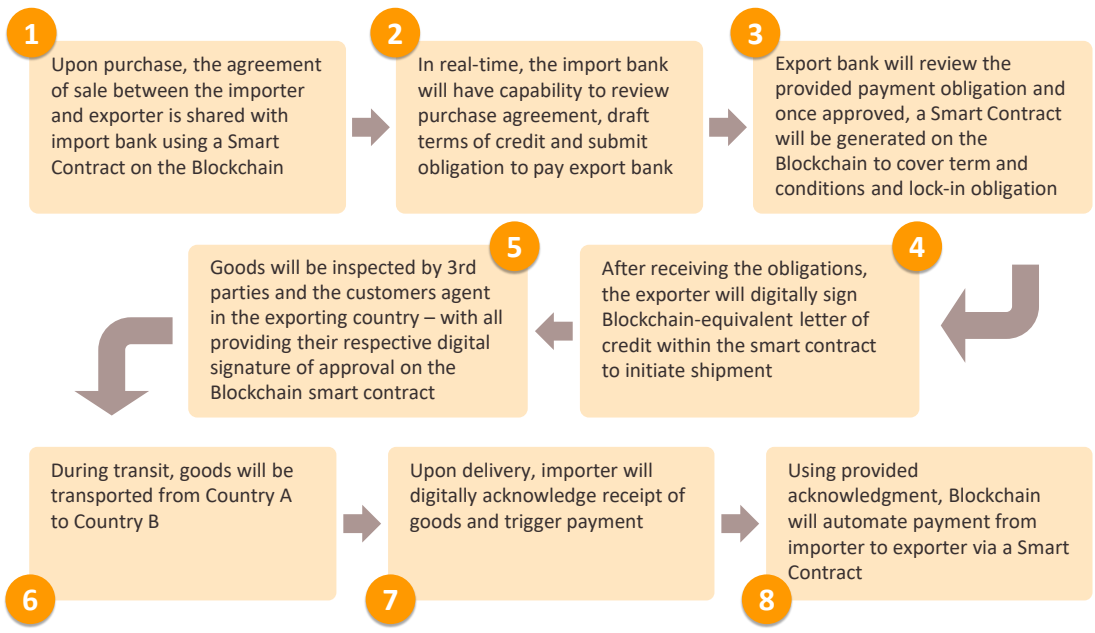


Source: DappRadar

Trade finance: Organizing the financing of international trade is a complicated and lengthy process that could be significantly simplified through the deployment of blockchain systems, and in particular, the use of smart contracts could automate many of these procedures. Using blockchain would also help companies prevent the release of certain types of data, such as sensitive pricing information, since by using the right type of blockchain, players are able to specify which information will be made public and which will be kept private. At present, within the area of trade finance, blockchain are used in Thailand as letters of guarantee[7/]. In addition, as discussed above, blockchain can be used to make international transfers and this will make it easier to arrange international trade finance. Companies active in the area of providing blockchain-enabled trade finance include Ornua, IBM, Standard Chartered, HSBC, BBVA, DBS, UBS, and Mizuho.

It can be seen that blockchain technology can help banks to simplify their operations, cut their costs, and reduce their exposure to risk. This will then allow banks to better serve their client base, leading to a richer customer experience and higher rates of customer engagement.

Figure 10:Trade finance on blockchain



Source: Deloitte

7/ For example, BCI (Thailand) Ltd., a joint venture between banks, state enterprises, and many leading business organizations that have cooperated under the Thailand Blockchain Community Initiative. Six Thai banks have invested in the company: Krungsri Ayutthaya, Bangkok Bank, Kasikorn Bank, Krungthai Bank, SCB, and TMBThanachart Bank, which all operate under the supervision of the Bank of Thailand.

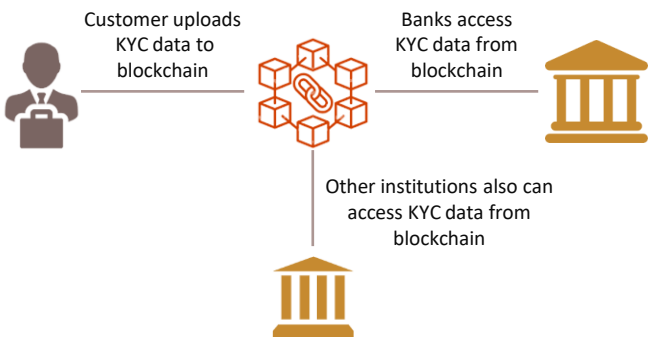
Figure 11: Example of blockchain users in trade finance



Source: CBinsights

Know-your-customer (KYC) and fraud prevention: Within non-blockchain-enabled systems, every bank and organization that is required to carry out KYC procedures has to separately inspect and confirm the identity of its customers, which causes an enormous duplication of work that then adds unnecessarily to costs. By contrast, **using blockchain to identify customers would not only save money for banks but would also reduce the difficulties experienced by those who have to establish their identity.** In addition, using blockchain would increase data security and reduce the risk of customers' identities being stolen. Deloitte thus estimates that blockchain-based e-KYC would help to save over USD 160 million annually that is currently spent on KYC. Indeed, many organizations are already using blockchain for this, including HSBC, Barclays, Deutsche Bank, MUFG, IBM, KYC-chain, and Thailand's NDID (National Digital ID).

Figure 12: KYC on blockchain platform

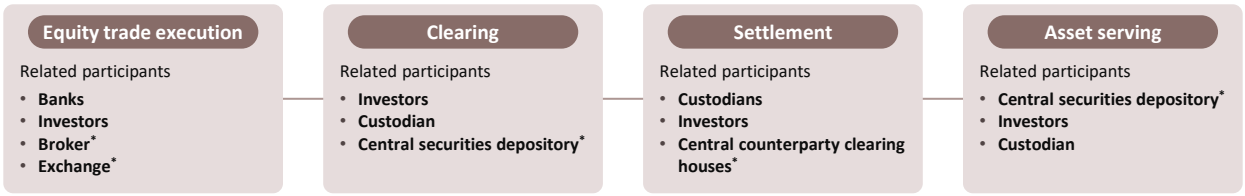


Source: Appinventiv, Krungsri Research

Capital markets: This is another area where blockchain technology could bring benefits since these involve: (i) many participants, whether that is buyers, sellers, providers of market exchange services, or brokers; and (ii) complicated business processes that impose high costs in terms of both money and time. This is especially notable for processing of payments and settlements, which typically takes 2-3 days to process. **blockchain would help to reduce the extent of intermediation involved in matching buyers and sellers, and within clearing and settlement systems**, which would then translate into lower costs. Bloomberg has therefore estimated that introducing blockchain technology into capital markets would save USD 17-24 billion per year. **This would also have the benefit of reducing brokers' monopolization of sales data, which would have the effect of increasing the transparency of financial markets.** Companies in the financial space that are currently using blockchain technology include Chain, PolyMath, tZero, Blocktrade, Alphabit Fund, Blocktower Capital, and CoinShares.

For banks, more widespread use of blockchain within capital markets may be a mixed blessing because while this would reduce the cost of trading assets, banks would also likely have to face increased levels of competition, and this may lead to their losing income from the fees charged for managing and trading these assets. It is thus estimated that if financial assets were tokenized, US banks would lose over USD 3 billion in income annually.

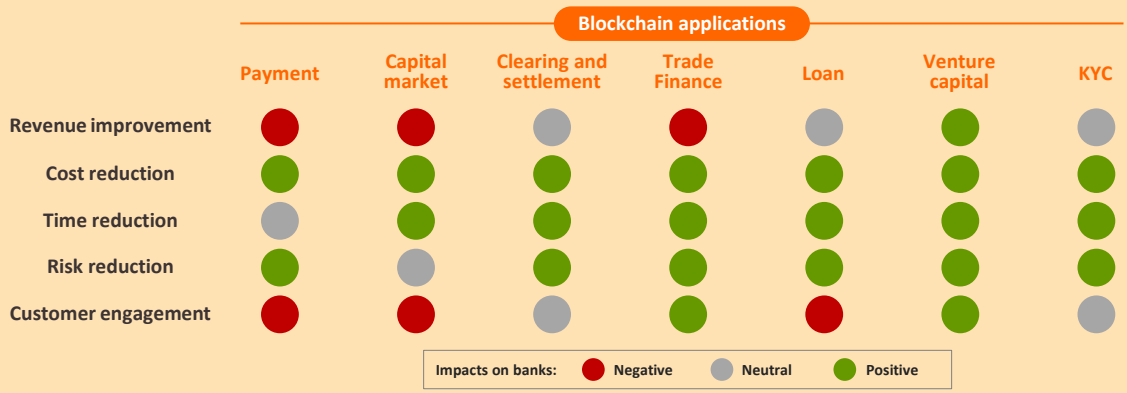
Figure 13: Current process in stock trading



Source: Roland Berger, Krungsri Research

It is clear that blockchain technology will bring overall benefits to the global financial and banking system, but from the point of view of banks themselves, the effect of the impacts will vary according to the context within which blockchain are used. Generally, banks will benefit from lower costs, the streamlining of business activities, and better risk assessment. However, the introduction of blockchain may also lead to banks having to contend with more intense competition. This would then increase the risk that they would lose income and see their customer base eroded, and against this background, it is essential that banks plan for the business transformation that the transition to blockchain will usher in.

Figure 14: Current process in stock trading



Source: Ankenbrand, T., & Bieri, D, Krungsri Research

However, if banks are planning how to apply blockchain technology, given their role as intermediaries within the currently established financial system, they should not begin by rushing to adopt blockchain blindly. Rather, they should consider what the weaknesses of the current system are and how it generates pain points for customers, before identifying what consumers' primary needs are and how they hope to use banking services. Having done this, banks will be much better placed to use modern technology, including blockchain, as tools to solve the problems experienced by consumers. In this case, by providing high-quality, efficient services, banks will be able to preserve their place as intermediators within the financial system, even as those around them expect blockchain to fulfil their role as disruptors of the status quo and destroyers of middlemen.

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