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Analysis of Blockchain Ecosystem and Suggestions for Improvement

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Abstract

The Fourth Industrial Revolution is currently leading humanity into a super-connected, super-intelligent, and super-converged society through key technologies such as artificial intelligence, the Internet of Things (IoT), and big data. Blockchain technology has the potential to lead social innovation that will improve the mutual harmony and understanding of the complex structures of human society as well as various phenomena (e.g., antagonism, confrontation, and ideological conflict). With such progress in social innovation, blockchain technology will result in a fairer and more transparent human society. In addition, blockchain technology is emerging as a core infrastructure technology, and its growth and expansion are expected to bring about revolutionary improvements to nearly all fields of development and research. In this paper, we briefly outline the main features of blockchain technology. Through a further analysis of its ecosystem, we intend to offer suggestions for a more robust and efficient development of blockchain-related industries.

Index Terms: Blockchain, Cryptocurrency, Ecosystem, DLT, ICO

I. INTRODUCTION

Blockchain was selected as one of the core technologies leading the Fourth Industrial Revolution era in the World Economic Forum in early 2016 [1]. Blockchain is a distributed ledger technology that allows all participants in a network to collectively verify and record transaction information. Blockchain has many advantages, such as security, transparency, disintermediation, decentralization, and speed. In addition, some researchers have surmised that blockchain has both infinite potential and widespread influence to drastically improve the paradigm of existing industry innovations. Before the fostering of the blockchain industry can accelerate technological development, there are diverse legal, institutional, and technical challenges to solve. When considering legal and institutional issues, legislation is urgently needed to improve and supplement areas that may interfere with proper compliance with regulations such as the Foreign Exchange Transactions Act, the Electronic Financial Transactions Act, the Personal Information Protection Act, and the Credit Information Act.

On the technical side, international standardization, training of professional technical development personnel, and a conducive environment of cooperation should be advanced. In this way, experts in various fields such as finance, education, public, economics, law, logistics, taxation, and accounting will participate together in the joint development of the blockchain system.

For a stable development of the blockchain industry, a healthy and robust blockchain ecosystem must first be built above all other goals. The preparation of rapid, national-level responses and methods can be an innovative domestic strategy that will later preoccupy the global market. A more detailed review of the blockchain ecosystem is necessary

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because blockchain is considered a significant cornerstone for the development of human society. Furthermore, to overcome the Coronavirus disease pandemic, now is a particularly opportune time to develop the blockchain system through international cooperation and information sharing.

II. OVERVIEW OF BLOCKCHAIN TECHNOLOGY

Blockchain stores data blocks that are managed in a distributed database through peer-to-peer (P2P) networking. Chains are formed between these blocks and thus they cannot be modified arbitrarily. Blockchain is a distributed computing-based trustworthy network technology because all results of any changes are viewable. Blockchain is a distributed ledger technology (DLT) that records and manages transaction information. Here, *ledger* refers to all data to be managed. These data are connected to a peer-to-peer (P2P) participating network rather than to the centralized servers of any designated institution.

In addition to these identifying traits, blockchain has twelve main characteristics: decentralization, immutability, and reliability through a consensus process in an untrusted environment, security, economics, swiftness, decentralization, disintermediation, safety, transparency, efficiency, and scalability. Security aims to prevent hacking by using multiple nodes to jointly own and record data. Economics refers to a cost reduction related to the use of open software, system development and maintenance, database operation, management, and asset protection. Decentralization explains how blockchain stores and manages transactions on many distributed computers to prevent forgeries, illegal usage, and other types of damage. Because blockchain enables transactions between individuals and individuals without any specific third-party evidence, it also exhibits a disintermediation. Blockchain can reduce the complexity and cost of mediation. Transparency increases the reliability by allowing anyone to view all transaction information. Finally, scalability refers to the process in which the blockchain system can be easily rebuilt by changing and using an open-source code suited to its purposes [2-8].

In the next section, three types of blockchain are discussed: public, private, and consortium block chain types. Each type has its own characteristics, with slightly different functions and structures.

A. Public Blockchain

Public blockchain is a well-known type of cryptocurrency (virtual currency) used worldwide in a decentralized distributed system. The structure of a public blockchain has many unspecified participants who share and verify transaction information occurring in the system. There is no special management entity; thus, anyone can participate anonymously, and there are no restrictions on authority. Public blockchains are also actively being researched in the financial sector. Because it is possible to apply authentication procedures without a third-party trust organization, public blockchains demonstrate their effectiveness in financial transactions such as cryptocurrency and overseas remittance, as well as in crowdfunding and transportation.

In summary, a public blockchain is an open system in which anyone can create transactions, participate as nodes, and provide high reliability and integrity through mutual verification of users. As a disadvantage, however, the recording and processing speeds may be slow because many participant transaction records are stored and shared.

B. Private Blockchain

A private blockchain is a concept related to a public blockchain. It is only possible with the approval of a service provider, such as an enterprise or institution. A private blockchain is a centralized blockchain because its technology is used to enhance security in a centralized structure. Unlike in the public blockchain, a management entity exists, and a single management entity applies the structure of the private blockchain. In this type of structure, only nodes verified through the authentication method can participate. Each participant must be granted the appropriate authority to access the transaction. In private blockchains, only a restricted institution can create transactions. In addition, only authorized organizations can verify the transaction history and data and approve transactions. Because only authorized nodes can participate, there is no need to wait for the approval and verification of other unauthorized nodes, and thus the block creation cycle or verification process takes place quickly.

It is important to note, however, that because the users of a private blockchain have to rely entirely on its service provider, there is a limit to the reliability compared to the use of a public blockchain.

C. Consortium Blockchain

A consortium blockchain is appropriate only for companies that meet certain requirements or for participants who have made negotiations in advance based on their business or institution. Some participants only allow viewing or trading all or part of the transaction information on the blockchain, and some participants may have different permission levels assigned to them, such as permission granting to add new blocks. The consortium blockchain is a semi-centralized blockchain composed of several companies or institutions as a co-host that can participate only through authorized nodes (i.e., computers), such as private blockchains.

D. BaaS: Blockchain as a Service

Blockchain as a service (BaaS) provides a blockchain development environment in the cloud. The process of adding and removing nodes to the blockchain network is simplified, and it is also possible to allocate server resources regardless of their location. Since 2015, cloud services have emerged that provide blockchain platforms through Microsoft Azure and IBM Bluemix. In addition, the Linux Foundation enables developers to directly create and manage blockchain networks based on open source Hyperledger, and Amazon Web Services (AWS) has released a cloud service that also applies blockchain technology.

E. Advancement of the Blockchain Platform

Continuous research and improvements are needed to develop a more intelligent, efficient, and stabilized blockchain system with the development of a blockchain system using artificial intelligence technology [9-18].

III. BLOCKCHAIN ECOSYSTEM

To accelerate the technological development required to foster the blockchain industry, there are challenges that must first be solved. It is important to consider the legal, institutional, and technical aspects of development. As for legal and institutional concerns, legislation is urgently needed to improve and supplement areas that may conflict with current regulations, such as the Foreign Exchange Transactions Act, the Electronic Financial Transactions Act, the Personal Information Protection Act, and the Credit Information Act. On the technical side, international standardization, the training of professional technical development personnel, and a conducive environment of cooperation should be advanced. In this way, experts in various fields such as finance, education, public, economics, law, logistics, taxation, and accounting will participate in a joint development of the blockchain system [19].

A. Cryptocurrency Exchange

Blockchain is known to be a highly secure technology, although its security has been tarnished by cryptocurrency-related incidents related to Bitcoin and Ethereum. Although known cryptocurrency-related incidents and accidents may arise from defects in the blockchain system itself, three other main causes exist: a poor operation of cryptocurrency exchanges, neglected management of electronic wallets or private keys, and infection by malicious code. One of the most recent types of shocking events, widely known as a doctor's room or room number-n, can be regarded as the criminal act of negative cryptocurrency trading. To minimize such problems, more detailed legal and institutional arrangements and technical supplements are necessary.

B. Robust Electronic Wallet

As a device that can store cryptocurrency, wallets have two classifications: a hot wallet that is always connected to a blockchain network, and a cold wallet that can be stored separately from a network. Many experts recommend the use of cold wallets to prepare for various types of cyberattacks. These include problems from a leakage or theft of secret keys used for personal authentication and problems owing to infection from malicious code.

C. Various Business Models and DApp Services

For the blockchain industry to develop, various business models must be discovered, developed, and widely distributed. Setting up locations where experts from across various sectors, such as IT, finance, economy, manufacturing, public, logistics, tax, accounting, education, medical, arts, administration, defense, and philosophy, can gather together for discussions and collaboration is also recommend [20-49].

D. High-performance Blockchain Platform

High-performance blockchain platforms that can quickly and easily implement various business models at a low cost must be developed and distributed.

E. Interconnectivity Among Various Blockchain Platforms

Interconnections are systems that can organically link together and operate various types of blockchain platforms according to business models, and services should also be developed.

F. Safe Investment Environment

For blockchain technology to be utilized in various fields, a sound investment culture must first be advanced, and a proper recognition of said culture must subsequently follow. In addition, an objective, rigorous, and transparent management and evaluation system for specific blockchain platforms must be developed.

G. Role of Educational Institutions

Applications of new business models should be used in real systems in tandem with technologies such as artificial intelligence, big data, and the Internet of Things, all of

which are recognized as the main technologies of the Fourth Industrial Revolution. Furthermore, it is necessary to cultivate high-quality professional human resources for high-performance platform construction and DApp development. Such individuals must possess multi-field flexibility and expertise. It is also extremely important to develop through multidisciplinary cooperation a more robust and stable system design as well as a variety of service models for the blockchain ecosystem.

In terms of leadership, the Republic of Korea has already taken initiatives at institutions of higher learning. In 2016, Dongguk University broke new ground with the establishment of a blockchain research center. Shortly thereafter, a blockchain research center was established by Sogang University in early 2017. It is expected that active research and education programs at institutions such as Korea University, Yonsei University, and Sejong Cyber University will also greatly contribute to the fostering of blockchain experts. Most recently, in January 2020, Youngsan University held an opening ceremony for its blockchain research institute. In addition, Pusan National University (PNU) was selected as the winner of the 2020 Blockchain Convergence Security Core Talent Training Competition conducted jointly by the Ministry of Science and ICT, the Institute of Information and Communication Technology Planning and Evaluation, and the Korea Internet & Security Agency. PNU specifically plans to focus on the core technology of blockchain convergence security. The university's goal is to establish and operate a graduate school of convergence security, which will nurture high-quality academic talent specialized in blockchain and FinTech with more than 10 master's graduates each year. The program has approximately 3 billion won in government support in addition to 4 years of municipal support.

H. Quantum Computer Research

High-performance quantum computers that exceed the limits of existing computing speeds will be necessary to analyze various types of potential cyberattacks. In addition, it is critical to study high-level cryptographic algorithms at the platform design stage such that blockchain systems can effectively respond to various types of attacks. Technologies that can solve problems and answer questions regarding the security and reliability of blockchain systems should be continuously studied [50, 51].

I. Laws and Governmental Institutions

On March 17, 2020, the Provisional Act on the Partial Revision of the Act on the Reporting and Use of Certain Financial Transaction Information passed the Korean State Council. Blockchain and cryptocurrency have been prepared as platforms for the incorporation of institutional rights.

The amendment to the law has made the following major points: First, digital asset providers must comply with anti-money laundering investigations. The second declares the obligation of financial companies to comply with requests concerning digital asset providers. Financial authorities believe that the proposed amendment will prevent crimes such as money laundering using cryptocurrencies and contribute to the establishment of a transparent trading order; however, the situation is still in turmoil owing to a lack of detailed related laws and clarification in the legal system. In short, this situation necessitates a complicated articulation of concerns and expectations. This remains an important factor that may slow the development of related blockchain technologies. Revisions to applicable laws and legal systems, such as the Foreign Exchange Transactions Act, should be enacted and managed as soon as possible to create an ecological environment conducive to the resilient development of technology. The revision of the Passenger Car Transport Business Act (also known as the "Tada Prohibition Act") it is also limited in terms of this discussion. Movement forward will require proper judgment regarding the creation of policies encouraging advancement in future society and technology [52].

J. International Community Cooperation and Standardization

Blockchain is a distributed storage technology that records transaction details or specific information transparently, and duplicates and stores such data on multiple separate computers around the world to verify records and prevent hacking. The data have characteristics that are nearly impossible to forge or falsify. International standardization of blockchain systems will simplify numerous global transactions and foster innovation. In particular, the threat of human society owing to the worldwide spread of COVID-19 in 2020 has further highlighted the importance of the global ecosystem, the natural environment, and the need for international cooperation. To effectively cope with and overcome the major challenges of human society, a variety of solutions must be promptly sought through active international cooperation [53].

K. Role of Busan Metropolitan City Designation as a Unique Special Blockchain Zone

The metropolitan city of Busan, Republic of Korea, was designated as a special blockchain zone in July 2019. The city is building a blockchain demonstration service with private operators in the fields of logistics, tourism, public safety, and finance. This collaboration focuses on a marine logistics platform related to aquatic product history, a smart

tour platform related to tourist information, public safety video reports, and a digital voucher for local currency in Busan. The Korean government recently established a strategy to proliferate blockchain growth and reflect the project in the 2021 budget. The Ministry of Economy and Finance emphasized the following: "The blockchain industry is expected to grow at an average annual rate of over 80%, and countries overseas are drawing attention to blockchain as a promising technology for the future and are competitively applying themselves to populate the global market early. Because the technological gap between advanced countries such as the United States and Europe is not large, this is the perfect time for pursuing the use of this technology. If the government offers effective support, it will be possible for Korea to populate the global market first. The government should therefore play a more active role."

Because of the city's unique designation as a special blockchain zone in Korea, various projects and policies that cannot be initiated in other regions will be possible in Busan; however, a large number of individuals have voiced their concerns about the project. Busan must meet the expectations of many stakeholders by introducing more aggressive and progressive business plans and policies. Busan is also playing a larger role as a pioneer in the development of the blockchain industry and a healthy technological ecosystem.

L. ICO: Initial Coin Offering

In 2015, the term initial coin offering (ICO) became widespread as Vitalik Buterin developed ethereum through cryptocurrency. To proceed with the ICO, a white paper containing the motive, purpose, operating method, and outlook of creating a new cryptocurrency has been released to recruit initial investors. A public ICO is a method in which a start-up company opens only white papers on the Internet for funds. In a reverse ICO method, companies provide commercially available platforms or services to raise funds. A representative example of a public ICO is the EOS, and a representative example of a reverse ICO is Telegram [54].

In June 2019, Facebook's plan to issue the cryptocurrency Libra attracted attention worldwide. However, in the face of strong opposition from regulators, the organization has recently released a white paper revising its plans. The biggest change is that Facebook will abandon a global payment network ecosystem centered on the Libra cryptocurrency, which it was originally trying to build. Instead, the company will support various legal currencies, such as the US dollar and the Euro. Facebook has a plan to issue currencies such as the Libra Dollar, Libra Euro, Libra Pound, and Libra Singapore Dollar, among others. The plan to convert the Libra blockchain into a public blockchain (Bitcoin) five years after the service start date has also been canceled. This change was made because, if the Libra network is transformed into a public blockchain, a criminal organization may intervene, and the operating system may be exploited for illegal transactions. Facebook is also reportedly planning to start a cryptocurrency business by the end of 2020. A new white paper was released to actively persuade regulatory agencies around the world [55-60]. In Korea, the ICO is not legalized, and the country's foreign exchange transaction law does not clearly define cryptocurrency. Therefore, domestic policies and laws are insufficient. Therefore, many ICO-related companies are concerned about possible legal violations. To build a blockchain ecosystem early on, related laws and systems should be prepared with meticulous attention to detail as soon as possible. In addition, it is necessary to take precautionary measures to prevent a variety of financial scams by providing sufficient prior knowledge and information to prevent indiscriminate investments.

M. Developing Environment and Framework

It is currently difficult and complicated to develop smart contracts and blockchain platforms. Therefore, the developing environment and framework are extremely important for developing smart contracts and decentralized application software (DApp) on the Bitcoin, Ethereum, and Hyperledger platforms [61-64].

N. Other Matters

The role of public media, such as newspapers and broadcasting, in conjunction with blockchain-related associations and societies operated by industry and academic organizations, is also extremely important. Since 2017, mass media organizations have started to appear, and related associations and academic societies have been formed. Despite this growth, development activity remains insufficient. Along with pan-national interests, governments need to more actively support blockchain policies.

IV. CONCLUSIONS

In this paper, we outline blockchain technology and its many features that are collectively emerging as core infrastructure technologies alongside artificial intelligence and big data as a product of the Fourth Industrial Revolution. Blockchain is poised to lead a societal transformation that is super-connected, super-intelligent, and super-converged. In addition, by analyzing the blockchain ecosystem, we examined the possibilities for developing blockchain-related industries more soundly and efficiently. To this end, this paper recommends the consideration of legal, institutional, and technical aspects: Conflict with current financial legislation needs to be addressed, international standardization of

technology should be pursued, a corps of highly skilled technical personnel should be trained, and intersectoral collaboration on the development of the blockchain system should be advanced. A healthy and robust blockchain ecosystem must be built for the blockchain industry to develop stability. It is thus necessary to examine this issue in greater detail because the preparation of nationwide response measures can be an innovative domestic strategy to preoccupy the global market. Finally, a finely tuned system of international cooperation should be promptly established to help mitigate modern catastrophes in human society, such as the 2020 COVID-19 pandemic. The blockchain system will likely play an extremely large role in human development in the foreseeable future.

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