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## 블록체인 생태계 연구

### A Study on Blockchain Ecosystem

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**요약** 본 연구는 생태계 측면으로 블록체인 기술을 논의하고 각 구성 요소의 역할에 대하여 조사하였다. 본 연구에서 블록체인 생태계는 구성원이 분산 원장을 기반으로 새로운 가치(서비스)를 창출하기 위해 서로 공유하고 협업하는 네트워크 구조이다. 따라서 식물생태계와 비교하면, 블록체인 생태계의 구성 요소는 서비스 제공 업체(생산자), 서비스 사용자(소비자) 및 분산 원장 소유자(분해자)로 구성된다. 블록체인 생태계에서 분해자 역할을 하는 분산 원장은 중요한 요소이다. 블록체인 생태계의 가치를 유지하고 활성화하기 위해 분산 원장 소유자가 효율성을 확보 할 수 있는 환경을 구축하여야 생태계가 활성화 될 수 있다. 본 연구는 블록체인 생태계의 내부 관계를 이해하고 관련 연구에 기여할 뿐만 아니라 생태계를 활성화시키는 데 도움이 될 것이다. 본 연구의 한계는 탐구적인 연구를 기반으로 작성한 것이며, 향후에는 객관적인 자료를 기반으로 관련 논의가 되어야 한다.

**Abstract** This study looked at the blockchain technology as an ecosystem side and examined the role of each component. In this study, the blockchain ecosystem is a network structure in which members share and collaborate with each other in order to create new value(service) based on the distributed ledger. Hence compare to bio-ecosystem, the components of blockcahin ecosystem are consists of service providers(producer), service users(consumer) and the distributed ledger owners(decomposer). Distributed ledgers, who act as decomposers in the blockchain ecosystem, play an important role. In order to maintain and activate the value of the blockchain ecosystem, the ecosystem can be effectively operated by constructing an environment in which the distributed ledger owners can handle effectively.

This will help us to understand the relationship between ecosystems and not only to contribute to the study but also to activate the blockchain ecosystem. The limitations of this study are based on exploratory research, and specific discussion is needed based on objective data.

**Key Words** : Blockchain, Distributed ledger, Ecosystem, Bigdata, Cloud ecosystem

#### I. Introduction

Blockchain, which is a new technology of the future, is emerging as a new paradigm to change existing

business processes. In early 2016, the blockchain was selected as one of the core technologies to lead the fourth industrial revolution era in the World Economic Forum (WEF). Global market research firms Gartner

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and Deloitte also selected blockchain as one of the main technology in 2017.

A blockchain refers to a digital ledger that is shared between network members by encrypting transaction information occurring in a public or private network. Especially, in the field of financial services, efforts are being made to improve business efficiency and build a new service base by applying blockchain technology. In addition, as the interest in the blockchain is expanding worldwide, international collaboration for technology utilization is increasing. Therefore, the blockchain technology will be applied not only to the financial sector, but also to logistics and distribution, and also to government public and administrative services.

Interpretation of the structure of various industries based on the concept of ecosystem is helpful for understanding related industries. Therefore, by understanding the blockchain in terms of ecosystem, we will be able to understand the activation of this industry and the development of related technology and industry.

The purpose of this study is to examine the blockchain ecosystem and the role of each constituent component of ecosystem. In here the research on ecosystems in various fields was examined, and the blockchain ecosystem was discussed based on this study.

## II. Background

### 1. Blockchain

A blockchain is a block that is connected to each other. The block holds the transaction details fixed for a certain period of time, and the user decides the transaction details to be included in the block. Every user has a copy of the blockchain. Only the transaction details that a majority of users agree on are really recognized and bound into blocks to be kept permanently. The newly created block is added after the blockchain created above. This process is repeated

at regular intervals.

It was born from the need to have a decentralized system of record, and a distributed, autonomous authorization entity and a secure, transaction record, that can ensure immediate fraud detection and prevent misuse.

The first Blockchain (Originally), was conceptualized by Satoshi Nakamoto in 2008 and implemented the following year as a core component of the digital currency bitcoin, where it serves as the public ledger for all transactions. Through the use of a peer-to-peer network and a distributed time stamping server, a blockchain database is managed autonomously.

The invention of the blockchain for bitcoin made it the first digital currency to solve the double spending problem, without the use of a trusted authority or central server. The bitcoin design has been the inspiration for other applications.<sup>[1]</sup>

According to the bank of England, a blockchain is “a technology that allows people who don’t know each other to trust a shared record of events”<sup>[2]</sup>

Gurvinder Ahluwalia who is working at IBM said that Blockchain has the underpinnings for a next generation IoT (Internet of Things) architecture.<sup>[3]</sup>

Christopher Stanley LR, at Tata Consultancy Services explained that despite its richly varied applications, a blockchain such as bitcoin’s aims to realize a simple goal.<sup>[4]</sup> Abstractly, it can be viewed as creating a kind of public bulletin board, often called a “distributed ledger.” This ledger is public. Anyone - plebeian or plutocrat, baker or banker - can read it. And anyone can write valid data to it.

### 2. Ecosystem

An ecosystem is a group of interacting organisms and the surrounding inanimate environment that interacts with them. Therefore if a group of living organisms that live in the same place and depend on each other form a totally independent system then it can be called ‘ecosystem’. This means that interdependence and completeness are essential

elements for an ecosystem.

The basic concept of an ecosystem began with a study by Arthur George Tansley, a British botanist who discussed natural ecosystems. He stated that an ecosystem is to be considered a whole that is made up of interconnected constituent parts.

This whole, Tansley claimed, is not only the whole of the available organic systems, “but also the whole complex of physical factors forming what we call the environment of the biome - the habitat factors in the widest sense.”<sup>[5]</sup>

In 1935, he explained the evolution of biological dependence and breeding. The ecosystem as a whole is made up of separate parts through their mutual relations with their environment. These interrelations, intercommunications, and interactions between the separate elements are precisely what create a whole. Ecosystem has decomposer and it's linkage structure that produce value through virtuous cycle structure between producer and consumer. The concept of food chain linking primary producers, secondary consumers, and third decomposers as components of natural ecosystem is presented.

Since then, the basic principles of ecosystems have been applied not only to the economy but also to various fields.

Jan Smuts<sup>[6]</sup> (1926, p.127) explains this whole as follows: “The whole fuses the action of its elements into a real synthesis, into a unity which makes the result quite different from what it would have been as the separate activities of the parts.”

The whole of the ecosystem can therefore not be explained based on knowledge of the separate constituent parts, but rather by acquiring knowledge of the pattern of mutual interaction and communication between the separate parts, which thus make up and further develop the whole of the ecosystem.

In 1996, Moor described the business ecosystem as an economic community supported by a foundation of interacting organizations and individuals.<sup>[7]</sup>

Moore's business ecosystem is divided into three

categories: core contribution, extended business, and business ecosystem. Looking at the business ecosystem components, the core contributions of Core Business are divided into direct suppliers and direct distribution channels.

Extended business refers to suppliers of my suppliers, direct consumers, consumers, and business ecosystem refers to areas that include organic relationships between government, standardization agencies, and other related organizations.

Business ecosystems are industries that involve governments, related organizations and stakeholders and are involved in expanding businesses. Compared with the Tansley study, the extended business area has characteristics similar to those of the natural ecosystem.

The extended business part consists of the supplier (producer), the consumer, and the distribution channel (decomposer). According to Moore, a business ecosystem is an area that encompasses extended business areas and involves related governments and stakeholders.

Iansiti & Levien (2004) are observing corporate ecosystems as business environments as well as corporations. According to them, corporate ecosystem is not only the core business that produces specific products and services but also an extended network that includes suppliers and producers of consumers, competitors and complementary materials, And all other stakeholders in the industry.

Therefore, ecosystem is an economic community structure based on interactive organizations and corporations, and the main players are composed of suppliers, major producers, competitors, investors and consumers.

Opportunities and environments include relevant investors, governments, regulators, associations, and standards bodies.

According to Russell Ackoff (1971), a system is “a set of interrelated elements”.<sup>[8]</sup> A system is, in Ackoff's theory, made up of at least two elements and the

relationship that keeps these two elements together and unites them with at least one other element in their environment. The functioning of the system as a whole can hence, in Ackoff's view, only be approached from a holistic perspective. He claims that the functioning of the system as a whole is not only driven by the separate elements, but also shaped by these elements and their mutual communications and interactions.

### 3. Bigdata ecosystem

Generally, bigdata is extremely large data sets that may be analyzed computationally to reveal patterns, trends, and associations, especially relating to human behavior and interactions.

Bigdata analytics helps organizations harness their data and use it to identify new opportunities. In turn, leads to smarter business moves, more efficient operations, higher profits and happier customers. That is, analysis of data sets can find new correlations to "spot business trends, prevent diseases, combat crime and so on."

According to the study by Korea Institute of science & technology evaluation and planning, (2012), bigdata ecosystem components were categorized as data producer, data distributor, data consumer and solution provider<sup>[9]</sup>.

On the other hand, if there is an exchange between the data provider and the user centering on the service provider, which is a key enterprise of the bigdata business ecosystem to be discussed in consultation, and the service provider needs to collect digital data, It exists as a complementary material.

Service providers also need a variety of solutions to directly build, store, process and analyze bigdata, and they are developing and securing various solutions for this purpose.

According to Ryan & Co (2013), bigdata components are defined as Provider, Data, and User. Provider is classified as Service Provider and Solution Provider, and Data is composed of Private Data, Public Data, and General. User was described as Government &

Company and Expert Group.<sup>[10]</sup>

According to the National Institute of Standards and Technology (NIST) Working Group (2013), bigdata components are defined as the concept of input and output through the system, and components are defined as data providers, data consumers, System Orchestrator, Bigdata Application Provider, and bigdata Framework Provider.

A data provider is an entity that produces internal or external data that can be used in a system. A data consumer is an entity that uses the results produced by the system.

The System Orchestrator refers to the entity that manages, supports, and monitors, and bigdata Application Provider is the entity that provides the application. Bigdata application providers are individuals that divide into collection, storage, analysis, visualization, and access, and perform tasks between data providers and data consumers.

The bigdata Framework Provider was described as an entity that provides resources. The external environment surrounding the bigdata component discusses the security, privacy and management aspects and interprets the whole as an aspect of the value chain.

According to a study by Yoo Soonduck in 2013<sup>[11][12][13]</sup>, in various aspects, the components of the Bigdata ecosystem are classified as service providers, data holders, service users, and infrastructure providers.

A data holder is an object that collects and discovers a large amount of data. Service users are individuals who consume value through services.

A service provider is an entity that provides value to users by utilizing software and manpower data. An infrastructure provider is an entity that provides hardware, software, and network infrastructure.

Through this analysis, we were able to identify the role of each constituent in the bigdata ecosystem and understand whether they are organically cooperating with each other.

#### 4. Cloud ecosystem

Simply put, cloud computing is the delivery of computing services—servers, storage, databases, networking, software, analytics, and more—over the Internet (“the cloud”). Companies offering these computing services are called cloud providers and typically charge for cloud computing services based on usage, similar to how you’re billed for water or electricity at home. Cloud technology operates in a centralized data storage format.

This technology took away the burden of on-premises software implementation and maintenance challenges, and laid the foundation for a new type of ecosystem provider.

According to a study by the Cloud Services Ecosystem Initiative (2014)<sup>[14]</sup>, the cloud ecosystem was divided into integrators, service users, and service providers, and a case – based exploratory study was conducted on suppliers and users to promote related markets. The integrator refers to a centralized way of integrating information for each related service.

According to the research, “Understanding the Cloud Computing Ecosystem: Results from a Quantitative Content Analysis(2011), Cloud Computing Ecosystem consists of Providers, Cloud Computing Service, and Clients/User.<sup>[15]</sup> This paper structured the topics and key words along the Cloud Computing service process from provider to customer. The stakeholders (eg., providers and customers) act on the basis of legal and compliance requirements as depicted by the Government/ Compliance box. The provision of Cloud Computing services is related to technical issues. Security issues and risks affect stakeholders and the provision of services. They are also linked to the technical issues.

As already demonstrated in the cloud ecosystem, the blockchain ecosystem is also described as a relationship between human and technology.

In the cloud ecosystem, centralized technology has increased the efficiency of human tasks. That is, all the data generated by humans are provided by an

organization that operates the central management system. It has a structure that is connected to each other through tasks (or organizations) that manage integrated data processing in terms of ecology.

### III. Research design

Interpretation of the structure of various industries based on the concept of ecosystem is helpful for understanding related industries. Therefore, by understanding the blockchain in terms of ecosystem, we will be able to understand the activation of this industry and the development of related technology and industry. It will also help to look carefully at the development of future industries in comparison to the results of similar ecosystem changes in industry. Therefore, this study discusses the blockchain in terms of ecosystem and suggests the viewpoint. The following are the contents of the study.

- Study 1: Presenting concept of blockchain ecosystem
- Study 2: What are the components of blockchain ecosystem?

In order to analyze the blockchain technology from the aspect of ecosystem, we used an exploratory study method to examine the research contents of previous researchers.

### IV. Blockchain ecosystem

#### 1. Blockchain ecosystem concept

As Tansley already said, ecosystems arise and develop as a whole based on interconnectedness between the separate components and their communications and interactions. In other words, when a group of living organisms that live in the same place and depend on each other form a completely independent system, it is called an ‘ecosystem’. This

means that the interdependent and interacting components are essential elements for an ecosystem.

Blockchain is based on interaction between people and distributed and random technological nodes (i.e. computers) that are interconnected in a network. With this network, the processing event creates a new way of executing information transactions between peers without the intervention of a trusted third party. Through this new kind of interaction, new people and technological nodes can always join the network (or leave it at any random moment) to execute one or multiple information transactions. The nodes updated that new decisions are made within the network all the time, and that these are linked up as blocks.

The data generated by the transactions is stored in a node form by all the users, thereby solving the limitations of the existing system. Therefore this system increases the possibility of data reliability and reduces forgery by having multiple participants hold the generated data. Thus, the blockchain, which is distributed ledger, has the opposite structure to the cloud system, which is a centralized management method.

In this study, the blockchain ecosystem is a network structure in which members share and collaborate with each other in order to create new value (service) based on the distributed ledger. In here, the node set as a distributed ledger is considered as value creator in blockchain technology.

This ecosystem are hence the result of communication and interaction between organic and physical entities that operate in a distributed manner and are interconnected in the ecosystem or network. This ecosystem develops itself based on the mutual relations of and communication and interaction between the separate parts.

Hence compare to bio-ecosystem, the components of blockcahin ecosystem are consists of service providers(producer), service users(consumer) and the distributed ledger owners(decomposer).

The following section discusses the components of

the blockchain ecosystem in detail.

## 2. The components of Blockchain ecosystem

According to FirstPartner, which announced the blockchain ecosystem in 2016, the components of the blockchain are divided into service user, service provider (merchant), and distributed ledger. This study describes the blockchain only in the financial sector and each part is classified into bitcoin based cryptocurrencies and open protocol for institutions.

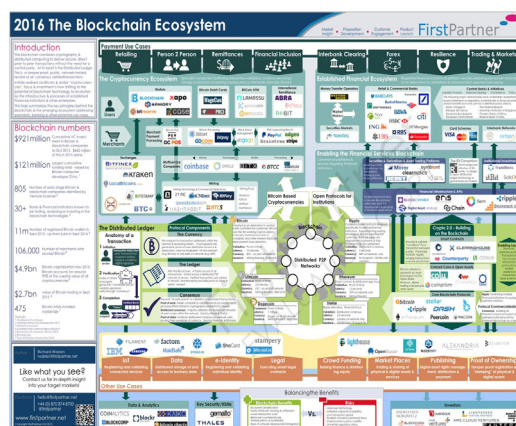


Fig. 1. 2016 Blockchain ecosystem by FirstPartner  
 그림 1. 퍼스트파트너에 따른 2016 블록체인 생태계

In this study, the distributed ledger is acting as a decomposer, a value creator in the general ecosystem. Therefore I propose to classify the blockchain ecosystem components into service users, service providers, and distributed ledger owners.

Service users are individuals or organizations who consume value through services. A service provider is an entity that provides services to users by utilizing software and manpower. A distributed ledger owner means an entity that keeps the generated data in block form according to the transaction.

Compared with other ecosystem components, there is a difference in the form of the decomposer seen from a general bio-ecosystem point of view. Decomposers are data holders in the bigdata ecosystem and are integrator that unify data in the cloud ecosystem.

Decomposers are participants who have distributed ledgers in a blockchain ecosystem. This means that this ecosystem produce new values through the function of distributed ledger.

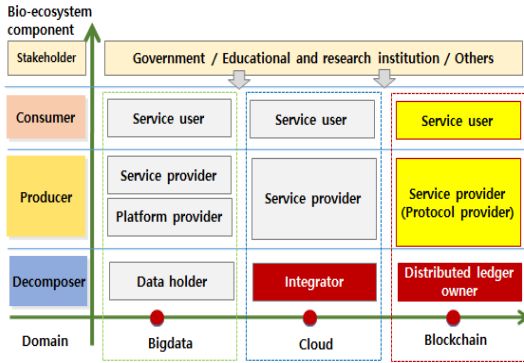


Fig. 2. Analysis of each ecosystem  
 그림 2. 각 생태계의 분석

Figure 2 compares the components of each ecosystem with bio-ecosystem. These components organically link together to form the relevant field ecosystem and induce activation. Therefore, it provides an important role in understanding the components of ecosystem and determining what to do to revitalize the industry.

The following discussion explains the relationship between each component and how they affect each other.

### 3. Discussion

The components of the blockchain ecosystem consist of service consumers, service providers, and distributed ledger owners. Service users are individuals who consume value through services and service providers are individuals that provide value to users by utilizing software and manpower. The owner of the distributed ledger is the entity that shares transaction data with each other.

From the perspective of an ecosystem, blockchain ecologies is that this ecosystem will be based on new combinations of human and technology, combined

action by man and technological nodes that strike up equal relationships, based on which they communicate, interact, and exchange and share information. Therefore the blockchain ecosystem provides value to the market as a decomposer, a way in which processing data is kept by each participant so that human and technology can maintain an equal relationship to each other.

The blockchain ecosystem allows humans to share data with one another to overcome the limitations inherent in existing cloud ecosystems, to provide value, and to form organic relationships with one another.

Of course, like other ecosystems, the role of producers and consumers is important, but ultimately, it is a big part of the blockchain ecosystem to be able to create new value through the role of the decomposer, the distribute ledger owners.

In this study, the blockchain ecosystem has the value of the distributed ledger, which is contrary to the role of the data integration manager in the cloud. As the value of the distributed node sets becomes larger, the number of related service providers increases.

In order for this ecosystem to operate well, it should be able to maximize the value of the distributed ledger while at the same time ensuring the benefits of each component and the efficiency of its processing.

This ecosystem will be maintained and preserved when the constituent organizations that make up the ecosystem interact with each other and human and technology operate in harmony.

This study discusses the blockchain ecosystem through an exploratory study based on Tensley 's botanical ecosystem, bigdata ecosystem, and cloud ecosystem analysis results. The blockchain ecosystem coexists with each component of the ecosystem as mentioned in the existing ecosystem.

Ultimately, this leads to the revitalization of the relevant market and the phenomenon of coevolution, which is the main feature of the ecosystem as a positive circulation relation. In a similar case, the cloud ecosystem has also benefited from consolidation, which

has allowed companies to enter cloud services and contribute to the development of related industries.

## V. Conclusion

This study examined the blockchain which is mentioned as the representative technology of the fourth industrial revolution in terms of ecosystem and this research investigated the blockchain ecosystem using an exploratory method based on previous studies.

Based on Tensley's theory of botanical ecosystems, we discussed the bigdata ecosystem and the cloud ecosystem that many researchers have mentioned. In addition, the concept of blockchain ecosystem and its components were examined.

In this study, the blockchain ecosystem is a network structure in which members share and collaborate with each other in order to create new value (service) based on the distributed ledger. In here, the node set as a distributed ledger is considered as value creator in blockchain technology. Hence the blockchain ecosystem are the result of communication and interaction between organic and physical entities that operate in a distributed manner and are interconnected in the ecosystem or network. This ecosystem develops itself based on the mutual relations of and communication and interaction between the separate parts. Hence compare to bio-ecosystem, the components of blockcahin ecosystem are consists of service providers(producer), service users(consumer) and the distributed ledger owners(decomposer). In other words, the entity that plays the role of the consumer is classified as the service user and the producer role has been classified as a service provider.

Distributed ledgers, who act as decomposers in the blockchain ecosystem, play an important role.

The blockchain is solving the limiting factor of the centralized cloud system with the distributed policy principle of distributed policy. In addition, it plays an important role in maintaining the equality relationship

by holding and linking various processing data composed of nodes. Also, by holding the generated data with several participants, it increases the reliability of the data and reduces the possibility of forgery.

In order to maintain and activate the value of the blockchain ecosystem, the ecosystem can be effectively operated by constructing an environment in which the distributed ledger owners can handle effectively.

This study looked at the blockchain technology as an ecosystem side and examined the organic role of each component. This will help us to understand the relationship between ecosystems and not only to contribute to the study but also to activate the ecosystem.

The limitations of this study are based on exploratory research, and specific discussion is needed based on objective data.

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