

Blockchain Technology – Opportunities for Emerging Economies

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Abstract - *The recent major scientific conferences on the Innovatube Frontier (IFS) have focused on four areas of pioneering technologies, including Artificial Intelligence, Internet of Things, Blockchain and Augmented Reality / Virtual Reality. Blockchain has gained a lot of attention, because not only it is the technology that has created the fever of the Bitcoin and Ethereum digital coins, but also because of its great potentials that can change the nature of the real world and in everyone's lives. There have been various studies on blockchain, however, in reality the percentage of people who understand blockchain remain minute. This paper will highlight the important role of blockchain technology in the development of our future world, especially for developing countries.*

Keywords: *blockchain; digital technology; distributed diary; industrial revolution 4.0.*

I. THE NEED TO DIGITIZE THE LEDGER

The world today depends a lot on the dual recording principle. Credit and debit systems are central to assessing a company's finances. The general ledger system dated back to the renaissance in Europe, and then spread throughout the world at the end of the 19th century. In the early twentieth century, Werner Sombart, a German sociologist (Andrew Keys, 2017), stated "Today's modern economy demands that bookkeeping be taken as a principle of development, but so far it's an open question." No one doubts the importance of this technique, because it is not only a record of what the company has done but also a way to determine what the company can do. However, facing the explosion of information on transaction demand, the traditional centralized bookkeeping technique has become increasingly convoluted. Fraud and fraudulent information steal around 4,000 billion dollars a year (Video VTC1, 2017), making people becoming more distrust toward the system. Therefore, the world needs a reliable, secure, fast, accurate, less convoluted and less expensive recordkeeping technology.

In 2008, together with Bitcoin, Blockchain, or decentralized ledger technology, was born and it has opened up to the world a new data storage technology with endless, easy-to-operate encryption algorithms. Blockchain is expected to not only bringing about radical changes, as it is a more reliable method the traditional way of storing information, as well as changing the way companies and governments operate. For the public as a whole, blockchain is expected to protect the privacy and property of the public, helps they avoid the abusiveness of bureaucracy; appropriation of property and many other corrupted situations.

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Although such new ideas may take a long time to persuade conservatives and political or personal elites, who maintain bureaucracy for profit, the current level of blockchain technology has proved that this new method of operation is completely possible.

II. THE BASIS OF BLOCKCHAIN TACHNOLOGY

A. What is blockchain?

Blockchain is a data-sharing infrastructure used to create peer-to-peer digital currency, the most famous of which is Bitcoin, which was launched in 2008 and more recently Ethereum. Blockchain is an accounting ledger operating in the digital domain, similarly to a company's cash accounting book. However, it allows for the recording and sharing of transactional information publicly within the network. Blockchain stores and transmits information through linked blocks that expands over time. Each block contains information on initialization time and is connected with the previous block. This transmission system is based on an extremely complex encryption system, consisting of multiple independent nodes capable of authenticating information without requiring a "common sign of trust". This node system is a sequence of independent servers, where all users must approve a transaction before it can be validated and logged into the network.

B. Why called blockchain?

In a company, to manage the ledger, it usually requires a competent person to take responsibility for checking all the data and verifying by signing their signature at the bottom of the content. This signature ensures that no one will be able to edit the archived content and is an indication that the data added later will not be accepted. Similarly, in the blockchain system, transaction log information is stored in a file called a block. These records are stored in a cabinet and stacked sequentially, the front block is followed by the next block forming a chain of block called blockchain.

C. How blockchain works?

Anyone has the opportunity to add a new trading block to the accounting ledger, provided that the cryptographic puzzles that the system provides are dealt with. The volunteers involved in solving these puzzles are called Miner, with the tool being a standalone server system. The miners will collect transaction information in the blockchain network every 10 minutes. That information is considered a ticket that allows the miners to enter a contest. Whoever wins will be entitled to create the next new block. After that, the miners will update the blockchain copy and start on another competition. The reward for the winning miner or answer to the current puzzle is 12.5 Bitcoin (Vinay Gupta, 2017). This is also the reason that blockchain technology is expected to dominate the world in a few years.

III. CHARACTERISTICS OF BLOCKCHAIN TECHNOLOGY

A. Advantages of blockchain technology?

- Every transaction is always legal. Everyone has the right to share and store information with others, provided they have the key to open their private wallet. In this way, Blockchain is able to protect the data owner and prevent fraudulent behaviors;
- The information cannot be altered and can only be added with the consent of all nodes (members) in the system. Even if part of the blockchain system collapses, computers and other nodes will continue to work to safe guard the information;
- Secure data transfer: Blockchain log data is encrypted and associated with the date of the initialization to prevent overwriting of information. The information will be updated for all copies worldwide in a few seconds;
- Transactions are not mediated: Copies of this digital ledger file are only shared with the miners who contributed to the system. Anyone can participate in the system, by downloading the Bitcoin software;
- Unique security: Blockchain is a distributed ledger - asset database that is hosted and shared worldwide. This information is related to finance and law and may exist in physical or digital form. No one can make change to this information;
- Transaction cannot be faked since everything has been determined to be unique. Thus, blockchain technology is a breakthrough against internet fraud, as well as financial transactions through third parties;
- Cost savings: By using blockchain, banks can create new infrastructure to ensure the security of their ledger, there is no need to worry about security, thus, reduce the costs associated with data recording;
- Faster transactions: Blockchain provides a system and tools to redesign and improve management reporting, control and acceleration of financial procedures. Blockchain can reduce transaction time to seconds and are processed 24/7;
- Secure data through encryption and decryption: It is not necessary for participants to have mutual trust. Resilience, reliability and longevity, due to decentralization allow blockchain to have no central point and can withstand devastating attacks;
- High quality, complete, consistent, timely, accurate and widely available data: Decentralized blockchain technology enables the aggregation and analysis of vast amounts of data between organizations as well as validating and verifying the accuracy of the data points;
- Automatically identify system vulnerabilities in the supply chain, finance and business processes: The records on a blockchain database cannot be altered

by third parties, thereby eliminating counterparty risks;

- Provides optimization, reduce costs and avoid infrastructure investment costs: By eliminating third-party intermediaries and input costs for asset exchange, blockchain smart contracts can provide automated and predictable performance, dramatically reducing direct transaction fees. , internal and external, maintenance and operating costs;
- Transparency and immutability: Public blockchains are publicized by simple eco-system components that facilitate transactions added to only one public ledger, reducing the confusion caused by the complications of multiple ledger system.

In general, the core value of a blockchain is to allow a database to be shared directly without the central administrator. Blockchain works based on a consensus mechanism to ensure synchronous nodes, transactions can be verified and processed independently. In which, the third party is replaced by a distributed database, which is secured by smart encryption. Gideon Greenspan (Sarah Kocianski, 2017) concludes, "Like what has happened before, they use the increasing capacity of computer systems to provide a new way to replace human with automation and once that has been written and fixed, the cost of information technology tends to be much cheaper."

B. The disadvantages of blockchain

Any technological revolution has its drawbacks. Throughout the developmental process, researchers have identified some of the issues and limitations, as well as the incompatibilities in Blockchain's digital interactions:

- Complicated: Blockchain technology carries with itself a wide range of new concepts. Blockchain has turned the virtual currency into a much "hot" topic than ever before. It has pulled in a wave of profiteers and is filled with convoluted jargon;
- Network Size: Blockchain has the ability to "resist" threats. This requires a large network of users that is strong enough for the system to fully benefit and grow. However, some comments said that this is also a fatal flaw, which forced some blockchain projects to be hampered;
- Price and network speed: Bitcoin is now paying close attention to the price of the transaction after being "almost free" in the first few years. By the end of 2016, it could only carry seven transactions per second, for \$ 0.20 per transaction, which contained 80 bytes of data;
- Human error: in order for the data on the blockchain to be reliable, it is required that the information entered into the database must be accurate from the beginning. If operators feed inaccurate information to the system, then the whole blockchain will be considered worthless;

- Inevitable security flaws: if more than half of the computers (nodes) serve the network lie, then the lie will turn into reality. This was called the "51% offensive", even Satoshi Nakamoto emphasized this when releasing bitcoin;
- Politics: Since blockchain protocols create new way to digitize administrative models, bitcoin miners must formulate more advanced types of governing models. This creates inconsistencies between communities, expressed through the "forking" event associated with updating the blockchain protocol, when the majority of blockchain users have agreed to it;
- The challenge of integrating with old enterprise systems and information systems: Due to its unique nature, Blockchain is always slower than centralized databases. When a transaction is being processed, Blockchain must do the same thing as a regular database but at the same time has to adhere to other protocols.
- Verification of signature: Each blockchain transaction must be validated using a public digital cipher scheme. Because of the "peer-to-peer" communication between nodes, their source cannot be proven. This creates computational complexity and forms the main bottleneck in blockchain products;
- The consensus mechanism: because the database scattered to reach consensus, it requires the parties to make an effort to ensure that the nodes in the network participate in the certification. This dependence is detrimental to blockchain, if there is deliberate manipulation from outside;
- Redundancy: because transaction is handled independently by every node in the whole network, resulting in the total amount of computing that a blockchain requires to be too large, compared to the recognized performance of a single node to validate for a result, blockchain consumes a lot more of energy;
- Unprotected customers: because Blockchain technology acts as a "push" based settlement system, individuals hold power over the resources they want to verify. Therefore, if the transaction is defective after being verified on the blockchain, reversing the transaction requires the use of a centralized system such as a bank;
- Resolution on a Blockchain is slow: Because of the needed consensus to validate transactions, it is required that all nodes in the network to recognize the transaction. This process is much slower than allowing the bank to verify the transaction immediately;
- Miners can be selfish. The blockchain exploit uses game theory, encouraging people to commit to using computer power to ensure network operations. But to make a lot of money, by finding and verifying a block in the quickest way, miners will probably find empty blocks and validate, or exploit, find and

validate a block without publication and distribution a valid solution for the rest of the network;

- Blockchain capacity grows as each new block grows, while each node confirms the need to save the entire Blockchain history in order to become a participant. According to Andrew Keys (2017), the total blockchain capacity in January 2017 is 98GB, while in 2016 is only 50GB. This will eventually remove many miners in the future;
- The last solution on the blockchain is not cheap, because the space in a block is finite resource. When the number of transactions to be dealt with in a block exceeds the storage capacity, higher-fee transactions will be required. Miners then can maximize their profits, by asking for the highest transaction fees available.

C. Challenges of blockchain technology

These disadvantages, along with the requirements for multi-faceted interaction with the digital world, have been set for the blockchain technology to be addressed such as:

- This new technology is required to solve challenges such as transaction speed, verification process and data limits. Therefore, the application of new regulations will be very important;
- Uncertainty regulations: Modern currency is always created and regulated by governments. Blockchain and Bitcoin will face obstacles to be widely adopted by existing financial institutions, especially if the positions of government regulation remains unresolved;
- Large power consumption: The Bitcoin blockchain miners must strive to make an average of nearly 450,000 billion computations per second, to confirm the transactions. This entails the need to use a significant amount of energy to supply computers;
- Control, confidentiality and privacy: Although the existing solution includes encrypted private keys, there are still security concerns on the internet that need to be addressed, before the public can entrust their personal data to the blocking solution.
- Integration issues: Blockchain applications provide solutions that require significant changes or complete replacement of existing systems. To make the transition, companies need to have strategic transformation plans to accommodate these new changes;
- Cultural acceptance: Blockchain represents a radical change coming to a decentralized network that requires the acceptance of users;
- Cost: Blockchain offers a great ability to save on transaction costs and time but its high initial capital costs are a drawback.

IV. WHAT ARE THE OPPORTUNITIES FOR DEVELOPING ECONOMIES?

According to the economist Hernando de Soto (Vinay Gupta and Rob Knight, 2017), poor people since long had little chance of accessing the formal economy, largely due to developing countries' record keeping system which is unreliable and people do not like to provide information of

transactions. Blockchain has the potential to help these countries make a leap over the more developed economies. Due to the low investment cost of infrastructure, it does not take much time and resource, while the benefits are very high if the blockchain application a success. Reality has also proved:

- The use of Bitcoin money through blockchain operation: the M-Pesa mobile payment system in Kenya and Tanzania is helping poor farmers to send and receive domestic currency payments at affordable prices, with extremely low transaction costs;
- The Aadhaar biometric identification card system in India uses a 12-digit number to identify the identity of users to facilitate trade, reduces fraud and generates market efficiency. If you use blockchain to store a central database, along with biometrics such as fingerprints and retinal scans, efficiency will ensure greater transaction security;
- Based on blockchain decentralized of nature and cryptography, blockchain will be as secure as any transactional services created anywhere in the world. Using blockchain to build its own technology centers to create commercial transactions that will eliminate the data transfer gap, helping to support local and national technology industries.
- Blockchain helps to modernize and digitize government functions, converting all documents into encrypted strings. Establishing standards of honesty in trading systems will create a new foundation for innovation, promoting economic growth and creating a huge opportunity for cost savings. Particularly significant, if export parties requires evidence of origin of goods such as coffee, timber, etc.;
- Using the Internet of Agreements (HBR), building on the blockchain platform will create global trade facilitation. Local regulations supported by technology will be effective, thanks to low transaction costs due to skipping intermediates. People do not need the TPP or EEA to reduce paperwork related to trade and borders;
- Using Blockchain to link people's ideas will reduce the transaction costs of economic activity. In particular: there will be less possibility of fraud and corruption, and trade becomes more efficient and less expensive, governments become more efficient and local tech centers can grow, build infrastructure and disseminate knowledge freely. However, localities also need to change the rules accordingly.

In general, if there is a full-scale transition based on blockchain, it can create a super-efficient government, with reliable infrastructure, new markets and opportunities for people to access the platform of mainstream economy. With equal opportunity, efficient operation, reduced prices and improved quality of goods, this will be the beginning of high-tech innovation around the world. All incoming and outgoing goods can be tagged as pharmaceuticals that are protected from fraud, harvested logically and manufactured goods ensure safe outlets. Educational records, calendars,

business information, health care information and credit ratings, all of which will be used throughout the world. These new change will benefit people who want to trade or travel or to prove their personal profiles quickly and easily.

Many companies and governments are also working to build their own blockchain network. This shows that the blockchain will soon create a new wave of change for the future of the world. Applying to various field with other applications, Blockchain shows unlimited potential. Three versions of the blockchain can prove this:

- Blockchain Currencies, including currency converter, remittance and digital payment system: This demand is developing very strongly and has brought remarkable results in currency conversion, remittances in Kenya, the Philippines ... Many companies, shops, even countries have also acknowledged Bitcoin as a legal payment currency;
- Blockchain Contracts: which are put into applications in the financial and market sectors such as stocks, checks, debt, ownership, and anything related to contractual agreements. This version is considered the greatest potential of blockchain, as the deal and the transaction will be confirmed without disclosing the information between the parties to a certain intermediary. Predictably, blockchain technology will be popular in industries that need data storage such as real estate, securities, or encrypted commodities;
- Blockchain Organizing Activity, applied to other areas of public life such as health, politics, education and arts. Within these areas, it is expected to have even more segments such as Physical, Digital or other health sectors.

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V. CONCLUSION

Generally, the appearance of blockchain is similar to the period of personal computer or internet technology. With recent contributions, along with new discoveries of potential in many other areas, the blockchain is expected to change the way people understand and perceive all facets of society. In the 4.0 revolution, Blockchain is said to be the pioneering technology that will play the core role of the universe in the IoT world. Predictably, Blockchain will enable electronic devices to communicate securely and transparently, preventing illegal hacking attempts in the internet world and much more. If there exists fundamental difficulties in implementing blockchain, then it is probably to ensure the order of past and present cryptography, but it is not a reason to ignore its role. However, the application of blockchain technology still takes time to be developed more, mostly about its benefits. The immediate need is to minimize the

costs incurred when using the system and then to open it up to a wider future.

In short, in the internet age along with the future of globalization, the development and innovation in blockchain technology can take place anywhere, without requiring proximity to traditional technology development centers. This is an opportunity for countries with underdeveloped economies. This opportunity is more valuable when most developed countries already have a number of well-functioning systems that may lack the incentive to apply the new change that Blockchain technology encompassed.

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