

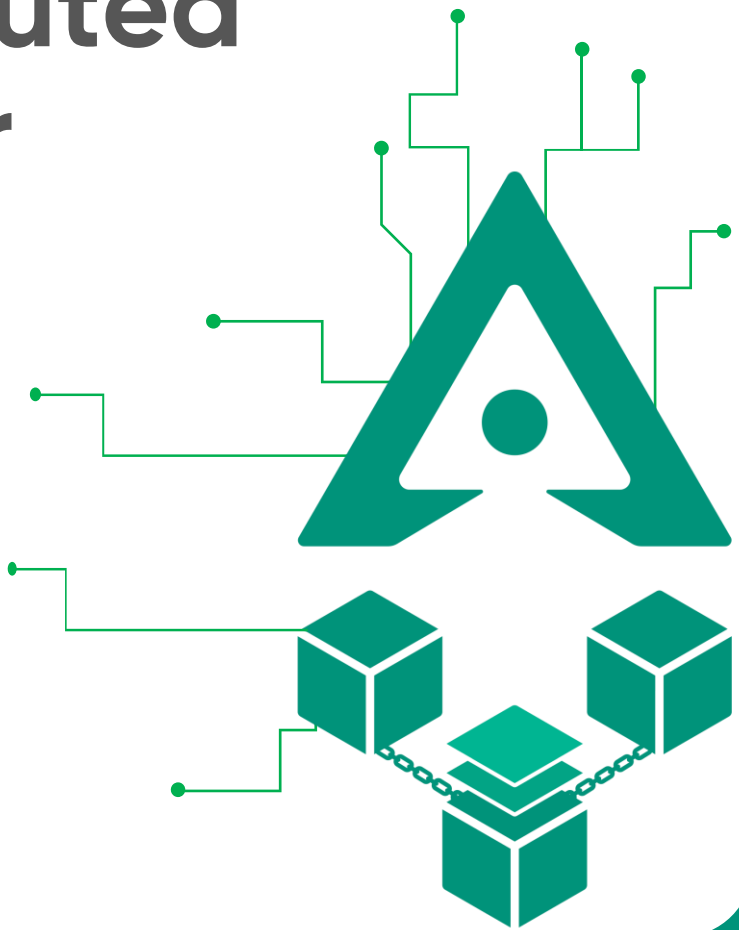


# Cambodia Distributed Ledger

WHITE PAPER

VERSION 1.0

September 1, 2022



[www.camdl.gov.kh](http://www.camdl.gov.kh)





# Abbreviation

• CamDL	Cambodia Distributed Ledger
• CBDC	Central Bank Digital Currency
• CeFi	Centralized Finance
• DApp	Decentralized Applications
• DeFi	Decentralized Finance
• E-KYC	Electronic Know Your Customer
• IP	Intellectual Property
• KYC	Know Your Customer
• DLT	Distributed Ledger Technology
• NBC	National Bank of Cambodia
• IoT	Internet Of Things
• IPFS	Inter-Planetary File System
• PwC	PricewaterhouseCoopers
• TradFi	Traditional Finance

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# Introduction to CamDL

CamDL is a blockchain network aiming to provide the public a platform for building and experimenting with blockchain technology to solve their everyday challenges within the community or the industry. CamDL is powered by Hyperledger Besu®, an open source Ethereum client developed under Apache 2.0 license written in Java.

Our mission is to introduce Cambodian developers a blockchain-based internet which provides interoperability, seamless integration, trust, transparency, traceability, and automation by leveraging smart contract and peer-to-peer file sharing among users. CamDL helps developers to build DApps with the use of our developer's documentation, tools, and frameworks.

CamDL works toward creating the best open blockchain infrastructure, retaining a focus on bringing health and wealth into the recently growing global blockchain superstructure as we reach out to all network users both locally and worldwide.



## Objectives

CamDL core objectives are:

- 1) to become a regulated blockchain in Cambodia and
- 2) to simplify distributed digital smart contracts, peer-to-peer file storage, identity and many other DApps based on blockchain infrastructure.

To achieve such objective, CamDL is designed to achieve three core regulatory objectives such as:

- 1) Consumer protection;
- 2) Financial stability; and
- 3) Financial Integrity.



# Overview of Blockchain

Emerging out of a new electronic payment system that relies on cryptography called Bitcoin invented by “Satoshi Nakamoto” in 2008, blockchain is the main mechanism in this payment system which records transaction in digital ledger which is distributed over the network, and it cannot be tampered with or reversed. It allows digital transactions from two parties to engage securely without a third party and anything of value like currencies, shares, land assets, etc., can be recorded on blockchain as a transaction. There are seven unique features not found in earlier network applications:

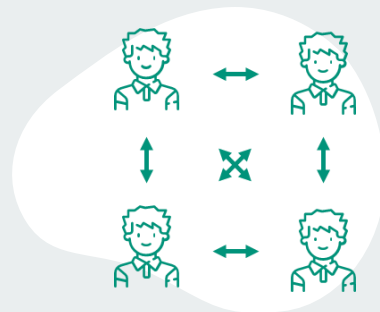
## Immutability

Blockchain ensures that the data is not modified or deleted without consensus from other parties. Every node on the network has a copy of the digital ledger. To add a transaction, every node needs to check its validity. It is then added to the ledger only when majority thinks it is valid. This promotes transparency and makes it unalterable.



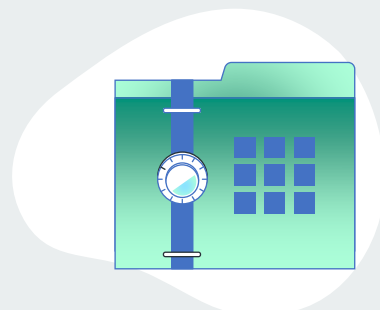
## Decentralized

The network is not governed by any authorities or any person, rather a group of nodes will maintain the network making it decentralized. You can store anything including documents, contracts or other valuable digital assets, and you will have direct control over them with your private key.



## Enhanced security

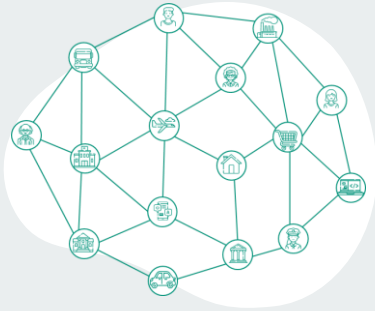
Because of its decentralized structure, no one can simply change the characteristics of the network for personal benefit. Using encryption ensures another layer of security for the system given that all the blocks in ledger come with a unique hash of their own and contain the hash of the previous block. Therefore, changing or tampering with the data needs to change all the hash ID in every block, and thus impossible.





## Distributed ledger

Ledger of the network is maintained by all other nodes within the system. Distributed ledger responds well to any suspicious activity through its quick update response, and thus tracking activities in the ledger is quite easy with all these nodes.



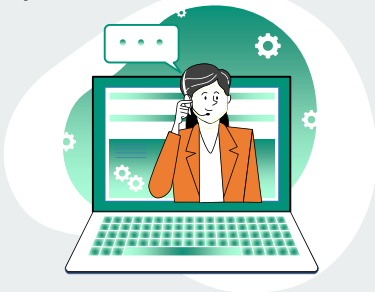
## Interoperability

With the leverage of smart contract and standard implementations, they allow collaboration between different application or industries' information or asset to be able to be sent back and forth between individuals or organizations.



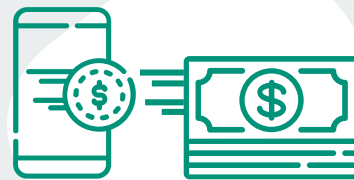
## Consensus mechanism

Consensus mechanism is the mechanism which agrees upon by nodes on the network and helps the network make decisions. While validating transaction, nodes should have rule and agreement in place to resolve any dispute or dissolutions occurs. It is similar to a voting system where the majority wins and the minority either has to accept the result or diverge from the majority as a new chain (Hard fork).



## Faster settlement

Blockchain offers a faster settlement compared to traditional banking systems. This way, a user can transfer asset relatively faster, saving a lot of time in the long run.



Today, blockchain is primarily used for cryptocurrency (or crypto) transactions. It could be used to bring solutions to the existing problem in various industries such as IoT, agriculture, government, tourism, health, finance, banking, insurance, supply chain, real estate, education, etc. Industries are starting to address the speed and cost inefficiency in their operation by using blockchain technology. Below, we discuss the challenges in sectors such as TradFi, CeFi, DeFi and low DLT adoption and how we can address them.



# Existing Challenges

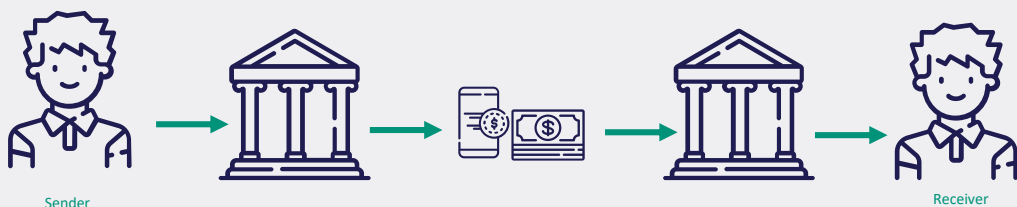
This section describes in details the current challenges in the finance sector such as:

- Operational transparency, speed and cost, as well as intermediary dependent presented in TradFi and CeFi;
- Financial and security risks, as well as consumer protection limitations associated with current DeFi ecosystems; and
- Reasons of low blockchain adoption within businesses or enterprises.

## TradFi

TradFi remains the foundation of the global financial system and provide overall stability to the financial system. It includes standard commercial or investment banking institutions, retail services and fintech businesses. TradFi offers trust, size and regulatory approvals provided by the legislative authorities and regulators. However, it has limitations when it comes to:

- Financial inclusion: Accessibility to financial services is limited due to high registration fee, physical distance to the institution and lack of necessary documents.
- Centralization: Even though traditional financial institutions comply with government laws and regulations, but they are not without flaws. Some of the largest banks in the world can fail. Washington Mutual with \$188 billion in deposit, and Lehman Brothers with \$639 billion in asset, collapsed in 2008. This level of centralization could pose a systemic risk leading to a collapse of a financial system.
- Operational transparency: Regular investors as well as regulators are unable to know what a financial institution do entirely. Some actions lead to the failure of the institution including high-risk mortgage-backed securities (2008 financial crisis), accountant fraud (2020 Wirecard collapse), etc.
- Interoperability and innovation: Different standards and protocols implemented by different institutions slow the speed of innovation within or across jurisdictions.
- Speed and cost: Transactions involving many financial institutions take a few working days to complete and involve all sorts of fee along the process.



Sender

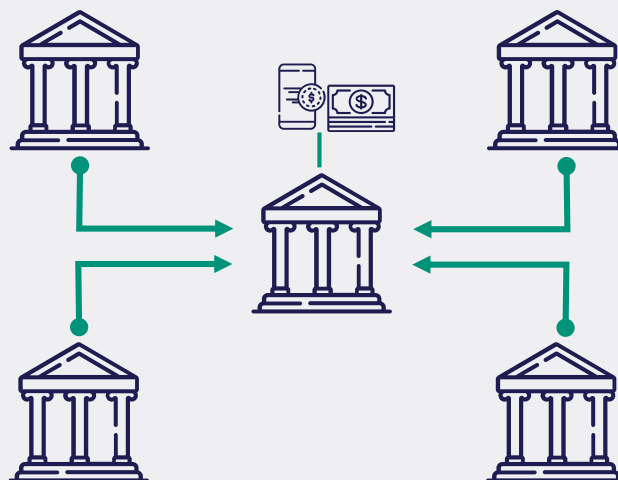
Receiver



## CeFi

CeFi are businesses involving centralized exchange (Binance, Coinbase, Robinhood, Celsius, etc.) by providing crypto trading services such as loan, interest-earning account, lending and borrowing etc. This range of services is rapidly expanding, and some of the more complex services, such as options and derivatives, are rapidly developing as well. However, there are significant problems regarding CeFi such as:

- **Intermediary dependence:** Users are not in control of their assets or do not perform any operation without depending on the exchange they are using.
- **Unequal Access:** High fee and complicated KYC process leads to low financial inclusion.
- **Lack of operational transparency:** There is a lack of transparency in the use of the user's asset. Some entities were caught using user's asset to invest in risky speculative asset, eg. Celsius and 3 Arrows Capital collapses. Failure of those entities could lead to a wider systemic risk that could collapse the whole financial system.
- **Regulation and consumer protection:** CeFi businesses operates and offer services like a bank, but most of them do not own a bank license (Shadow Banking). Users that deposits their assets with these companies could lose all their assets in the event of hack or any insolvency happens due to the lack of deposit insurance provided by those exchanges.
- **Monopolistic competition:** Some exchange practices display anti-competitive behavior due to their technological or capital advantage. This could impose a barrier for new businesses to compete. This monopolistic practice leads to a situation of "Too Big to Fail" where outage or failure could lead to a full financial crisis.
- **High cost and slow transaction:** The cost of transaction within CeFi is dependent on the rate imposed by the platform. Users have no other choice rather than following rules imposed by the exchange. While transferring assets across the exchange were made to be difficult, slow, and expensive as a mechanism to prevent user to move to another platform.







## DeFi

DeFi replicates existing financial services found in Traditional Finance system, including core banking, lending, trading activities and implements these services through innovation and technology. The peer-to-peer model provide unique opportunities for retail and institutional participant to unbundle TradFi, retains control over their own asset and innovate to tailor services without the need of intermediaries. However, DeFi comes with its own inherent risks such as:

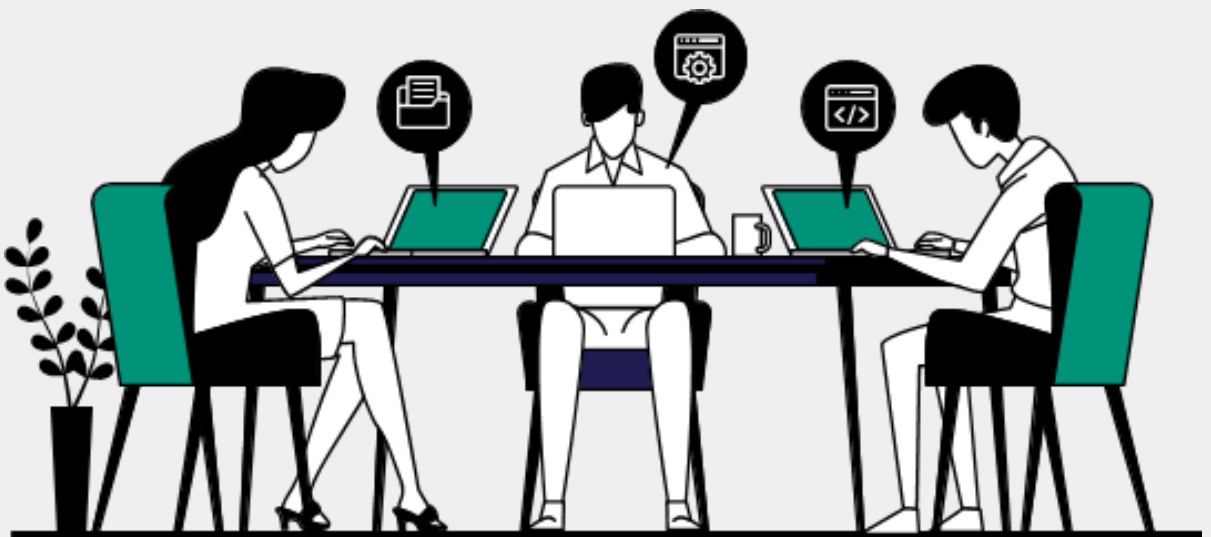
- **Technology risk:** Complexity and immaturity of DeFi increase its vulnerabilities. blockchain foundation itself could be susceptible to failures or attacks which more common when these networks scale at rapid pace without commensurate technological safeguard. In addition, the reliance on Smart Contract exposes DeFi application to software malfunctions and programming flaws.
- **Security Risk:** Risk in DeFi such as fraud, misappropriation, conflicts of interest, money laundering, terrorist financing, market manipulation or deceptive trading activity could be hard to regulate. In addition, Smart contract vulnerabilities could allow bad actor to misuse and exploit. Moreover, private key mismanagement or theft could lead to complete loss of user's asset related to that wallet.
- **Compliance and Legal Risk:** DeFi makes difficult to regulate any single identity, identify responsible parties or enforce any regulatory actions. These make DeFi the best spot to commit any illegal activities such as fraud, financial crime, or market manipulation and at same time bypass any legal or regulatory obligations.
- **Financial risk:** Lack of law and regulation authorities involving interpretive, supervision, examination and enforcement expose DeFi to financial risk. With the size of DeFi continue to grow, risk present could destabilize the financial system. This financial risk is further divided into 4 subcategories:
  - **Credit risk:** Anonymity of DeFi makes it difficult to assess risk, conduct due diligence, determine credit worthiness, and calibrate interest rates for borrower. Volatility of underlying digital asset leads to high risk of under-collateralization while inhibiting margin call process to account for any drop of collateral.
  - **Liquidity risk:** DeFi services rely on incentivizing market makers to liquidate undercollateralized loans. These mechanisms are baked within smart contract which limits the respond to unanticipated market condition and consumer behavior. This also make counterparties and liquidity providers with risk stemming from inability to meet liquidity obligation.
  - **Market risk:** DeFi structure increase the possibility of market abuses due to pseudonymity of transaction and smart contract owner make it difficult to identify the sources of market manipulation. DeFi also susceptible to excessive leverage facilitate using cryptocurrencies or stable coin as collateral on DeFi platform which could lead to a sudden price change that could render loan position to be under-collateralized and liquidation occur.
  - **Tax risk:** limited regulation and guidance on taxation of digital asset and the implication of transaction within DeFi space. This requires regulator to analyze each transaction to determine which may be considered as taxable and enforcement of taxing into DeFi transaction.



## Low adoption of DLT from sectors beside cryptocurrencies

DLT or blockchain have advanced beyond initial implementation as a method of transfer digital value, and attempts have been made to introduce the technologies to solve various issue across enterprises all over the world. Primary mission of blockchain and DLT is generating, verifying, updating, sharing, transferring, and storing transaction within distributed ledger without intermediary with the goal of speed, traceability, trust, security, disintermediation, immutability transparency and automation. However, there are barrier for those sectors to select DLT as their implementation such as:

- Manual process and traditional practice still being used in the industries especially the ability to manually change and reverse transaction due to human error at application level
- Compatibility issue with their existing systems and how to move their existing data from conventional system to DLT.
- Scalability problem such as data transmission latency, transaction processing rate, storage and how it could be scaled up to meet the increasing demand
- Low managerial support regarding the benefit of DLT with financial investment, operational cost, and benefit from the investment.
- Scarcity in experts and developers with the knowledge of cryptography science, smart contract, legal affairs, and DLT for the implementation
- Technology accessibility and the government support over the emerging technologies particularly blockchain.





# Core Features

01

## Hybrid Network

As we discussed in Section 2 about the challenges on fully permissionless blockchain regarding risks across various aspects, CamDL is designed to prevent such things by position itself as a hybrid permissioning network. CamDL is created with the purpose of providing the public with the benefit of using blockchain technology and protect general consumer from various risk associate with blockchain technology. This is the reason CamDL need to maintain some control over the network such as account and contract permissioning and many other things while allowing for access from everyone.

02

## Ethereum Virtual machine

To encourage more and more public participants to take part into blockchain technology, CamDL network chose EVM to be the software to execute and compute the state of the smart contract. It supports the use of solidity programming language which is a matured and widely used programming language among smart contract developers with abundant of resources available for anyone who want to be a smart contract developer to get start with.

03

## Account and Identity

For consumer protections and complying with regulatory objectives, users within CamDL is required to perform KYC. CamDL is integrated with CamdDigiKey (a mobile-based E-KYC service, developed under camDX, with the aim of verifying the digital identity of users on the network). After performing KYC, user's information is kept off-chain securely while at the same time user can anonymously interact with other participant within the network.

04

## Privacy

For organization and enterprise application which requires privacy over the data, CamDL also provide the options for them to create a private smart contract among each other's. Where only selected participant has access to that specific contract at the same time, all transactions performed within in that contract is guaranteed immutable by CamDL public record.

05

## Wallet App

CamDL provides user with digital wallet which allow users to store and manage asset within mobile application. Our wallet app allow user to securely submit transaction by the scan of the QR code to our network without the transfer of wallet keys to multiple devices such as computer or phones etc.

06

## Private IPFS

CamDL also provides IPFS as a service for user to host any file on our peer-to-peer file storage. In addition to that, it allows user to specified permission to the file to prevent unauthorized access to private information of the user files store within the distributed file storage.



## Possible Use Cases

Blockchain technologies can be utilized in almost if not all sectors, and major corporates have already leveraged the benefits of distributed ledgers to their advantages. Below are some examples of real business use cases of blockchain.

### Blockchain Use Cases in Banking & Finance

Blockchain core feature, faster settlement and decentralized, allow users to transfer asset relatively faster, which saves a lot of time in the long run. The network is also not governed by any authorities or any person, rather a group of nodes will maintain the network making it decentralized. You can store anything including cryptocurrencies, documents, contracts or other valuable digital assets and you will have direct control over them with your private key.

#### International Payments

A tamper-proof log of sensitive activities can be easily and securely created using blockchain technology. This makes it ideal for transferring money and making overseas payments. For instance, the first blockchain-based money transfer service was introduced by Banco Santander in April 2018. Customers can send money internationally the same day or the next using the "Santander One Pay FX" service, which uses Ripple's xCurrent. Santander has increased process efficiency by automating the entire process on the blockchain, which has decreased the number of intermediaries traditionally needed in these transactions. Santander, a sizable commercial bank, serves a huge number of retail customers who would profit from faster, less expensive, and international transactions. blockchain technology can be used to decrease the cost of these transfers by reducing the need for banks to manually settle transactions.

#### Peer-to-Peer Transactions

In October 2020, the National Bank of Cambodia launched a blockchain based nationwide payment system, Bakong is an implementation of permissioned blockchain based on Hyperledger Iroha framework and a consensus algorithm called YAC with Bakong as the only validating node, and other financial institutions as nonvalidating nodes. Cambodia's payment system is usually done by physical cash and a variety of payment service providers offered by different commercial banks, as the NBC described. According to the World Bank, despite having more than 40% of the population sends or receives domestic remittances annually, only 5% of the population transfer cash through bank and the remaining remittances are either done by payment service provider or cash deliveries. To bridge this gap, the NBC introduced an entirely new network that includes all types of payment provides and commercial banks. By leveraging permissioned blockchain technology, all commercial banks within Bakong network that involved in transactions can see customers information while they are hidden from Bakong. Transaction information can still be verified when require, hence, providing both integrity, transparency and user's privacy as well as enabling them to transfer money peer to peer between different banks seamlessly.





## Regulatory Compliance and Audit

Blockchain's incredibly secure features make it rather handy for accounting and auditing because they greatly reduce the likelihood of human error and guarantee the accuracy of the records. Additionally, once the account records are secured using blockchain technology, nobody, not even the record owners, is able to change them. The trade-off is that blockchain technology might eventually do away with the need for auditors and eliminate jobs.

## Money Laundering Protection

Once again, the encryption that is so integral to blockchain makes it exceedingly helpful in combating money laundering. The underlying technology empowers record keeping, which supports KYC the process through which a business identifies and verifies the identities of its clients.

## Trade Finance

Due to the lengthy procedures that frequently create business interruptions and make managing liquidity challenging, traditional trade financing techniques have been a big source of pain for companies. When transmitting facts about a product's nation of origin and other details, cross-border trading includes a lot of variables and generates a lot of paperwork. blockchain has the potential to streamline cross-border trade finance transactions. It makes it possible for businesses to communicate more freely across national and geographic barriers.





# Blockchain Applications in Business

## Supply Chain Management

Walmart, one of the world biggest retailers utilized blockchain technologies to manage their supply chain. Each supply needs to be ship to more than 200 distribution centers and stores across the country. Because systems within those stores can't simultaneously communicate, it requires extra efforts to perform reconciliation process on 70% of their payment invoices. As a result, there always a long delay when processing invoices and payments. However, blockchain completely changed everything. With the help of distributed ledger technologies, all information is stored can be stored on a blockchain making it secured, synchronized and visible to other systems or parties involved in the transactions. Because of this, the cost of reconciliation processing has reduced drastically and less than 1% of the total invoices needed to be reconciliated, and Walmart was able to save both time and cost to make sure each invoice is correct and valid.

## HealthCare

With the leverage of smart contract and standard implementations allows collaboration between different application or industries allowing information or asset Change Healthcare, which is one of the largest healthcare technology providers, is a clear example of how blockchain offer more versatility compared to that, a traditional healthcare system. Change Healthcare blockchain is an implementation of Hyperledger Fabric, and is used to process thirty million transactions per day. Sensitive information about patients is stored on a private network, giving patients privacy and security over their personal information. At the same, those medical records are accessible to anyone with the appropriate permission whenever needed via an off-chain mechanism. With blockchain, insurance eligibility check is reduced from 7-14 days to a few minutes allowing healthcare payment to be processed immediately at the point of care. Moreover, Change Healthcare's implementation has to the potential to save insurance companies billions of dollars. Based on a study, 34% of healthcare cost is wasted on reconciliation process, which is equivalent to \$910 billion in 2011 and only \$1.2 trillion in 2017. By using blockchain, patient's data can be shared between parties including insurance companies that are involve in the transactions. This process provides trusts and ensures the information are valid and correct, and reduce their risk from frauds as well as speeding up the reconciliation process. to be able to send back and forth between individual or organization.





## Real Estate

Every five to seven years, the typical homeowner will sell their home, and during their lifetime, the typical person will move close to 12 times. blockchain might undoubtedly be useful in the real estate industry given the volume of movement there. By immediately confirming finances, it would speed up home sales. Thanks to encryption, it would also decrease fraud and provide transparency throughout the entire selling and buying process.

## Media

Blockchain technology is already being used by media firms to combat fraud, cut expenses, and even safeguard the IP rights of material, such as music recordings. MarketWatch projects that by 2024, the worldwide market for blockchain in media and entertainment would be worth \$1.54 billion. Eluvio, Inc. is one platform that has captured attention for using blockchain for media. Eluvio Content Fabric, which was formally introduced in 2019, leverages blockchain technology to let content creators manage and distribute premium video without the aid of content delivery networks to customers and business partners. Additionally, media juggernaut MGM Studios has chose the platform for global streaming to online, mobile, and TV everywhere audiences of 'certain IP.

## Energy

According to PwC, blockchain technology has the potential to underpin systems for metering, invoicing, and clearing in addition to carrying out energy supply transactions. Ownership documentation, asset management, origin guarantees, emission permits, and renewable energy certificates are some more potential uses.





# Blockchain Applications in Government

## Record Management

Governments at the federal, state, and local levels are in charge of keeping track of personal information on citizens, such as dates of birth and death, marital status, and property transfers. However, handling this data can be challenging, and some of these records continue to be kept on paper. Additionally, it's occasionally required for residents to physically visit their local government offices to request changes, which is time-consuming, pointless, and frustrating. Blockchain technology has the potential to streamline recordkeeping processes and strengthen data security.

## Identity Management

Proponents of blockchain tech for identity management claim that with enough information on the blockchain, people would only need to provide the bare minimum (date of birth, for example) to prove their identities.

## Voting

Blockchain technology has the potential to increase security while also simplifying the voting process. Blockchain technology would be impenetrable to hackers since even if they had access to the terminal, they couldn't modify other nodes. Each vote would be associated with a single ID, and since it would be impossible to produce a false ID, election officials could count ballots more quickly and accurately.

## Taxes

Blockchain tech could make the cumbersome process of filing taxes, which is prone to human error, much more efficient with enough information stored on the blockchain.

## Non-Profit Agencies

Greater transparency provided by blockchain technology has the potential to address the anti-trust issues that charities are increasingly experiencing. The technology can demonstrate to donors that NPOs are actually using their donations for the purposes for which they were intended. Additionally, blockchain technology may be able to assist such NPOs in managing their resources more effectively, tracking donations more effectively, and more.

## Compliance/Regulatory Oversight

Although recordkeeping is the primary source of regulatory supervision, the penalties of failing to retain records are unquestionably much greater. As a result, compliance is a need for businesses. Blockchain can reduce time lags and enable the quicker detection of red flags and discrepancies by making record updates available to authorities and enterprises in real time.







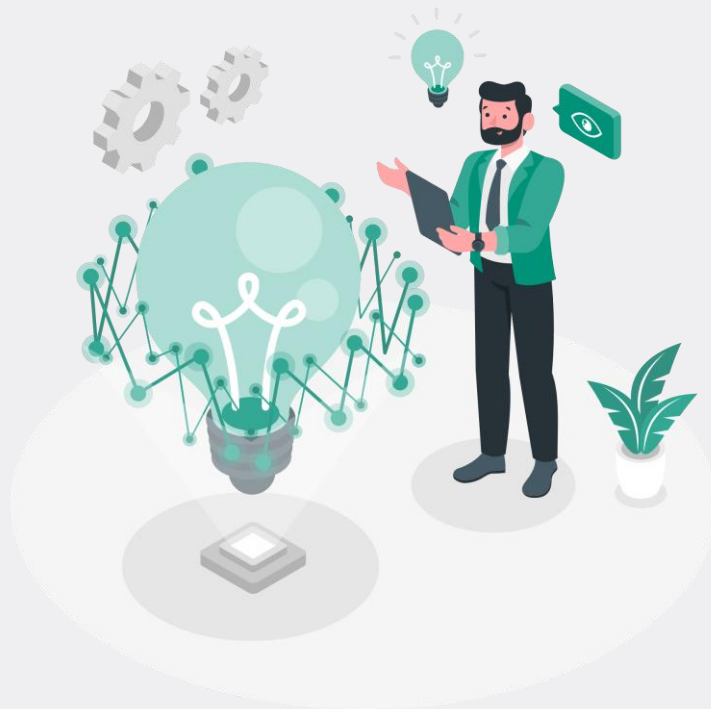
# Blockchain Applications in Other Industries

## Cybersecurity

The possibility of a single point of failure is eliminated, which is blockchain's main benefit in cybersecurity. Additionally, blockchain technology offers anonymity and end-to-end encryption.

## Big Data

Blockchain is a fantastic tool for storing massive data because to its immutable nature and the fact that every computer connected to the network is constantly confirming the data stored there.

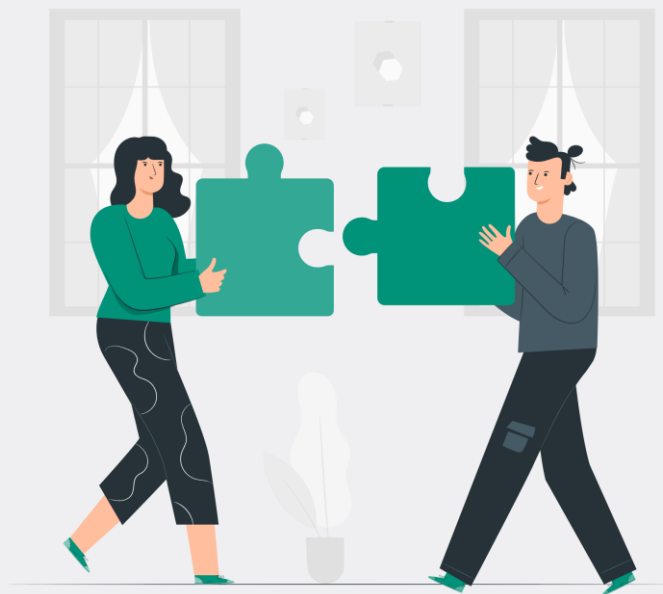




## Conclusion

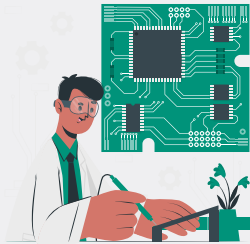
CamDL is a blockchain network that aims to offer the general public a platform for developing and experimenting with blockchain technology to deal with their day-to-day difficulties within their communities and businesses. It is secure against any attacks. With CamDL core features such as CamDL wallet that let users manage their assets, private IPFS for decentralized file hosting with file access control, KYC for consumer protection, hybrid network offerings advantages from both public and private blockchain, user privacy and EVM which allows developers to work with smart contract and DApps with ease.

Since the release of the CamDL network, our mission have always been introducing people the use of internet based on blockchain with web3, revolutionize financial system with decentralize finance within peer-to-peer financial technologies, and provide low barrier of entry for enterprises to solve their issues or new innovation within the industry by leverage of blockchain technology. With these features we have introduced above, we highly encourage other developers as well as non technical people to learn more about blockchain technologies with our network, solve existing problems, and explore their creativities by developing DApps on our decentralized network.





# Roadmap



Jan 2022

Research & Development



April 2022

Pilot CamDL Alpha



Jan 2023

Mobile Wallet  
Privacy Feature



Sept 2022

Mainnet CamDL  
Online



April 2023

Offchain Data  
Integration  
IPFS



Business Development Center (BDC) Building, 11th Floor, OCIC Blvd, Sangkat Chroy Changvar, Khan Chroy Changvar, Phnom Penh, Cambodia



+855 81 922 329



info@techostartup.center



www.camdl.gov.kh

