대한경영정보학회
「경영과 정보연구」 제38권 제1호 2019년 3월
http://dx.doi.org/10.29214/damis.2019.38.1.005

A Guideline for Identifying Blockchain Applications in Organizations†

Su Hyeon Namn*

〈요 약〉

Blockchain is considered as an innovative technology along with Artificial Intelligence, Big Data, and Internet of Things. However, since the inception of the genesis of blockchain technology, the cryptocurrency Bitcoin, the technology is not utilized widely, not let alone disruptive applications. Most of the blockchain research deals with the cryptocurrency, general descriptions of the technology such as trend, outlook of the technology, explanation of component technology, and so on. There are no killer applications like Facebook or Google, of course. Reflecting on the slow adoption by businesses, we wanted know about the current status of the research on blockchain in Korea. The main purpose of this paper is to help business practitioners to identify the application of blockchain to enhance the competitiveness of their organization. To do that, we first use the framework by Iansiti et al (2017) and categorize the blockchain related articles published in Korea according to the framework. This is to provide a benchmark or cases of other organizations' adoption of blockchain technology. Second, based on the value proposition of blockchain applications, we suggest evolutionary paths for adopting them. Third, from the demand pull perspective of technology adoption for innovation, we propose applicable areas where blockchain applications can be introduced. Fourth, we use the value chain model to find out the appropriate domains of blockchain applications in the corporate value chains. And the five competitive forces models is adopted to find ways of lowering the power of forces by incorporating blockchain technology.

Key Words: Blockchain, Innovation, Decentralization, Value chain, Competitiveness, Smart contract, Consensus

논문접수일: 2019년 02월 07일 수정일: 2019년 03월 04일 게재확정일: 2019년 03월 06일
† This study was supported by the 2018 Hannam University Research Fund.
* Professor, Dept of Global IT Business, Hannam Univ, namn@hnu.kr

Ⅰ. Introduction

Business activities are summarized as contracts, transactions, and keeping records of contracts and transactions. That is, the contracts should be kept as written without any modification possible and the records should be kept as in original without any alteration permitted. In addition, the contract needs to be followed without any difficulty when the terms of the contract are satisfied, including the payment and delivery of assets.

Blockchain is the new technology to ensure the integrity of business transactions efficiently and effectively. This the fundamental reason that organizations adopt blockchain technology. The second reason is that this technology is to sustain and augment the incumbent business model to gain competitive advantages. The third reason might be the technology can disrupt the existing business model completely, making the current competition mode totally obsolete.

Since the paper by Satoshi Nakamoto in 2008, there have been much expectation and bright outlooks about the Bitcoin and blockchain, bringing much research on this and heralding fast adoption of the new technology by the business organizations. However, we saw Bitcoin bubbles in 2018, which slowed the pace of new business models using blockchain.

Iansiti et al.(2017) proposed a framework of blockchain application adoption. To build the framework, they suggested two dimensions: the degree of complexity and coordination and the degree of novelty. We use the framework to investigate the Korean blockchain research to find out the current status of blockchain adoption. Based on the result, we analyze the current situation and propose possible direction of blockchain technology adoption in the future. How to develop business models utilizing blockchain technology.

Blockchain is considered as an innovative technology along with Artificial Intelligence, Big Data, and Internet of Things. However, since the genesis of blockchain technology, the cryptocurrency Bitcoin, the technology is not utilized widely, not let alone disruptive applications. Most of the blockchain research focuses on the crypto currency, general descriptions of the technology such as trend, outlook of the technology, explanation of component technology, and so on. There are no killer applications like Facebook or Google. Reflecting on the slow adoption by businesses, we wanted know about the current status of the research on blockchain in Korea.

The main purpose of this paper is to help business practitioners to identify the application of blockchain to enhance the competitiveness of their organization. To do that, we first use the framework by Iansiti et al.(2017) and categorize the blockchain related articles published in Korea according to the framework. This is to provide a benchmark or cases of other organizations' adoption of blockchain technology. Second, we use Roger's innovation and diffusion theoretical attributes to find out the candidate attractive areas for utilizing blockchain technology. Third, we use the value chain theory to find out the

appropriate domains in the corporate value chains. And fourth, the Five forces competitive model is adopted to find ways of lowering the power of forces by incorporating blockchain technology.

The structure of this paper is as follows: In Section II, we provide a brief overview of blockchain technology and related literature. In Section III we explain how we get the sample data to categorize academic articles on blockchain published in Korea. In fact, we use keyword filtering method from the Korea Citation Index(www.kci.go.kr).

In Section IV we categorize the articles filtered in Section III according to the framework proposed by Iansiti et al.(2017). In Section V we suggest a guideline which we believe would be useful for practitioners to identify which blockchain technology and where to apply the technology in their organizations. In Section VI a conclusion and comments on the limitations and future direction of the research is given.

Ⅱ. Related literature on blockchain technology and identification of application adoption

In this section we first provide an introduction to blockchain technology and what are the main differences from the previous data keeping systems. And then we review related literature which will be useful to guide the practitioners for identifying appropriate blockchain applications in their organizations.

1. Blockchain technology

The advance of information technology(IT) and the Internet has changed the way of doing business, exchange of data, communication process, and way of competition among organizations: Mostly in terms of speed and cost efficiency. However, the current IT is not effective to provide the sustaining value among the participating entities. For example, vulnerability to security from the hackers, DDoS attack, lack of robustness of data due to the centralized management, and difficulty to ensure trust in diverse business processes. Since late 1990 when music sharing system called Napster was introduced, a really successful P2P(peer to peer) network was not available, which does not rely on a centralized entity, making the transaction cost minimal, and is resistant to system failure.

The first blockchain was conceptualized by Satoshi Nakamoto(2008). The characteristics of the original blockchain are 1) decentralized control of network where no authorized party controls the network, 2) list of transactions are shared and kept by all participants, compared to the current centralized database management, 3) transactions and block are the elements and they are encrypted and kept along with hash codes to protect data from modification, allowing only appending; each block is linked to the previous and following blocks along with hashes to make the data immutable.

The mechanism of blockchain can be specified as follows: 1) Records of transactions or databases are distributed across the participants so that any single party is not responsible for the records. Thus, an intermediary between any participants does not need to exist to convey a record of a party to the others. The two parties directly participate in the transaction without any third party, make the transaction more efficient in terms of time and cost. 2) Once a transaction is recorded, it cannot be altered later since the transactions are encrypted and kept along with hash code and put into a block. A block is again encrypted and hashed, and the block is linked from the previous and to the next blocks, which makes the change of transactions prohibitively difficult. 3) Transactions in the distributed ledger can be programmed so that smart contracts can occur without the parties involvement to make the transaction efficient and transparent.

Blockchain applications can be implemented in several ways for the purpose of serving a single organization, a consortium comprising of a set of interrelated organizations, or incorporating the general public. The differences from the several category of the three types are given in <Table 1>. Of course the scope of the implementation of private blockchain in a single organization makes the network easy and efficient. But the payoff from the technology is not much. It is a centralized system, not much of the difference from the current IT infrastructure.

<Table 1> Comparison of Blockchain Types (Modified from Zheng et al., 2018)

Category	Public Blockchain	Consortium Based Blockchain	Private Blockchain
Participants	General Public Permissionless	Consortium of Organizations Permission-based	Single Organization Permission-based
Consensus	Proof of Work by Mining	Predefined set of nodes	Single node
Trust	Trust-free	Trusted	Trusted
Scalability	Very high	Medium	Low
Efficiency of Network Management	Low	Medium	Very high
Representative Application Examples	Bitcoin, Ethereum	accounting and record keeping	Logistics, Provenance proof
Degree of Centralization	Decentralized	Semi-decentralized	Centralized

For public blockchain, there is no limit to participate in the blockchain network. A Bitcoin is a representative example of public blockchain network. Thus the network is called DAO (Distributed Anonymous Organization). Consistency of transactional data is preserved by the

voting procedure. A winner is declared by the proof of work in bitcoin environment. On the other hand, in private blockchain network, the network is controlled by an organization or a consortium of participating organizations. One example is a supply chain network where manufacturers, suppliers, logistics companies, warehouses, and wholesalers and retail stores. The network is specific and exclusive in terms of who are participating organizations and what are the roles of each participants and what are the governing rules. One or more participating organizations are granted rights to verify and distribute the transaction data to other members of the network. In Hyperledger Fabric, memberships are granted by MSP(Membership Service Provider) and the one or more leaders are declared to distribute the transaction data to the other members. There are issues which make public blockchain network inefficient to handle transactions; voting procedures, block generating intervals, and huge amount of databases to be kept by participants. Moreover, the proof of work verified by the randomized search process for nonce makes energy consumption extremely high.

Private blockchain network is simple to implement and manage the network. However, it is not transparent to all nodes: as in the centralized network it does not rely on anonymous nodes to validate the transactions and make blocks. That is, the network is under the control of the owner, not by anonymous users as in public networks. Owner of the network can alter the data.

2. Literature about blockchain applications adoption

First of all, most of the literature deals with the overview of the technology, representative cases such as Bitcoin, overview of the underlying mechanisms of the technology, future outlook. Moreover the technology is not mature yet, so the real implementations of the technology are rare, let alone killer applications like from Google or Facebook. (For example, see Lee, 2017). Related literature deals mostly with blockchain types and characteristics, implementation technology and outlook of the technology.

From the news articles, Cho(2018) used text mining and semantic network analysis techniques to find out the differences in the keywords related with blockchain among the areas of finance, energy, and logistics.

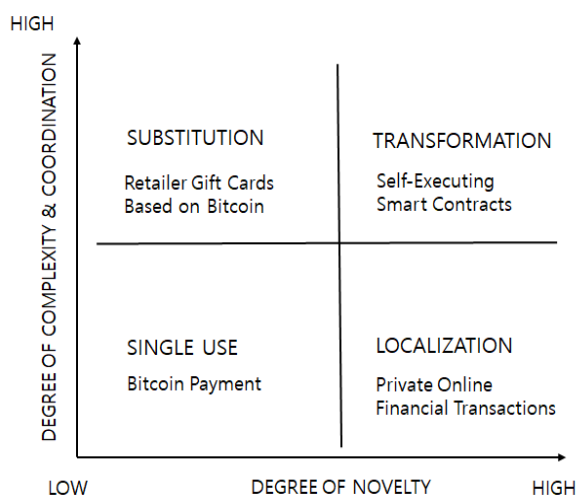
Catalini et al.(2018) states the main thrust of adopting blockchain technology is the economics value of blockchain applications. Economic costs are associated with the cost of verification and the cost of networking. By introducing blockchain applications, if the cost for verifying the attributes of a transaction is low and if the cost for operating the marketplace without the centralized intermediary is lower than the networking cost under centralized one, the blockchain innovation will be successful and worth to adopt it.

The intrinsic nature of P2P of blockchain goes back to Napster model where participants were able to share music files between two parties without any intermediaries. However,

the Napster model was not the real P2P system since without the centralized music database, the whole music sharing network does not have any supporting mechanism to hold the network.

Disintermediation of the market becomes possible due to the distributed transparent ledger through the participants of the market place. The benefits, such as trust, security, and transparency of the transactions derived from the disintermediation, need to be bigger than the management cost of distributed records throughout the network.

Iansiti et al.(2017) compared blockchain to the foundational telecommunication technology, TCP/IP, upon which diverse telecommunication applications to deliver values to users. TCP deals with the foundational technology to provide end-to-end delivery of packets and IP is responsible to route the packets through routers which are the interconnecting entities of networks. Thus, TCP relies on the service of IP. In the similar way, blockchain is the foundational technology to support transactions in reliable, immutable, secure, and fault tolerance ways. Thus, blockchain is contrasted with the traditional centralized TTP(Trusted Third Party) model of transaction processing, which gave way to many undesirable consequences of single point of data crash and unwanted data changes.



<Figure 1> Blockchain Application Framework by Iansiti et al.(2017)

The framework of <Figure 1> proposed by Iansiti et al.(2017) is useful to categorize blockchain applications. In fact, we utilize the framework in Section IV to understand the current status of blockchain applications in Korea. In Section V we modify the framework so that it can be used to guide practitioners for identifying blockchain applications appropriate

for their organizations.

The two dimensions in the framework of are: 1) the degree of complexity and coordination in terms of the number of stakeholders involved.

If the degree of complexity and coordination is high, it is more difficult to coordinate diverse parties to produce value by using blockchain. 2) the degree of novelty of the business problems to be solved: if the novelty is high, users are difficult to understand what and how the blockchain will solve problems. The denomination of the four cells in the framework are: 1) The “single use” cell with low complexity and low novelty. The example give by the authors is Bitcoin since the payment transaction has been existing for long and it involves transactions between individuals, and the required coordination and complexity is very limited. The Bitcoin transactions were limited in the black market for the payment of ransomware attack. Cloud services from Amazon or Microsoft are available as BaaS(Blockchain as a Service) to be experimented by a single organization to manage physical or digital assets, to record internal transactions, or to verify identities. 2) The call “localization” is characterized as low complexity, but high novelty. Many applications of supply chains such as food, diamond, or meat are good examples of this category. Permission or consortium based blockchain networks are used to solve local problems efficiently without involving the difficulty of maintaining the public network. 3) The cell of “substitution” refers to the high complexity and coordination difficulty but low novelty. The representative example is Bitcoin payment adopted in the general transactions, since it requires social and legal consensus for adopting technology. The major difference between “substitution” and “localization” is the environment where the application is implemented: “Substitution” is applied to the general public, whereas “localization” is applied to a set of selected parties for the application. 4) The cell “transformation“ involves the high level of complexity and coordination among the public participants since the application needs to be implemented across many organizations or stakeholders to produce values, but it requires a high level of novelty. A large scale public identity systems like passport can be grouped in this category(Iansiti, 2017). Possible introduction of “transformation” blockchain technology is to the application into the sharing economy models such as Airbnb and Uber. Moreover digital asset markets such as media contents and deals with the involvement of general public will be an attractive transformation application area.

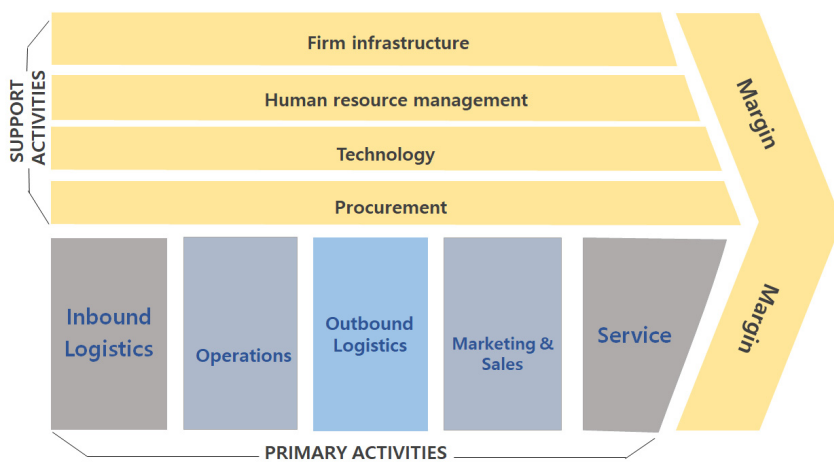
It is noted that “single use” and “localization” applications are located in the private blockchain domain, where we do not need to worry about the trust issues since only the permissioned members are invited in the network, making the network management much easier and efficient. However, for “substitution” and “transformation” are placed in the public blockchain domain, where the network is trust-free so that strong consensus and mining process rule should be introduced.

The framework is useful to categorize

blockchain applications into each group so that how to develop applications and how much efforts needed to adopt and make the applications work in the real situations.

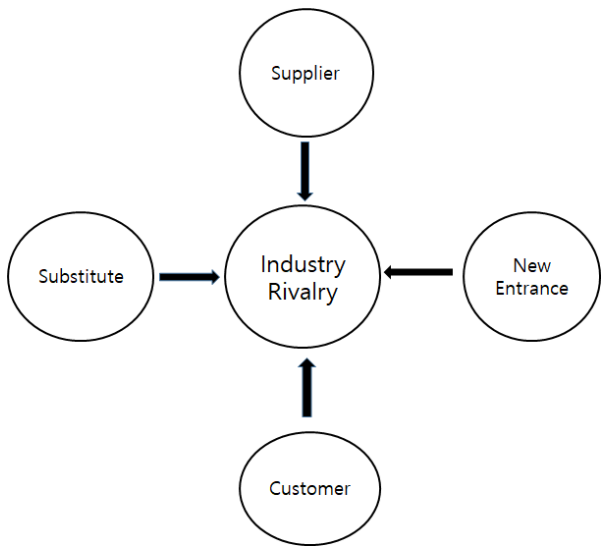
In Porter et al.(1985), information technology (IT) can be utilized to promote the value accrued, thus making the company competitive in the market. However, from the value chain perspective, trust issues of information such as authenticity, sustainability, and integrity is not considered.

To investigate the applicability of IT in organizations, Porter et al.(1985) proposed that value chain(Refer to Figure 2) is a good media to locate the areas where value can be increased by utilizing IT. In specific, the value chain can be divided into two: primary and supporting activities. Primary activities include incoming logistics, production, outgoing logistics, marketing and sales, and customer services. Supporting activities covers procurement, R&D, human resources management, and infrastructure management.



<Figure 2> Value chain by Porter(Source: en.wikipedia.org/wiki/Value_chain)

For the analysis of an organization's strengths and weaknesses, Porter argued that the five forces model (Porter, 1979) including competitive rivalry, supplier power, buyer power, threat of substitution, and threat of new entrance would be useful. Especially the model was extensively used how the Internet technology can be used to lower the power of the competitive rivalry, supplier power, and buyer power, while raising the threat of substitution and new entrances. The five competitive forces model is given in <Figure 3>. In the similar way, we believe that the model can be used to find opportunities under blockchain technology applications.



<Figure 3> Five Forces Model

Ⅲ. Data

For the analysis of blockchain applications, we used peer reviewed academic articles registered in the KCI(Korean Citation Index). The search on the database of KCI (www.kci.go.kr) was done in January, 2019. To obtain the sample of blockchain related articles, we used keyword filtering method.

The sample for this study was filtered out by the following procedure. Using the word “blockchain”, we filtered all the articles in two ways: First we searched the titles of the articles, since the title usually conveys the most significant meaning of the whole articles. And second, we performed search on the keywords provided by the author(s). In most of the academic journals, a set of keywords in both Korean and English is required to describe the contents of the articles. However, we did not search on the abstract since we found the resulting articles are too general to interpret them as blockchain related research.

The titles and author provided keywords were searched with the disjoint condition of “or”. All the articles were filtered if there exist word “blockchain” in the title, or in the keywords, or “block chain“ in keywords. To minimize the omission, both Korean and English keyword search were performed simultaneously. With the conditional filtering, we obtained a total of 250 articles.

Even with the restricted search on KCI database, we found the articles dealing with blockchain applications which we are interested in are few; we still found most of the papers introducing blockchain in passing or trivially, not touching the detailed issue of applications.

Ⅳ. Categorization of KCI articles on blockchain

In this section we analyze the filtered result obtained in Section Ⅲ. Based on the set of 250 articles, we first provide basic descriptive statistics, and second we categorize the sample of articles according to the framework in <Figure 1>.

For the general characteristics of the sample, the distribution of searched articles by year is given in <Table 2>. As expected, the research on blockchain began recently, only 4 years old. The number of publications by year is increasing dramatically in 2018, about 7 times of the number in 2017.

Usually, academic journals represent specific research domains. Thus, categorizing journals publishing blockchain research provides us with the idea of research activities in different domains. The distribution by academic discipline is given in <Table 3>.

Law tops the list, 55, followed by Computer related discipline. Unlike the expectation, management area is not active, trailed by legal and technical disciplines. This means that the lifecycle of the blockchain technology is in the early stage, and it also indicates that in the organization it is not accepted much.

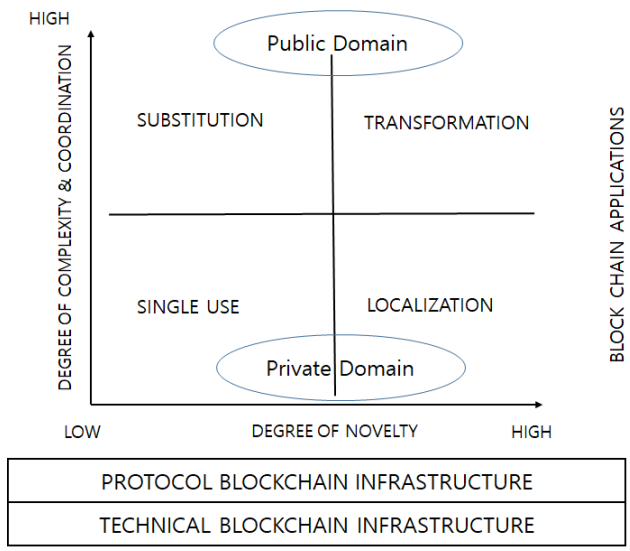
<Table 2> Distribution of articles by year

Year	Number of articles
2014	4
2015	1
2016	6
2017	36
2018	203
Total	250

<Table 3> Distribution of articles by discipline

Discipline	Number of articles
Law	55
Computer	38
Electronics/Telecommunications	33
Management	32
Interdisciplinary	22
International Trade	15
Science & Technology	15
Finance	5
Tourism	2
Others disciplines	32
Total	250

For the categorization of the articles, we again utilize the framework in <Figure 1> and modify it by adding "Protocol Blockchain Infrastructure" and "Technical Blockchain Infrastructure" which are the required services to support the four types of applications. "Protocol Blockchain Infrastructure" refers to the protocol related issues such as legal, consensus, or voting. "Technical Blockchain Infrastructure" deals with such issues as platform technology, encryption, authentication, or security. The modified framework is depicted in <Figure 4>.



<Figure 4> Categorization framework of blockchain articles

Based on <Figure 4> we categorize the filtered blockchain research articles into the original four cells, two infrastructure related cells, and "Others". Articles are grouped into "Others", if they provide just overview of blockchain as a new technology, current status, or research popularity in general, without detailed research in applications.

Judgment of mapping an article into a cell is made by the author: First if the title conveys the meaning of appropriate cell, the article is assigned to that cell. Otherwise, the author examined the abstract of the article and further to the full text until the assignment becomes satisfactory.

In <Table 4> the filtered set of articles are categorized according to the cells in <Figure 4>.

<Table 4> Distribution of articles assigned to framework in <Figure 4>

Cell	Number of articles
“transformation”	8
“substitution”	5
“localization”	26
“single use”	1
Protocol Infrastructure	18
Technical Infrastructure	9
Others	183
Total	250

From the review of the filtered articles, the author found that most of the articles deal with unrelated issues such as general introduction of blockchain technology in the context of 4th industrial revolution, privacy issues, specific technical aspects such as security protection, cryptocurrency, taxation, legal issues, and general trend of blockchain. This phenomenon indicates that the generalizability of the analysis might not be strongly supported due to the small sample size of the relevant articles. These papers are exclude from the analysis. Among the relevant application set, “localization” applications on private blockchain domain are dominating in the list, followed by “transformation” applications. The number of articles on infrastructure is 27.

For each of the four application cells in <Figure 4>, we provide the detailed characteristics of the applications from <Table 5> to <Table 7> so that practitioners understand what applications are possibly implemented in the organizations.

<Table 5> “transformation” Application area

Application Applied	Domain
Blockchain application into power grid	Energy
Real estate registry	Real estate
Donation management system	Charity
Blockchain application in music industry	Digital contents management
Blockchain application for reliable real estate transaction	Real estate
Copyright management of music	Digital contents management
Public opinion survey	Voting
Blockchain usage for art article transaction	Art transaction

For the public domain blockchain applications, protection of the assets from being used illegally and fraud is the major motivations of blockchain applications in “transformation” cell.

For “substitution”, large scale information systems have been used to encompass the public. But the level of novelty is low, replacing the current information systems.

In private domain but novelty added applications in “localization”, logistics and finance are most conspicuous. Logistics, part of supply chain, by the urgent needs from the customers is mature stage of adopting blockchain applications. The characteristics of applications require a consortium of participating organizations to implement blockchain applications.

<Table 6> “substitution” Application area

Application Applied	Domain
Blockchain application into tourism information systems	Tourism
Distributed energy transaction system	Energy
Second handed product transaction	Used goods market
Bicycle registration system	Vehicle management
Pet registration system	Animal registration

<Table 7> “localization” Application area

Application Applied	Domain
Four articles dealing with Fintech	Finance
Innovation in financial institute	Finance
Blockchain application for bill of lading	International Trade
Six articles on blockchain application for logistics	Logistics
Driving recording system	Public transportation

For “single use”, voting based on the blockchain technology was applied in private domain replacing the current voting system.

V. Guideline for identifying blockchain applications

In this section we suggest a guideline which we believe would be useful for practitioners to identify which blockchain technology and where to apply the technology in their organizations. We suggest four approaches: First, the benchmark, derived from the Iansiti et al. (2017). Second, based on the innovation and diffusion theory, suggested by Dobrovnik et al.(2018). Third, we use the value chain approach pioneered by Porter. Fourth, Five forces model by Porter is used.

1. Benchmark

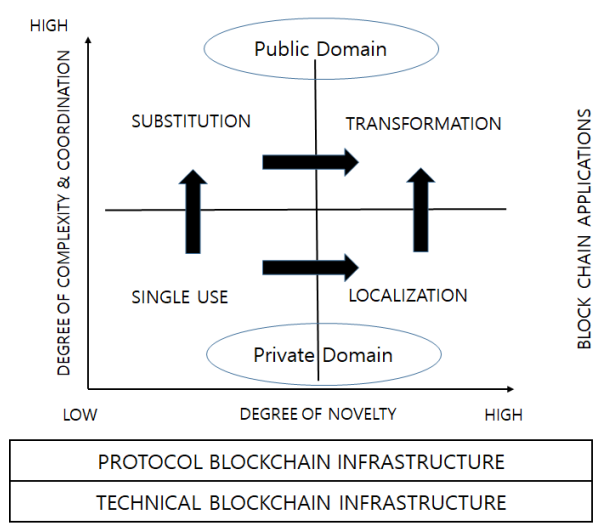
Based on the framework of applications, we categorized the blockchain research articles into the four cells in Section IV. The practitioners can use the applications as benchmark to check the feasibility in their organizations.

Theoretically, we can claim that the ideal blockchain application is determined by the levels of two dimensions such as degrees of novelty and complexity & coordination. This relationship can be described in a functional form as in <Table 8>.

<Table 8> Blockchain application determination model

competitiveness of blockchain application = f (novelty, complexity & coordination)

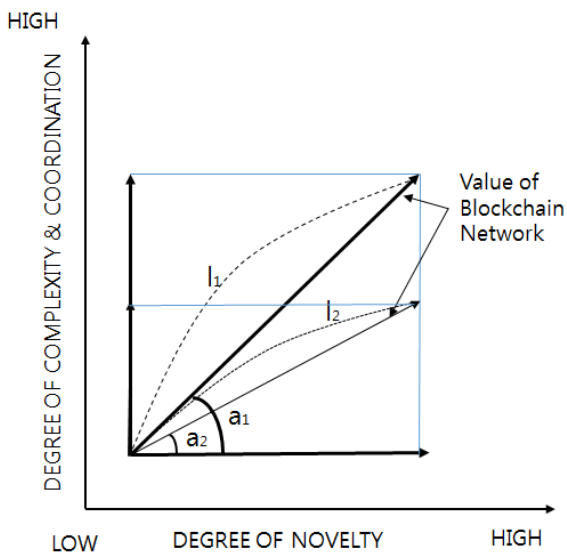
In <Table 8> we have two independent variables such as novelty and complexity & coordination, which are determined or controlled by the capability of an organization, while the dependent variable refers to the resulting effect of the blockchain application. The effect can be measured by competitiveness of the business model, or distinctiveness of the application so that competitors can not copy it easily. Thus, the model implies that organizations need to maximize the level of the competitiveness of blockchain application by controlling the two dimensions, which is categorized as the strategic decisions. In addition, they can develop evolutionary paths of adopting blockchain applications as in <Figure 5>.



<Figure 5> Evolutionary paths of application adoption

The possible evolutionary paths that we can draw are: 1) from private to public like “single use” to “substitution” or “localization” to “transformation”; 2) by increasing the novelty from :single use“ to ”localization“ or from ”substitution“ to ”transformation“. Theoretically applications in”transformation“ cell is considered to be as ideal and most matured. Thus organizations need to develop capability to reach the stage.

Additional usage of the framework in <Figure 5> is to measure the value of blockchain applications as in <Figure 6>. In the similar vein as in <Table 8>, a blockchain application can be decomposed into two composite characteristics.



<Figure 6> Value accrued from blockchain application adoption

Y-axis refers to the network effect and X-axis refers to the novelty of business model to meet the market demands. The diagonal vector is resulted by adding the two vectors of X-axis and Y-axis and it becomes the value of the blockchain network. We have two applications described in <Figure 6>: Two applications are the same in terms of novelty domain, but they are different in network effect domain, and the value of the blockchain denoted by diagonal vector l_1 dominates vector l_2. Thus, in <Figure 6> the value of the application can be described as the length of a vector (l_1, l_2) and direction or angle (a_1, a_2). Thus, the angle and the length are the strategic control variables of an organization: To produce a certain level of value from the blockchain application, an organization can control the angle which is formed by the degree of novelty and network coordination.

2. Demand pull based technology acceptance

For the adoption of new technology, we have two strategies: technology push and demand pull(Zmud, 1984, Chau et al., 2000) In the previous section, the identification of blockchain applications is based on technology push, where organizations adopt the new technology in the market simply due to the attractiveness of technology such as efficiency and effectiveness. On the other hand, organizations need to search for new technology desperately to satisfy the needs of organizations, for example, imperative to innovate the current system.

Blockchain technology can be considered as an innovation, If it is to be adopted and to be diffused in the organization, the technology should be attractive to promote the level of attributes which are significant to innovation. In this sense, Dobrovnik et al.(2018) point out five innovation attributes such as relative advantage, compatibility, complexity, trialability, and observability.

Blockchain as business innovation and the attributes promoting innovation can be used in two ways: First, if the attributes of a blockchain application are considered high as a whole, then the likelihood of blockchain adoption and diffusion will be high, compared to the others. For example, if the relative advantage is considered to be big, the innovation is accepted more readily. Second, we can search for the areas where these attributes score high, then the area or domain can be the place where blockchain can be introduced. For example, data integrity and data availability are the important issues in the organization, then blockchain technology can ensure the objectives, and thus blockchain technology can be implemented in that area.

3. Value chain & five competitive forces model

Based on the value chain model, the most prominent area of blockchain application in the primary activities is the logistics networks with participating partners by providing the traceability of the raw materials and parts. In the supporting activities, human resources recruitment can be effective by exploiting job candidate blockchain network.

Likewise, blockchain in supply chain is easily identified for the possible application through value chain model. At present, there is no transparency in the transaction since customers do not know the real value of products: provenance of the products or any illegal or unethical practices (Forbes, 2018) onto the products among the intermediate parties involved during the transit of the product. Also the current system is inefficient to get appropriate logistics information since many information systems should be traversed through the system to collect all the information.

One example of the supply chain is in diamond industry. According to Forbes (2018), De Beers uses blockchain technology to trace the whole supply chain of diamond; from the

mining raw stones, cutting, and to the delivering the finished product to the customers, so that so called blood diamonds are not dealt with and the consumers can make sure the purchased diamond is the real one. Thus, blockchain can ensure the integrity and reliability in a supply chain.

The five forces model which is useful to measure the competitiveness of an organization, relative to the other players in the market can provide insights where to deploy blockchain technology for the advantages of an organization. For example, private logistics blockchain networks can be used to level off the threats of supplier and buyer and to provide better quality of the product by the transparent providence of the parts and supplier information.

Ⅵ. Limitations and conclusion

In view of the immature stage of blockchain technology lifecycle, few killer applications exist. This might cause a delayed adoption of blockchain applications. However, to gain competitive advantage, organizations need to be prepared for the future and the practitioners should be able to identify the feasible blockchain applications for their organizations.

The main objective of this paper is to provide a guideline fill the gap.

A natural guideline derived from the modified framework of <Figure 4> is to start from private domain and less risky domain. From this point we can expand the application into the public domain and to increase novelty to enhance our business models. The other three approaches such as innovation and diffusion theory based, value chain theory based, and five forces model based would provide practical guidelines to the managers in charge.

Subject judgment of mapping an article into a cell is made by the author, which makes the justification of the article assignment in question. A committee of reviewers can be utilized to make the decision in the future research.

As indicated in Section IV, due to the small number of application research articles out of 250 filtered set, the generalizability of the analysis might not be strongly supported. In addition, the number of applications identified from the academic articles published in Korea is not enough to claim that they represent a sample in the market. Since IT market is global in nature and there is no clear boundary of organizations between local and global, there is no reason that the sample should be limited to the local cases. In the future, the sample needs to incorporate the global cases too.

References

1. Catalini, C. and Gans, J.(2018), “Some simple economics of the blockchain,” *National Working Paper*, No. 22952, Bureau of Economic Research.

2. Chau, P. and Tam, K.(2000), “Organizational adoption of open systems: a technology-push, need-pull perspective,” *Information & Management*, 37, 229-239.
3. Cho, S. H.(2018), “A Study on Analysis of the Trend of Blockchain by Key Words Network Analysis,” *Journal of Korea institute of information, electronics, and communication technology*, 11(5), 550-555.
4. Dobrovnik, M., Herold, D., Furst, E., and Kummar, S.(2018), “Blickchain for and in Logistics: What to Adopt and Where to Start,” *Logistics*, 2(18).
5. Forbes(2018), “Dangers of centralized systems, lack of trust becomes the issue,” https://www.forbes.com/sites/bernardmarr/2018/03/23/how-blockchain-will-transform-the-supply-chain-and-logistics-industry/#10cc1dc05fec.
6. Iansiti, M. & Lakhaki, K.(2017), “The Truth about Blockchain,” *Harvard Business Review*, Jan-Feb, 119-127.
7. Lee, J. K.(2017), “An Exploratory Case Study of Distributed Ledger Processing Using IBM Bluemix Blockchain,” *Korean Computers and Accounting Review*, 15(1), 25-38.
8. Nakamoto, S.(2008), Bitcoin: A Peer-to-Peer Electronic Cash System.
9. Porter, M.(1979), “How competitive forces shape strategy,” *Harvard Business Review*, 57(2), 137-145.
10. Porter, M. and Millar, V.(1985), “How information gives you competitive advantage,” *Harvard Business Review*, 63(4), 149-160.
11. Tapscott, D. & Tapscott, A.(2017), “How Blockchain Will Change Organizations,” 52(2), *Sloan Management Review*, 9-13.
12. Zheng, Z., Xie, S., Dai, H., & Chen, X.(2018), “Blockchain challenges and opportunities: A survey,” *International Journal of Web and Grid Services*, 14(4), 352-375.
13. Zmud, R.(1984), “An examination of push-pull theory applied to process innovation in knowledge work,” *Management Science*, 30(6), 727-738.

요 약

기업에서 요구되는 블록체인 애플리케이션 탐색을 위한 가이드라인†

남수현*

블록체인은 인공지능, 빅데이터, 사물인터넷 등과 더불어 혁신적인 기술로 간주된다. 최초의 블록체인 애플리케이션이고 암호화폐인 비트코인 출시 이래로, 블록체인은 파괴적 기술로의 인식은 물론 폭넓게 확산되지도 못하고 있다. 블록체인 관련 연구를 살펴보면, 암호화폐, 기술 일반동향과 전망, 요소기술 등에 대한 설명이 대부분이다. 물론 아직까지 블록체인 기반의 킬러 애플리케이션이 존재하지 않고 있다. 이와 같이 늦게 확산되는 블록체인 기술을 고려하여, 국내의 블록체인에 대한 최신 연구 상황에 대한 이해가 필요하다. 본 연구의 목적은 기업의 IT실무 담당자들이 조직의 경쟁력을 높이기 위해서 필요한 블록체인 애플리케이션을 식별할 수 있도록 가이드라인을 제공하는 것이다. 이를 위해서 우리는 네 가지의 접근법을 소개한다. 첫째, Iansiti & Lakhaki(2017)가 제안한 분석틀을 적용하여 국내에서 발간된 블록체인 관련 연구논문을 분류하였다. 이 작업의 목적은 조직의 실무자들이 블록체인 애플리케이션의 도입을 고려할 때 벤치마크 또는 사례로서 활용할 수 있도록 도움을 주기 위함이다. 두 번째는 제시된 분석틀을 이용하여 블록체인 애플리케이션의 가치 개념을 도입하여 조직의 블록체인 애플리케이션 채택의 진화적 경로를 제안하였다. 세 번째는, 블록체인 기술 도입을 조직의 혁신을 촉진하기 위한 수요관점에서블록체인 기술 적용이 가능한 영역을 식별할 수 있는 근거를 제공하였다. 네 번째는 기업 가치사슬 모형과 다섯 경쟁세력 모형을 이용하여 블록체인 애플리케이션 도입의 탐색할 수 있는 근거를 제공하였다.

핵심주제어: 블록체인, 혁신, 탈중앙화, 가치사슬, 경쟁력, 스마트 계약, 동의

† 본 연구는 2018년도 한남대학교 교비연구비의 지원으로 수행되었음.
* 한남대학교 글로벌IT경영전공 교수, namn@hnu.kr