

# 제4차 산업혁명과 블록체인 전자정부에 대한 연구 -사이버범죄와 사이버부패방지 측면에서

이상윤\* · 윤홍주\*\* · 서원찬\*\*\*

A Study on the 4th Industrial Revolution and Block Chain Electronic Government  
-In terms of the prevention of cybercrimes and corruption-

Sang-Yun Lee\* · Hong-Joo Yoon\*\* · Won-Chan Seo\*\*\*

## 요 약

본고에서는 디지털범죄와 부패방지 측면에서 제4차 산업혁명시대의 바람직한 블록체인 전자정부 위상을 탐색하였다. 연구결과, 제4차 산업혁명시대의 바람직한 블록체인 전자정부 위상 구축에 있어 지향해야할 4가지 방안을 제시하였다. 결국 블록체인 기술의 핵심이념인 공유성을 통해 모든 참여자들이 정보를 공유하고 조작방지를 통해 기록한 정보에 대한 위변조를 어렵게 하며, 투명성을 통해 다양한 참여자들이 모든 정보를 공유하기 때문에 투명성이 보장되고, 나아가 이러한 다양한 참여자들이 감시자로서 수평적인 네트워크의 거버넌스 체제 속에서 기능하면서 블록체인 자체에 대한 신뢰성의 증대 혹은 확보를 통해 전자정부에 대한 신뢰확보와 안전성에 대한 믿음을 높일 수 있다. 사실상 전자정부의 경우, 정보민주주의가 강화되는 전자민주주의 확대가 미래의 지향이념인 점에서, 또한 이를 위해서는 다양한 참여자들이 보장되는 네트워크가 강조되는 전자거버넌스의 확립 역시 제4차 산업혁명시대의 바람직한 지향할 미래상인 만큼 도출한 블록체인의 주요이념에 따른 4가지 추진원칙과 방안에 따른 미래 전자정부의 위상정립이야말로 이른바 다가올 블록체인 전자정부의 미래에 있어 가장 적합한 모델이라 할 수 있다.

## ABSTRACT

This paper explores desirable status of block chain electronic government in relation to the prevention of cybercrimes and corruption. After the research, we suggest four measures to establish desirable status of block chain electronic government. Eventually, transparency is ensured thanks to the core concept of block chain technology, sharing, not only allowing all of the participants to share information and but also preventing them from forging or falsifying information. Furthermore, a wide variety of participants can play a role as monitors in the horizontal structure of governance system, which also assures credibility and reliability on electronic government through trust on block chain itself. Electronic government aims at virtue of expanded electronic democracy which strengthens information democracy. Also, establishment of electronic governance, that emphasizes networking and guarantees, is a desirable image of the future of the fourth industrial revolution. Therefore, the establishment of future electronic government according to the four principles drawn from this paper can be the most suitable model.

## 키워드

The 4th Industrial Revolution, Cybercrime, Block Chain Technology, Electronic Government  
제4차 산업혁명, 사이버 범죄, 블록 체인 기술, 전자 정부

\* 부경대학교 공간정보시스템공학과(sylee@pknu.ac.kr)

\*\* 부경대학교 공간정보시스템공학(yoonhj@pknu.ac.kr)

\*\*\* 교신저자 : 부경대학교 신소재시스템공학과

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• Corresponding Author : Won-Chan Seo

Dept. Materials System Engineering, Pukyong National University

Email : seowc@pknu.ac.kr

## I. Introduction

The essence of the fourth industrial revolution is centralization and intellectualization of which core technology are the internet of things, cloud, big data, and mobile based on information communication technology.

The fourth industrial revolution is a form which collects information in central cloud and analyzes with big data. With such aspects of the fourth industrial revolution, adopting and materializing block chain to establish e-government is no longer distant future but reality. Block chain is one fourth industrial revolution technological feature which distributes authority to record and manage with distribute process without conventional central systems.

Meanwhile, as cyber space activates communication of information, it is likely that cybercrimes manipulating the core source of cyber space. In other words, cybercrimes on information resources is expected to sharply increase as informatization matures with the fourth industrial revolution. Therefore, the ability to confront and control cybercrimes is critical in establishing desirable e-government objective for fulfilling electronic democracy with maximum information accessibility. In addition, better interaction among the citizens based on opening, sharing, and communicating with information in the fourth industrial revolution, the easier access and reduced cost to information will be achieved from not to mention easier corruption prevention. Namely, enhancement in e-government where the network of a wide variety of participants to establish e-government promotes corruption prevention.

The materialization strategy for establishment of future e-government that adopts and utilizes block chain in the fourth industrial revolution is described below.

## II. The 4th Industrial Revolution and Block Chain

### 2.1 Related Research

Researches regarding the fourth industrial revolution and e-government with block chain are rare because discussions on e-government with block chain and entry to the fourth industrial revolution have begun only recently. However, the research utilizing a scenario planning approach regarding future policy of e-government and national informatization is described below.

S. Lee(2017)[1] recently contemplated a desirable future of e-government of Korea and its national informatization applying scenario planning methodology which is commonly used for future prediction. Also, S. Lee and M. Chung(2016)[2] preformed a research on establishment of platform e-government for providing customized public service. In addition, S. Lee and H. Yoon(2016a)[3] suggested big data administrative space information system in terms of system materialization regarding internet of things. Moreover, S. Lee and H. Yoon(2016b)[4] has also performed a research on application of administrative space information as metadata. Furthermore, S. Lee and H. Yoon(2016c)[5] put emphasis on the need of administrative space information system. Additionally, S. Lee and H. Yoon(2012a)[6] performed a research of e-government of Korea and cloud computing technology to secure relative advantage of future e-government in relation to core information communication technologies such as cloud computing and big data. Also, S. Lee and H. Yoon(2012b)[7] pursued a research regarding big data e-government along with national information strategies. Furthermore, S. Lee(2012c)[8] performed a study of electronic voting system in relation to e-government. In addition, S. Lee(2013)[9] performed a research on space information system. Moreover, S. Lee and M. Chung(2014)[10] have also

performed a research on materialization of platform e-government. Lastly, S. Lee and H. Yoon(2015)[11] performed a research of governance risk management.

## 2.2 The Fourth Industrial Revolution and Block Chain Technology

Block chain has gained attention as one of the significant information communication technologies in the fourth industrial revolution. Before researching technological status of block chain, understanding the fourth industrial revolution takes precedence. So far there have been four industrial revolutions. The first revolution occurred in the Britain in last 18th century and the revolution advanced from manual industry to factory automation with appearance of steam engine. The second industrial revolution enabled mass production. The factories started using conveyor belts with the invention of electricity. The third industrial revolution is information revolution with the advent of the internet in the late 20th century. During the time the rate of sharing information went up dramatically more rapidly and the technology advancement took place remarkably fast. Less than fifty years have passed and we are facing the fourth industrial revolution now.

Then what is the source of the fourth industrial revolution? Thermal energy was the source for the first revolution, electricity for the second, and the internet for the third. In a nutshell, the key to the fourth industrial revolution is intellectualization. To be more specific, it is intellectualization of the things interacting with information centralization, which aims for maximizing happiness of the people and improving convenience and efficiency. The core technologies to the intellectualization are the internet of things, cloud, big data, and mobile.

As the described below [figure 1], the fourth industrial revolution collects information in the central cloud, utilizes intellectualization, and

analyzes with big data. In other words, intellectualized communication such as the internet of things enables information collection regardless of time and place. The collected information will be stored in cloud, then the information is analyzed by big data using artificial intelligence and transmit to the users' mobile device.

Of course, the user interface will not be limited to smart devices and the internet of things will enable things such as cars, clothes, and houses to be a mobile device equipped with the internet.

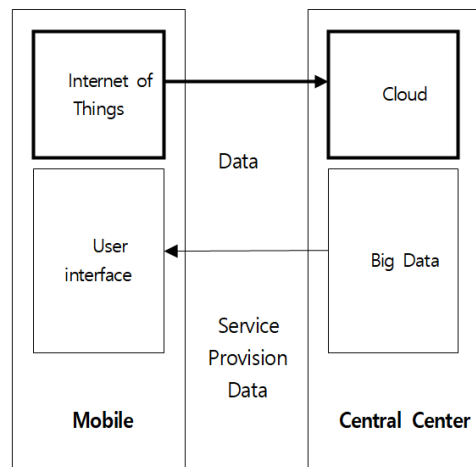


Fig. 1 The Fourth Industrial Revolution and Data Transfer

Meanwhile, another characteristic of the fourth industrial revolution, centralization, can be put differently as information monopoly. The term 'monopoly' is anti-democratic and it is highly likely to cause prevalent corruption. When the central distorts information, it is difficult for the people to detect. In addition, the amount of information in the central will increase exponentially as information is accumulated and centralized in the central through the internet of things due to which problems related to distortion and corruption of information can be vulnerable. Block chain technology can solve

or even prevent this issue. As a technology enabling P2P(Peer-to-peer) network which connects individuals to the other, block Chain requires neither central server nor managers. The blocks containing transactions between the individuals are connected with a long chain where participants exchange transaction information that is to be verified by all of the participants after distributed transmission. Once verified, the block is registered in existing block chain of which transaction information is verified only with consensus of the majority, which is why it is nearly impossible for an individual user to tamper. That is, the essence of Block technology is allowing every participant to share information with credibility through information distribution. In other words, it functions beneficially to avoid a problem of monopoly and centralization of information while preventing corruption. Naturally, the shared information can be seen and checked by anyone at anytime.

The algorithm of block chain technology shares all information and constantly checks if the information has been forged. When checking the information, it always follows the saved information contents by the majority. For example, the participants 'A' records the information a while the other participant 'B' records differently with the information b, the Block Chain algorithm changes the information a to b. In other words, it makes forging nearly impossible because of the principle of majority rule, which means hacking is possible only when at least the majority of the information is hacked. Eventually, the participants of Block Chain can rely on it thanks to co-ownership, credibility, and anti-forgery of the information.

### III. The 4th Industrial Revolution and E-Government

#### 3.1 E-Government and Cybercrimes

The e-government and national informatization in Korea are at world-class level thanks to establishment of internet network and improvement in service quality that have been led by government and private enterprises. Although informatization made a progress through the evolution of information communication technology, it is undeniable that the expansion of cyberspace has given rise to digital crimes. The term 'Digital Crime' or 'Cybercrime' refers to criminal activities occurring in cyberspace of such as computer systems or computers connected by information network such as the Internet. While the computer-related crimes in the past were confined to a computer system, the terms are being used more broadly today. Therefore, it is likely that the crimes will occur more frequently as cyberspace of which main resources are information and communication is more activated. Namely, the cybercrimes related to information resources are expected to increase rapidly as informatization is more deeply involved with the fourth industrial revolution. Meanwhile, the national informatization and e-government of Korea will take another step closer to information democracy and electronic democracy with the slogan of the government 3.0 which is sharing, opening, and communicating.

Therefore, increased possibility of cybercrime is inevitable due to the nature of openness of information and eventually, an evolution to a desirable future e-government will be the form where it prevents and deter cybercrimes while maintaining its highly accessible characteristic. In other words, taking actions against cybercrimes are critical in establishing a desirable e-government where electronic democracy is being pursued and information democracy is being enhanced with maximized openness of information.

### 3.2 E-Government and Preventing Corruption

Opening, sharing, and communicating with information opened to the external allows the government and citizens to interact more smoothly and prevent corruption and information monopoly as access to information costs less than before. It is easier to locate and resolves the problems that stem from the central when a society is equipped with more open information infrastructure. One of the easiest ways to prevent corruption of centralized information is to guarantee the participants to play their roles as observers in the course of accessing and opening the information. Hence, as more participants exist, chances are that more examiners will be available to prevent corruption. To guarantee an expanded participation in e-government yields governance. As the term 'governance' elucidates a variety of participants, enhanced governance can provide better response to corruption and the fundamental outcome of governance is networking. In fact, the emphasis on networking in governance requires effort beyond ordinary capacity of government, which includes preventing corruption. Rather than central government's dominance, governance focuses more management by state, people and local government with market oriented and decentralized horizontal network.

In other words, the establishment of governance that improves openness issue of centralized or monopolized information is the best way to prevent corruption. As mentioned earlier, some of the key components of the fourth industrial revolution are centralization and intellectualization. In addition, enhanced electronic governance can prevent corruption. As a result, with improved governance with horizontal networking, the fourth industrial revolution can enjoy the ideology of governance where enhanced centralization and intellectualization maturity is encouraged while corruption is prevented.

## IV. Discussion

Hitherto this paper has discussed the desirable E-Government with Block Chain technology in terms of prevention of cybercrimes and corruption. As mentioned earlier, the core of the fourth industrial revolution is centralization and intellectualization and the key elements of block chain technology are sharing, transparency, and credibility. In terms of prevention of cybercrimes and corruption in the fourth industrial revolution, information in the fourth industrial revolution is expanded further as it is more opened to the public, which naturally may also cause a surge in cybercrime.

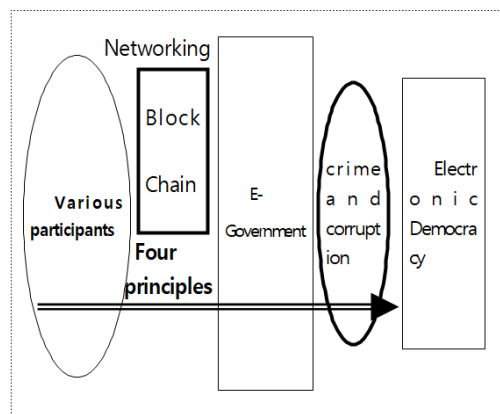


Fig. 2 Futurama of Block Chain E-Government

In terms of preventing corruption, monopoly and centralization of information, improvement in the governance where participation of observers is guaranteed. It is also crucial to enhance horizontal networking relationship, not vertical or monopolized one. Below are the suggestions to establish desirable e-government in the fourth industrial revolution. Refer to the figure 2. The first core of block chain technology is emphasizing the importance of sharing which promotes enhancement in democracy through opening and sharing

information. The second is the transparency which allows a wide variety of participants to simultaneously check information and make changes depending on how the information from the majority have been recorded. The third is the prevention of forging in cyberspace in responding against cybercrimes. The fourth is the credibility in e-governance that allows a number of participants to share information and let them play an observer role in horizontal networking in order to respond properly against corruption.

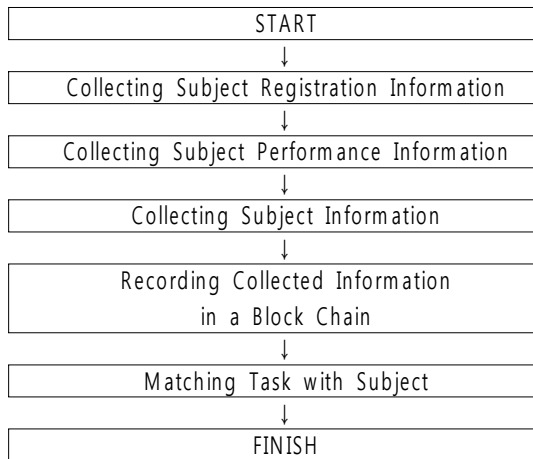


Fig. 3. Block chain and e-Government System Flowchart with Operation Algorithm

Therefore, Figure 3 shows an example of the task processing of each participant in terms of enhanced electronic governance for the purpose of enhancing understanding of the implementation of the e-government applying the above-described block chain technology. Figure 3 shows a schematic overview of the e-government system, which is a block-based system in which e-governance is being reviewed and filed as a present patent proposed by the present study.

## V. Conclusion

This paper considers a desirable e-government status with block chain technology. Also, it provides desirable plans to establish such desirable e-government in the fourth industrial revolution. Eventually, the core values of block chain make it easier for participants to share and avail information while preventing others to forge or falsify the information. Furthermore, the transparent nature of block chain can cultivate credibility and reliability on e-government with different participants observing block chain in horizontal networking. Ultimately, e-government aims enhancement and expansion of electronic democracy. Moreover, the desirable future of the fourth industrial revolution requires e-governance with network and a wide variety of participants and thus, the four principles discussed above are the most suitable model to plan and promote the establishment of future e-government.

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of Nuclear Power Plants," *J. of the Korea Institute of Electronic Communication Sciences*, vol. 10, no. 1, 2015, pp. 81-94.

## 저자 소개

### 이상윤(Sang-Yun Lee)



2002년 부산대학교 조선해양공학과 졸업(공학사)  
 2009년 부산대학교 대학원 정치외교학과 졸업(정치학석사)  
 2011년 부산대학교 대학원 공학박사(STS)수로  
 2013년 한국행정학회 학술정보이사  
 2014년 부산대학교 대학원 공공정책학 박사  
 2014년 ~ 한국전자통신학회 총무이사  
 2013년 ~ 2014년 부경대학교 공간정보연구소 소장  
 2015년 ~ 현재 부경대학교 행정공간정보화연구소 부연구소장  
 2015년 한국이민정책학회 학술정보이사  
 2016년 (사)한국생태공학회 부회장  
 ※ 관심분야 : 정보기술정책, 전자정부, 행정공간정보화, 이민다문화와 사이버안보, 빅데이터 디지털정책

### 윤홍주(Hong-Joo Yoon)



1983년 부경대학교 해양공학과 졸업(공학사)  
 1985년 부경대학교 대학원 해양공학과 졸업(공학석사)  
 1997년 프랑스 그르노블 I 대학교 대학원 위성원격탐사전공 졸업(공학박사)  
 2010년 부산대학교 대학원 융합기술정책 박사수로  
 1997년~1999년 기상청 기상연구소 원격탐사연구실 기상연구관  
 1999년~2002년 전남대학교 해양공학과 교수  
 2002년~현재 부경대학교 공간정보시스템공학 교수  
 2012년~2013년 부경대학교 공간정보연구소 초대소장  
 2013년 (사)한국클라우드협회 부회장  
 2014년 한국전자통신학회 부회장  
 2015년 공간정보 Big Data 센터장  
 2015년 행정공간정보화연구소 소장  
 2016년 (사)한국생태공학회 회장  
 2017년 부산시 지능정보산업협의체 위원장  
 2017년 부산시 4차산업혁명 대응협의체 위원  
 ※ 관심분야 : 원격탐사 & GIS, 공간정보정책학



**서원찬(Won-Chan Seo)**

1988년 부경대학교 해양공학과  
졸업(공학사)

1992년 일본 OSAKA대학 대학원  
생산가공공학과 졸업(공학석사)

1995년 일본 OSAKA대학 대학원 생산가공공학과  
졸업(공학박사)

1998년 ~현재 부경대학교 신소재시스템공학과 교수

※ 관심분야 : 위성정보처리, Machine Vision