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Blockchain: Exploring possibilities for Capital Markets

Background:

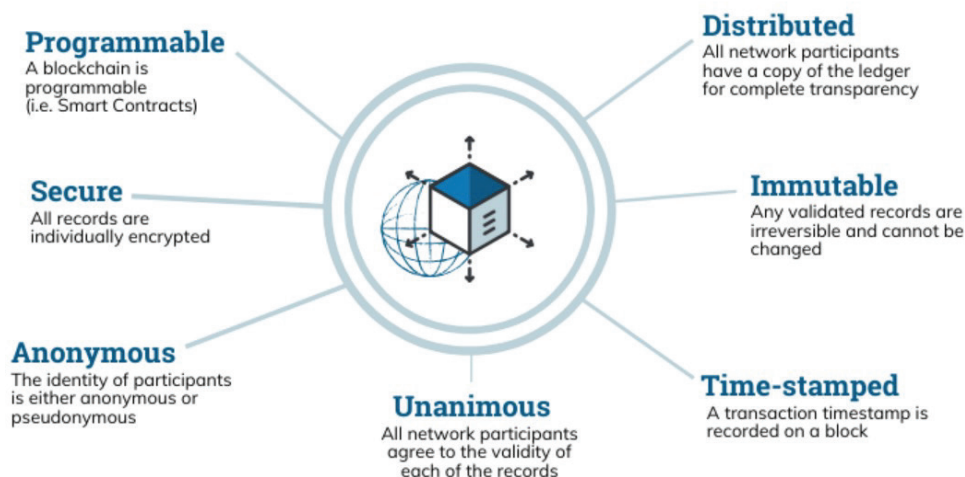
Blockchain is a distributed digital ledger that facilitates transactions to be completed on a peer-to-peer basis, without any centralized trust agency. In other words, blockchain is a decentralized, immutable, secure system of record, which participants can audit, inspect, retrieve, and update. It is also referred to as DLT (Distributed Ledger Technology) which can be visualized as a distributed ledger or a shared database accessed, updated, and participated by multiple users and participants. The key characteristics which make the distributed ledger unique is the ability of the participants to self-regulate and to maintain the central database without any need for trusted middlemen. Every participant can access an identical copy of the ledger; thus, any discrepancy in the ledger can be immediately verified or rectified. Based on a consensus protocol and the underlying cryptography, any additions or updates in the database can be validated by a network of participants called "nodes". Nodes are the key participants in the blockchain ecosystem who confirm and validate the transactions in the system, thereby maintaining the integrity of the system.

The distributed digital ledger records transactions in a continuous series or "chain" of blocks which are cryptographically linked. This blockchain spreads over multiple copies across the network (i.e., computers). There is a cryptographic linkage between the consecutive blocks. All participating nodes on blockchain network receive up-to-date versions of the state of ledger when new transactions occur. Users may access and update the data, but they cannot amend or delete the existing data. This makes every transaction entry on the blockchain an immutable record, and a permanent and public trail of activities on blockchain, this makes blockchain a tamper-proof database. Any attempt to falsify the ledger requires a coordinated attempt to falsify the total number of ledger copies across all the nodes which effectively is an impossible probability to achieve. This gives blockchain the unique features of security, immutability, and transparency. These characteristics have given blockchain technology a plethora of use cases in the form of cryptocurrencies which can be programmed in multiple ways to record, tokenize, transact, exchange, and store the value on blockchain.

Key properties of Blockchain:

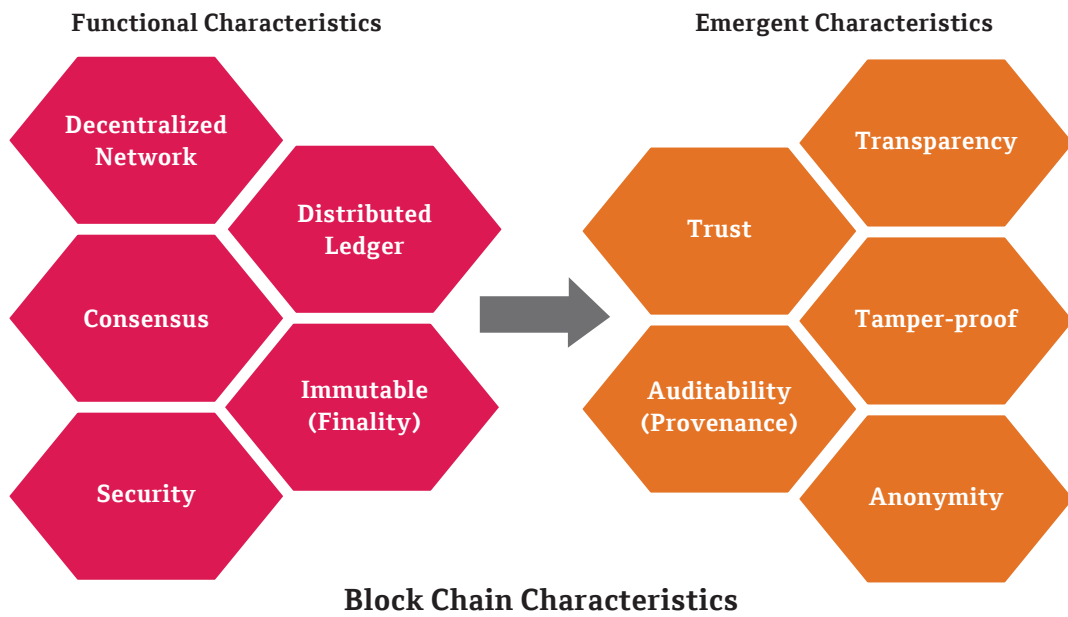
Characteristics such as immutable, auditability, shared database, multiple entities being authorized to make changes to the database, absence of trust and disintermediation makes the application scope of DLT wider and deeper for the financial markets.

The Properties of Distributed Ledger Technology (DLT)



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Source: <https://www.euromoney.com/learning/blockchain-explained/what-is-blockchain>



Challenges with Blockchain Technology:

Despite having immense benefits and transformative potential several challenges exist in the blockchain ecosystem that need to be addressed to harvest the full benefits of blockchain applications. Some of these challenges are lack of scalability and interoperability, high transaction costs, disproportionate dominance of crypto currencies, etc. A few additional concerns are listed below.

Inefficiency: No doubt inefficiency is the cost to avoid the reliance on the trusted third parties. Immutability is also not always desirable. In the financial world there are instances where flexibility is required to reverse things. Once validated and stored on blockchain, a transaction stays permanent. This feature may not be desirable in financial scenarios where amends and updates are required based on the nature of transactions. For example, “fat-finger” trades, or trades dictated by regulators for reversal, can only be reversed by an equal and offsetting trade, which both parties must accept.

Standardization: As the technology is still in a nascent stage, there is a lack of standardization between the emerging use cases and technical solutions implemented in this space. This is a major issue which gives rise to another problem or hindrance to interoperability and consequently to scalability.

Achieving consensus: Consensus is the bedrock of the blockchain network. Because of the distributed nature of the blockchain, any protocol update must be approved by all. A potential solution is to embrace a permissioned network, which would authorize one or many nodes to make the desired changes in the network. However, this solution brings in the centralized control of trusted parties thus compromising with the basic tenet of blockchain disintermediation.

Legal uncertainty: As the technology is still in an exploratory stage, there is great uncertainty of the laws and regulations related to taxation, consumer protection, KYC/AML, applicability of existing compliance frameworks, etc.

Privacy: The very nature of the public blockchain is to make it publicly verifiable so that in the absence of a centralized authority trust can be induced in the system. However, anonymity and confidentiality are durable for many use cases in the finance sector where it is in the interest of the party’s competitiveness that the information must not be disclosed publicly.

Intellectual property: Legal challenges in the area are immense as the technology involves the usage and application of patented components and intellectual property. This can not only hinder innovation but also discourage the parties from attempting genuine use cases fearing the legal consequences. Unfortunately, there is not much regulatory clarity in the area.

Regulatory challenges uncertainty: Regulators across the globe are still evaluating blockchain use cases and there is an absence of global consensus on the regulatory landscape related to the application of DLT, taxation, contractual legality, etc.

Currency control: Central banks are mandated to exercise control over digital currencies. If the cryptocurrencies ecosystem needs to be mature in the payments area, then it is imperative that the activities are not only acceptable to central banks but also be regulated up to a certain extent. The announcement of adoption of CBDCs (Central Bank Digital Currency) is a right step in this direction.

However, despite these challenges the promises and benefits of blockchain far outweigh the shortcomings. The social impact of financial inclusion and disintermediation are far too immense to be overlooked.

The trilemma of Blockchain:

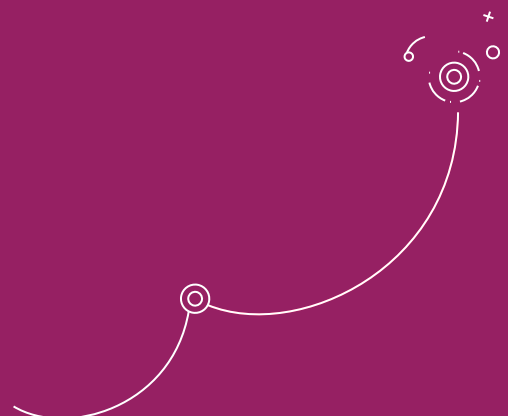
It is well-known that despite having revolutionary capabilities blockchain does not have it all. The following three characteristics cannot be achieved simultaneously. For practical purposes, one feature needs to be sacrificed.

Security: The ability to resist malicious actors and other attacks while ensuring that the immutability of blockchain is maintained.

Decentralization: Providing a trustless and disintermediated environment where individuals can indiscriminately participate.

Scalability: This pertains to the volume and throughput of transactions a blockchain can process in a given amount of time.

Solving the above “trilemma” would be imperative to maximizing the DLT’s potential. However, in many instances maximizing security, decentralization, and scalability are not the desired features. The adequate balance of scalability, decentralization and security depends on the nature of the project and the solution undertaken.





Promising application areas

Three key themes or properties of DLT have immense potential to transform the financial markets in myriad ways. The application of these properties in varied forms has already been experimented upon in the financial services industry and the results are promising.

1. DeFi:

Decentralized finance (known as DeFi) refers to a new financial infrastructure leveraging blockchain technology which facilitates transparent, p2p, decentralized, and global financial interactions without any central financial intermediaries like banks, clearers, custodians, etc. Instead, it replaces them with programmable codes like smart contracts, which run on blockchains or distributed ledger technologies (DLTs). DeFi or Open Finance (OpFi) also referred to as decentralized applications (Sapps) which offer services like micro-loans, tokenized asset trading, investing, insurance, financing, etc. It is diverse and inclusive, allowing access to anyone in the world who has a smartphone with internet connectivity. Moreover, the smart contracts used to create DeFi often employ open-source code, creating opportunity for innovation and community auditing. By disintermediation, DeFi users can maintain full control over their virtual assets and participate in the economic activity outside of their scope in the traditional banking system.

Stablecoins are the core components of DeFi which represents the fiats and other digital assets as digital tokens on blockchain. **Decentralized exchanges** allow users instant token launching, listing, and accessing liquidity without going via the traditional centralized and monopolized exchanges. As the technology is still in a nascent stage there are issues like inefficient use of capital, disproportional liquidity allocations, and over-collateralizations. A few examples of Defi applications are Uniswap (decentralized exchange), Synthetix (derivatives), Maker (stable coin), Compound AAVE (MM and lending protocol), Solana, etc.

2. Tokenization:

Tokenization of assets is the digital representation of real-life tangible or non-tangible assets on distributed ledgers. It has enormous potential for transformation of existing value transfer mechanisms which generates immense benefits such as **efficiency** by high levels of automation and speed, **disintermediation**, transparency, and openness, enhancing liquidity, tradability of non-liquid assets and making them available to the secluded and marginalized **audience**, inducing **liquidity** to currently illiquid assets, and smoothing the **reconciliation, clearing and settlement** processes. **Fractional ownership** is possible which lowers the entry barriers to investment and promotes diversity and inclusiveness to the left-out populations.

Tokenization not only creates the new markets and accessibilities of the new and old assets, but it also **improves the pricing** of assets by making the market data, asset demand, and liquidity more transparent and real-time. It improves the price discovery mechanism, reduces information asymmetries, and opens doors in the traditional asset financing domain which has been devoid of any major innovation for long time. A potential adoption and integration of tokenization in the financial and capital markets can redefine trading by disrupting the market-making model, affecting volatility and liquidity of assets. The significance of such change is amplified at times of stress.

Illustrated below is the asset tokenization process of creating tradable digital assets or digital evidence of asset ownership in a decentralized way.

Smart Contracts:

Smart contracts refer to the purpose-oriented programmable code stored on the blockchain and executed in the node by validators. Smart contracts are designed to be executed based on the satisfaction of a certain set of conditions. The output of execution can be independently verified on the public blockchain. Smart contracts behave according to the pre-specified rules set in the code. The purpose is to achieve a high level of transparency and security so that subjectivity and risk of manual intervention and manipulation can be removed. These attributes have huge significance when it involves the transfer or movement of an asset of value at a future date depending on meeting certain pre-requisites. Smart contracts induce contractual certainty in the outcome of execution. This can be used in asset financing, clearing, security settlement, money movements, and many more use cases without having to rely on trusted middlemen.

Functionally, smart contracts need to have three characteristics:

Deterministic: A program is deterministic if the outcome is always the same as long as the inputs are the same.

Terminable: It must have the feature to self-terminate so that it can be saved from going into an infinite loop.

Isolated: The smart contract must be independent and isolated so that its termination or contamination doesn't impact the entire system.

Application in the financial sector:

Features such as removal of intermediaries, speed, efficiency, reliability, providing control and ownership over the assets in the form of secured wallets, streamlining end-to-end value transfers, reducing costs, operational risks, and settlement periods make the DLT a revolutionary technology.

For example, by using the fiat currency tokens exchanged with XRP token, Ripple's XRP ledger provides real-time cross-border settlements. In trade finance the settlement of bill of credit and asset loans takes weeks to months to get verified and settled. The same can be achieved through blockchain in almost real-time basis. DLT could implement it by tokenizing the shared record of goods, shipments, credit receipts, financing, and insurance. This effectively eliminates the entire lifecycle of events, manual processes, and default chances. Similarly, Stablecoin and CDBC's have the potential to transform the payments and settlement sector.

With the proven success of DLT in the cryptocurrency space as well as recent regulatory activism in the area, capital market participants have been encouraged to adopt and utilize the DLT. There is wide scope to enhance efficiencies, reduce cost, or even explore new business models in line with the scalable DLT adoption in the financial sector. There are certain sections in the capital market ecosystem which can immediately benefit from the DLT technology such as optimization of balance sheet management via efficient capital and liquidity usages, reducing manual intervention in the reconciliation processes, and reducing the complexity and redundancies in the counterparty credit risk and collateral managements.

A few initiatives

Post Trade Distributed Ledger group (PTDL): PTDL is a UK-based industry group that provides a platform for financial institutions to explore and exchange ideas on the usage of DLT in post-trade processes. The membership of the group includes key market participants, infrastructure providers, and 40+ financial institutions in the clearing and settlement domain.

Hyperledger project: The Hyperledger initiative was launched in December 2015. It led by the Linux Foundation and participants in the initiative come from both major financial firms and large technology companies. The key purpose is to develop the cross-industry global standard for distributed ledgers. The membership includes many fintechs, blockchain companies and other industry groups in the same ecosystem.

R3 consortium: A US-based startup which leads a consortium partnership with 40+ financial institutes. The purpose is to achieve and finalize the common blockchain standards for the use of DLT in banking and finance. Unlike the other two initiatives, R3 is a venture with commercial intent.



Capital markets:

Today's global financial market infrastructures enable the safe, seamless, and efficient flow of assets, money, information, and value across markets and regions. However, the current system has certain limitations, and distributed ledger technology presents an ambitious opportunity to re-define and modernize market infrastructures to address long-standing operational and legacy challenges. Distributed ledger technology (DLT) has proven potential to disrupt payment, clearing, settlement, issuance, custody, and other such services.

Thus, the industry should explore the benefits of this technology in the multiple areas of capital markets where it can give instant results such as reference data management, bonds and security issuances, tokenization of custody services, trade confirmations and validations, micro payments, liquidity pool generations, clearing and settlements, nettings, collateral management, etc.

The existing technology stack of clearing and settlements, payments, digital identity, corporate actions, reporting and compliance, and collateral and ownership transfer can be restructured on DLT. This enables more efficient post-trade processes, enhanced reporting and oversight, greater resilience, and availability, reduced counterparty risk, enhanced collateral management, and reduced costs.

DLTs emerged from the consumer-to-consumer (C2C) market with the exchange of cryptocurrencies as a decentralized means of value transfer without intermediaries. Evidently, the wider financial industry has an altogether different set of requirements than the application of individual consumers seeking alternative methods of value transfer. Below are the key requirements that DLTs need to attain to be widely adopted in the financial industry.

Strong governance to clearly articulate the roles and responsibilities of involved parties as well as the business and technical operating rules.

Data controls are needed to access control over data availability and to preserve data sanctity and confidentiality.

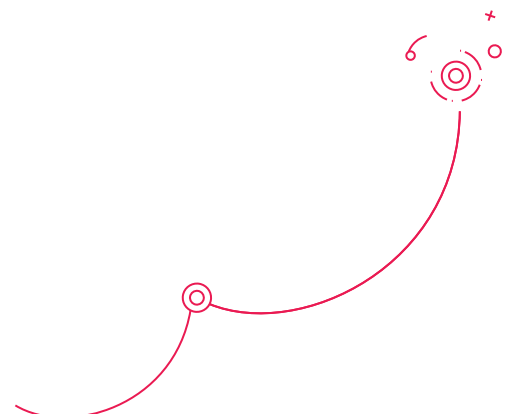
Compliance with regulatory requirements (sanctions, KYC, AML, reg reporting, etc.).

Identity framework establishing digital identities of parties involved to ensure compliance and accountability for financial transactions.

Security and cyber defense with the ability to avoid, detect, resist and prevent sophisticated cyberattacks.

Reliability with high availability, throughput, and readiness to support critical financial services.

Scalability for readiness to support voluminous transactions and qualitative processing of thousands of transactions per second.





Some Capital Markets areas where DLT is in an advanced stage of implementation:

Settlements:

The benefits of adoption of DLT in the settlement space range from reduced costs (reconciliation, matching errors, etc.), speed up settlement (quick and reliable validation), high resilience (high fault tolerance, no single point of failure), increased transparency (auditability, open accessibility), efficient reconciliations, etc. Shortened settlement times significantly reduce market and credit risk and margin requirements, which gives opportunity for the efficient allocation of the freed-up capital and saved time. In the current state, every transaction passes through several intermediaries and each one maintains their own data in silos. This gives rise to a widespread nuisance of data multiplicity and duplicity resulting in reconciliation and transaction disputes elongating the settlement cycles. One of the key benefits of introduction of DLT in the settlement space is the resultant shortening of the settlement cycle. This is helpful in multiple ways such as:

Margin reduction: For dealer banks and broker intermediaries, a move to T+1 or T+0 would lead to a significant reduction in collateral and margin requirements. On an average \$14+ billion is held in margin every day to balance the mark to market with counterparties to manage the default risk in the system. Shortening the settlement cycle will improve the balance between risk-based margining and pro-cyclical impacts and also free up the RWAs and regulatory capital requirements. In 2021, DTCC's risk analysis and risk model simulations proved that the volatility component of NSCC's margin could potentially significantly reduce beyond 40% by shortening to T+1, assuming the current technology stack, systems, processes, and client behavior are intact. The volatility component accounts for approximately 60% of NSCC's total margin requirements. In stressed times and highlighted bearish sentiments the share of volatility component significantly rises to an even higher number.

Risk reduction: The market resilience could be significantly enhanced by shortening of the settlement cycle. It will be cheaper for investors, process owners, and for the overall market. Some of the benefits can be summarized as reduced systemic risk, operational risk, counterparty risk, settlement risk, reduction in liquidity needs, buy-side counterparty exposure, etc.

The current state of affairs of automation of securities transactions is marred by the complex web of disparate number of applications and intermediaries. The unique combination of utilization of distributed ledger for trade authorization, confirmation, affirmation, allocation and clearing can accelerate the settlement process significantly. In an ideal scenario, the settlement could be achieved in near real-time basis. The possibility of instantaneous settlement may sound encouraging but in the current market practices it may not be desirable for certain types of transactions. The elongated settlement cycle has its own benefits in the current market structure as it provides the necessary time for parties to arrange for funds and movement of assets. Nevertheless, shortening of the cycle is certainly advantageous for the larger market interests because the advantages of mitigated counterparty risk, enhanced reconciliation, and reduced collateral requirements far outweighs the additional 1-2 days consumed in managing the essential settlement formalities.

Under current clearing and settlement arrangements, a Central Counterparty Clearing House (CCP) offers benefits beyond the pure function of clearing, including netting risk exposures, payments, transfers, reducing balance sheets, and increasing market transparency. Central Securities Depositories (CSDs) hold securities in dematerialized form so trades between parties can be made by book entry without issuing physical certificates of ownership. A CSD also provides clearing and settlement functions and potentially mitigates operational risk.

Collateral management:

DLT can solve new collateral requirements and allows one to tap into unused assets, reduce operational complexity and overheads, enhance efficiency and flexibility, and automates the flow of initial and variation margin.

The use of DLT could expedite the trade clearing and settlement to nearly real-time reducing counterparty risks and unfreezing collateral to the usable liquidity pool, removing manual and recon-related impediments, and reducing risk-weighted assets, thus generating capital efficiencies for parties. On the other hand, post-trade processes can be significantly simplified, operations and back-office processes will be optimized, and manual intervention is reduced significantly. However, the experiments and proof of concepts of the DLTs usage in clearing and settlement has produced mixed results. The barriers related to the lack of standardization, regulation, and scalability solutions needs to be addressed before the large-scale adoption can be realized.

Confirmations:

Confirmation the contractual attestation of the trade which is a tedious process in the current implementations. It involves scanning the key trade attributes on an agreed template and then exchanging and acknowledging that amongst the parties. It involves complex linkages between trading, legal, documentation, communication exchange, interfaces, etc. If the DLT's promise of trust and transparency (with a golden common data source) is implemented on a common ledger then the same thing can be achieved bypassing all the above subsystems and intermediaries. This will significantly reduce costs (i.e., reduced data entry duplication and reconciliation errors), strengthen resilience, reduce operational risk, boost efficiency and enable reliable management of the data flow. In short, DLT addresses the below key problems to achieve this:

Resolving issues of trust: Trading parties, market participants, and service providers often have divergent or competing business interests. Thus, establishing trust amongst them though desirable is inherently antagonistic. In a DLT implementation each party acts as an independent node. They can have equal access to data, so they can collaborate to achieve the bare minimum trust to sign the confirmation agreements. The same can be achieved with an efficient consensus protocol. This strengthens the trust because each party is aware that no single party can tamper with or alter the data.

Unequal access to data: In the entire security and asset ecosystem, there is a lack of a single “golden source” of master and reference data. This creates a disparity among players seeking different means to collect data, which renders unequal access across the parties. Blockchain allows controlled, common, and secure data sharing allowing each participant to have access to a combined data pool.

Inefficiency: Lack of a single data source gives rise to multiple to and fro reconciliations, manual verification processes, operational risks, and slowness in the transaction movement. With DLT, near real-time settlement and confirmation can be achieved. Programmable codes called “smart contracts”, could streamline or automate the manual and routine aspects of transactions, sub transactions, regulatory reporting, etc.

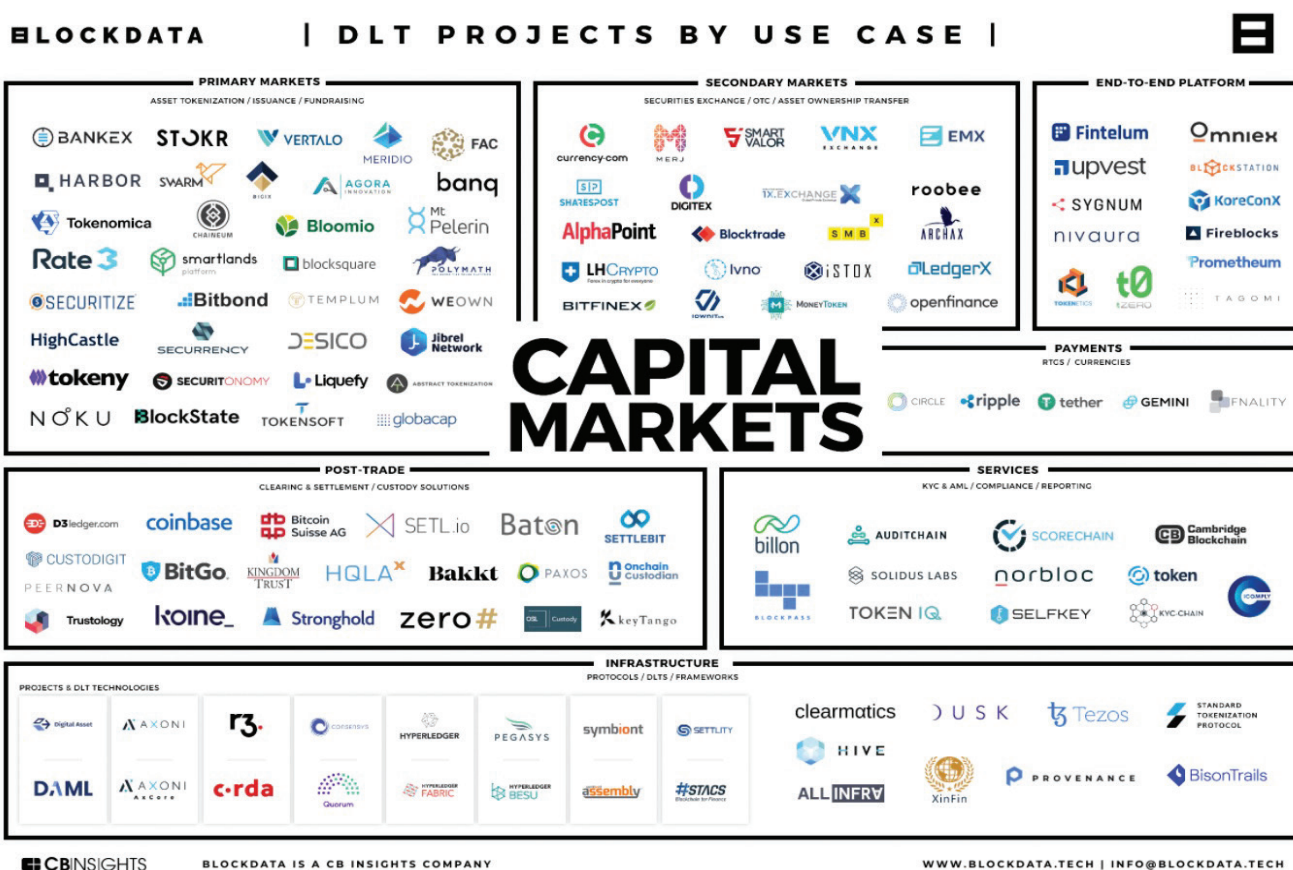


Democratization: Democratized access to data, information, and assets would benefit all parties. Issuers would be able to diversify sources of funding and end-investors would gain through transparency, market-based pricing, and portfolio diversification. Even SMEs and small investors would be benefitted by micro services enhanced financial accessibility.

Market disintermediation:

Market participants who act as the intermediaries for financial services such as central depositories, reporting repositories, clearinghouses, security exchanges, brokers, clearing members, custodians, prime brokers, investors, market makers, asset managers, dealers/brokers, corporate and retail banks, transfer agents, and liquidity providers can either be entirely bypassed or efficiently aligned with the use of decentralized ledger technology. The implementation of this technology can offer the following opportunities:

Internal ledger synchronization (transactions/messages/bookings/transfers/allocations/payments), transformation of post-trade processes such as asset/securities/issuance/capital booking and transfer, digitization and automation of the existing manual processes, security issuances, tokenization of liquid and illiquid assets, confirmations, settlements and payments.



The above illustrated blockchain vendors provide an array of services that range from tokenization, finance, delivery versus payment (DvP), asset transfer, asset trading, post-trade services, and the active infrastructures that are powering a number of these solutions. T+0 or T+1 settlement is a key focus for capital market participants. DLT provides an alternative solution from a conventional central clearing counterparty (CCP) who usually facilitates the delivery versus payment settlements. A few notable examples are: Broadridge’s “Blockchain” Platform, European Investment Bank (EIB), DBS, Deutsche Bank, and UBS have already experimented on bond issuance using different DLT solutions.



Clearing:

Clearing and settlement of derivatives involves numerous manual processes and cumbersome facilitative activities including the daily valuations, exchange of recon reports and variation margins, sharing interest on the margin naming PAI (price alignment interest), maintenance of audit and ownership records, and arrangements of cross-system margin obligations. With the advent of the UMR regulations, the clearing and risk management of OTC derivatives has become a costly affair due to collateral, valuation, capital, and regulatory requirements. DLT with the usage of tokenization and smart contracts could optimize the pricing and margin calculations efficiently, thereby realizing financial cost benefits for market participants. Finally, on the payments front, DLT can be utilized to carry the seamless cross-border transactions in a fast, reliable, and cost-effective manner.

Challenges:

It is now widely believed and acknowledged by regulators that the implementation of DLT in capital markets has the potential to enhance efficiency, smoothen post-trade processes, and reduce costs for all engaging parties. At the same time, regulators and supervisors have also encouraged the participants to address the concerns of interoperability, governance, privacy, cyber security, and scalability.

Due to the sophisticated nature of the technology often tarnished by crypto-related fraudulent activities, the issues related to privacy, anonymity, and cybercrimes need to be prioritized before successful adoption in capital markets. Other risks, such as operational and technology concentration risks and their mitigations should be redefined in the DLT context. Risk to fair competition, information symmetry, market interconnectedness, and liquidity risk must also be deliberated and documented from the beginning. In most cases, the risks associated with clearing, settlement, and payments carry the similar probability and consequent outcomes irrespective of whether it is on a single central ledger or a synchronized distributed ledger. That said, DLT may give rise to new forms of risks, including:

- Untested operational and security issues with technology which might arise only with scalability.
- Lack of interoperability with existing legacy infrastructures and interfaces.
- lack of regulatory and legal certainty on settlement finality.
- Legal, contractual, compliance, privacy, and consumer-related issues of DLT implementations.
- The absence of a globally accepted standardized and robust governance framework.
- Issues related to data integrity, immutability, and interoperability between DLTs.





One notable challenge which needs to be collectively addressed by regulators is related to the lack of clarity and guidance on the regulatory policy and frameworks on DLTs.

In EU jurisdictions, clearing activities are regulated by EMIR and MiFIR set of regulations. EMIR necessitates that certain classes of OTC derivative transactions must be standardized and cleared via CCPs and reported to trade repositories. It also requires the implementation of certain risk mitigation techniques such as mandatory clearing and portfolio compression. MiFIR extends the clearing obligation by central counterparties to regulated and supervised markets for ETDs.

On DLT context for clearing, ESMA clarifies that OTC derivative transactions which are subject to the CCP clearing obligation are also subjected to the same requirements if the clearing is carried out in DLT implementations.

On DLT context for settlement, it has been clarified by regulators that any activity in the provisions of the CSD regulation done on a DLT network, such as a node acting as “settlement internalizer”, requires compliance with CSDR and cross-jurisdiction requirements. Key challenges to that include ensuring settlement finality, and providing DvP payments, notably in central bank money. It is uncertain at what point of time, and in which form the central bank’s currency or CBDC will be available in a DLT ecosystem. ECB expressed recently that DLT implementations have not proved conclusively how the cash leg of the transactions can be synchronized with the securities leg. CSDR plays a pivotal role for post-trade harmonization in the European market and any structural change in the regulation must pass through the transition of long-established legacy technology and processes. It is applicable on the settlement of transactions in various asset classes and financial products as defined in various regulations mentioned above.

Final thoughts – Conclusions and way forward

No doubt that DLT has promising expectations, but its large-scale adaption requires cooperation among market participants, regulators, and developers which is unlikely to occur in the short term. The organic growth towards the adaptation of the technology in capital markets is the only way forward for achieving the long-term transformation goals. The applications of DLT have far-reaching benefits going beyond financial markets. Tokenization, smart contracts, and decentralization can solve long-standing issues related to the inefficiencies and rigidity of the supply chain. It even extends to the sustainability and ESG agenda to achieve the net zero targets which requires the measuring and tracking of carbon footprints, releasing the illiquid assets for green financing, and verifiability by the regulators and investors, thus inducing trust in the carbon credit markets. Looking at the results of the pilot projects and success of crypto transactions it appears that all this can be made much easier by the application of DLTs.



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Satyawan Singh has over 13 years of experience in investment banking in varied capacity in business analysis, consulting, implementations and project management. He has served on key global regulatory projects, digital transformations and industry initiatives. He is passionate about the emerging technologies and their role in reshaping the future of the banking industry.

About Mindtree

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