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Korea Regional Technology
& Innovation Lab

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EMERGING TECHNOLOGIES CURATION SERIES

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Issue #1:
Korea Blockchain Ecosystem



WORLD BANK GROUP
Information and Technology Solutions



ACKNOWLEDGEMENTS

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Acronyms

BAAS	Blockchain as a Service
CDN	Content Delivery Network
DAPA	Defense Acquisition Program Administration
DAG	Directed Acyclic Graph
DPoS	Dual Delegated Proof of Stake
DID	Decentralized Identity
DLT	Distributed Ledger Technology
FSC	The Korean Financial Services Commission
HACCP	Hazard Analysis Critical Control Points
ISP	Information Strategy Plan
IoT	Internet of Things
ITSTI	Information & Technology Solutions Technology & Innovation Lab / Unit
KCS	Korea Customs Service
KFTC	Korea Financial Telecommunications and Clearings Institute
KISA	The Korea Internet Security Agency
KRW	South Korean Won
MIST	Ministry of Science and ICT (Information and Communications Technology)
PCFIR	Presidential Committee on the Fourth Industrial Revolution
NIPA	National IT Industry Promotion Agency
ROK	Republic of Korea (South Korea)
SDGs	Sustainable Development Goals
Telecoms	Telecommunication companies
WBG	World Bank Group

ABSTRACT

Emerging Technology Curation Series aims to capture and share Korea experience and lessons learned in regards to exploration and adoption of emerging technologies like blockchain, AI, Edge-computing, IoT, 5G, etc.

Korea Blockchain Ecosystem is the first of the series and provides a short description of the blockchain technology and its potential for solving development challenges and key highlights of the Korea Blockchain Ecosystem. The Korea Blockchain Ecosystem note is a collaboration effort of the WB Korea Country Office, ITS Technology & Innovation, Digital Development (DD) Global Practice, and Finance, Competitiveness & Innovation (FCI) Global Practice.

I.

ABC OF BLOCKCHAIN TECHNOLOGY

I. ABC of Blockchain Technology

Blockchain is a decentralized technology, which facilitates collaboration and exchange of transactional data and information among and across different players, industries, sectors and countries in a secure and transparent way.

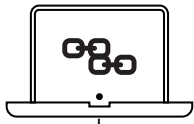
Blockchain creates an immutable chronological record and provides a verifiable audit trail of information on the shared ledger. Blockchain technology is one type of Distributed Ledger Technology (DLT) or a database ledger that can register blocks of cryptographically secure, tamper-proof data with members of a network or shared ledger. It is not a completely new technology but a “particular orchestration of three technologies, the internet, public key cryptography and a protocol governing incentivization” aim to build a secure system of digital interactions without the need of a trusted third party. The coming together of these three technologies, has unlocked new possible technology features such a timestamping, trust, openness and transparency, which are built into the blockchain design, with benefits that are wide-ranging and impact multiple SDGs.

Blockchain creates trust through cryptographic operation by allowing parties to securely exchange value without the use of an intermediary. Blockchain technology has other capabilities and features such as tokenization, smart contracts, wallets, which could enable multiplicative advantages and benefits. The combination of these various capabilities like *smart contracts, tokenization and digital wallets* can bring transparency, disintermediation where needed, and could provide foundational components for the platforms, which will power and support the digital economy of future.

There are technology tradeoffs associated with the choice of design for the core blockchain ledger such as permissioned or permission-less networks. Such distributed blockchain protocols like that of bitcoin, Ethereum, etc. are open decentralized permissionless networks where anyone can participate in the consensus mechanism of the shared ledger while permissioned networks allow entities to collaborate and form closed decentralized networks, allowing only authorized entities to participate. One such tradeoff is the acceptable risk in the form of trusted parties authorized in a permissioned network vs the complexity and risk associated with permissionless networks. Depending on the functional need of organizations, institutions and corresponding requirements for privacy and security, clarity on governance, scalability issues, majority of the exploration and experimentation effort by the governments and other organizations is taking place on permissioned distributed ledger technology systems. As the blockchain ecosystem matures, there might enable new approaches of re-engineering economic models and enabling the creation of markets and products that were previously unavailable or unprofitable across emerging markets¹.

1 For more information on applications, benefits, and limitations of Blockchain, please consult Blockchain research, practice and policy: Applications, benefits, limitations, emerging research themes and research agenda. <https://www.sciencedirect.com.libproxy-wb.imf.org/science/article/pii/S0268401219302014>

FIGURE 1.
Key Potential Features of Blockchain



BLOCKCHAIN: THE INTERNET OF VALUE



Near Real Time

Blockchain enables the real-time settlement of recorded transactions, removing friction and reducing risk.



No Intermediary

Blockchain technology is based on cryptographic proof instead of trust, allowing any two parties to transact with each other without the need for a trusted third party.



Distributed Ledger

The peer-to-peer distributed network records a public history of transactions. The blockchain is distributed and highly available. The blockchain does not typically preserve the identities of the parties or the transaction data, only the proof of the transaction existence.



Irreversibility & Immutability

The blockchain contains a certain and verifiable record of every single transaction ever made. This prevents past blocks from being altered and, in turn, stops double spending, fraud, abuse, and manipulation of transactions.



Smart Contracts

Stored procedures executed in a Blockchain to process pre-defined business steps and execute a commercially/legally enforceable transaction without involvement of an intermediary.

Source: Deloitte U.K.



II.

BLOCKCHAIN VALUE PROPOSITION FOR DEVELOPMENT AGENDA

II. Blockchain Value Proposition for Development Agenda

The world is witnessing a rapid transformation and is increasingly moving from analog to digital owing to technology-oriented reconfiguration of business models, institutions and service delivery infrastructures.

Blockchain and Distributed Ledger Technology, in convergence with other emerging and conventional technologies, fit in the broader scheme of foundational technologies, which have the potential to power the digital infrastructure for the Digital Public Service Delivery, Digital Economy, and Sustainable Development.

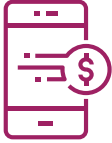
Data has become a key enabler for inclusive and sustainable development. A majority of products and service delivery models of present and future are based on availability of clean, verifiable and standardized data. Coordination among multiple stakeholders requires increased transparency, verifiability along with privacy and immutability of information. Blockchain and DLT based distributed technical architecture can help address some of the existing data immutability, transparency and coordination challenges, and create the foundational data management layer to support Sustainable and Inclusive Development efforts.



Blockchain technology can be leveraged to build the **foundational layer of government data infrastructure, platforms and registers** and bring enhanced capabilities of ‘a single source of truth’, resiliency, integrity and safety. **Blockchain-enabled government data infrastructure, platforms and registries** can facilitate secure reuse and sharing of data among both public and private entities, bring in innovation, efficiency and enhanced end user experience.



Blockchain and DLT technologies have the potential to help **governments architect and enable record-keeping, verification and traceability of goods and services, facilitate inclusive and transparent systems where multiple participants are involved, and reduce the potential operational costs.**



Blockchain technology can potentially create **new digital economy platforms, business models and services by introducing disintermediation, where needed, while addressing the “trust” challenge**. Digital Trust is a key driver of all interactions in the digital economy. In convergence with other emerging technologies, Blockchain could potentially change how data and value are structured and exchanged. Distributed ledger technology can be leveraged to build, operate and deliver secure and efficient digital identification and digital payments platforms and services.

III.

KOREA BLOCKCHAIN ECOSYSTEM

III. Korea Blockchain Ecosystem

1. GOVERNMENT INITIATIVES

Korea Government has been a leader in creating an enabling strategy, policy and investment environment to support the development of the blockchain technology ecosystem. Korea central and local government organizations have been leading efforts to explore and mainstream blockchain technology to enable innovation in government's operations, public service delivery and digital economy development.

1.1. Strategy, Policy and Public Investments in Blockchain Ecosystem Development

In 2020, **the Government of South Korea** announced plans for a multi-trillion won **'new deal'** stimulus package including the **'green new deal'** and the **'digital new deal'**. The "new deal" aims to tackle the Korean economic crisis triggered by COVID-19 while laying the "groundwork" for long-term prosperity.

- **The Bank of Korea:** In April 2020, the central **Bank of Korea**² launched pilot program on central bank digital currency (CBDC) to explore the issuance of its digital currency by 2021³.
- **The Financial Services Commission (FSC)**⁴: FSC is the financial sector regulatory body, has created a Financial Innovation Bureau that leads formulation of policy initiatives for financial innovation and fintech industry (including blockchain applications) as well as establishes policies on information security/data protection. In 2019, the **Financial Service Commission (FSC)** also launched the first financial regulatory sandbox where selected financial service providers (including those with blockchain applications) can test innovative financial services on the market (including those using blockchain technologies) under more flexible regulatory oversight during the trial period of up to four year.⁵

2 The Bank of Korea., "한국은행 (The Bank of Korea)." The Bank of Korea, www.bok.or.kr/portal/search/search.do.

3 Jung Min-kyung, "BOK to Virtually Test Distribution of Digital Currency next Year." The Korea Herald. October 07, 2020. Accessed December 04, 2020. <http://www.koreaherald.com/view.php?ud=20201007000809>.

4 Financial Services Commission. Financial Services Commission. Accessed January 25, 2021. <https://www.fsc.go.kr/eng/ab020101#orgPos11>.

5 "Fintech 2020." Fintech 2020- South Korea | Global Practice Guides | Chambers and Partners. Accessed December 03, 2020. <https://practiceguides.chambers.com/practice-guides/fintech-2020/south-korea/trends-and-developments>.

- **The Korea Internet Security Agency (KISA):** Since 2018, KISA has supported funds and implemented a blockchain pilot project with the Ministry of Science and Technology to create public services and spread the use of blockchain solutions.⁶
- **The Ministry of Science and ICT (MSIT):** MSIT announced the Blockchain Technology Development Strategy^{7,8} in 2018 to provide an enabling environment and over 230 billion KRW investment into blockchain initiatives by 2022.⁹ In June 2020, at the 16th general meeting of the Presidential Committee on the Fourth Industrial Revolution (PCFIR)¹⁰, the Ministry of Science and ICT (MSIT) announced the updated inter-ministerial Blockchain Technology Diffusion Strategy for a Hyper-connected and ‘uncontact’ Society with Trust.
- **The National IT Industry Promotion Agency (NIPA):** NIPA offers funding opportunities for blockchain startups or enterprise. They also provides consulting services and proof of Concept (PoC) for blockchain solutions.¹¹
- **The South Korean National Assembly:** The National Assembly passed legislations to adopt and develop blockchain technology services and applications¹².

1.2. Blockchain technologies for Public Service Delivery Innovation

Korea public sector entities, at the central and local levels, have been exploring and mainstreaming blockchain technology for public service delivery and digital economy innovation, as shown in Table 1.

-
- 6 KISA. 입찰공고 < 알림마당 : 한국인터넷진흥원. Accessed January 22, 2021. https://www.kisa.or.kr/notice/bid_View.jsp?mode=view&p_No=35&b_No=35&d_No=6995.
- 7 Embassy of the Republic of Korea in the United Kingdom of Great Britain and Northern Ireland. “ [Science]Korea Plans to Adopt Blockchain in Seven Sectors with a Goal to Promote Decentralized Identifiers (DIDs) (June 25) Economy & Science Embassy of the Republic of Korea in the United Kingdom of Great Britain and Northern Ireland. July 31, 2020. Accessed December 03, 2020. http://overseas.mofa.go.kr/gb-en/brd/m_8349/view.do?seq=761121&srchFr=&srchTo=&srchWord=&srchTp=&multi_itm_seq=0&itm_seq_1=0&itm_seq_2=0&company_cd=&company_nm=&page=1.
- 8 Ministry of Science and ICT. “Ministry of Science and ICT.” Press Releases- 과학기술정보통신부 >. Accessed January 22, 2021. <https://www.msit.go.kr/eng/bbs/view.do?sCode=eng&mid=4&mPid=2&pageIndex=&bbsSeqNo=42&nttSeqNo=441&searchOpt=ALL&searchTxt=blockchain>.
- 9 “South Korean Gov’t to Invest \$200 Mln in Blockchain Initiatives.” CryptoSlate. March 24, 2020. Accessed December 03, 2020. <https://cryptoslate.com/south-korean-govt-to-invest-200-mln-in-blockchain-initiatives/>.
- 10 Embassy of the Republic of Korea in the United Kingdom of Great Britain and Northern Ireland. “ [Science]Korea Plans to Adopt Blockchain in Seven Sectors with a Goal to Promote Decentralized Identifiers (DIDs) (June 25) Economy & Science Embassy of the Republic of Korea in the United Kingdom of Great Britain and Northern Ireland. July 31, 2020. Accessed December 03, 2020. http://overseas.mofa.go.kr/gb-en/brd/m_8349/view.do?seq=761121&srchFr=&srchTo=&srchWord=&srchTp=&multi_itm_seq=0&itm_seq_1=0&itm_seq_2=0&company_cd=&company_nm=&page=1.
- 11 The National IT Industry Promotion Agency (NIPA). 전체 사업 게시물 상세- 사업소개- 주요사업- 정보통신산업진흥원. Accessed January 22, 2021. <https://www.nipa.kr/main/selectBsnsVsnNttWebView.do?key=103&bsnsVsnNo=1&bsnsDtIslemNo=0&bsnsDtIslemNttNo=67&businesscode=business5&pageUnit=10&searchCnd=all&searchKwd=&pageIndex=15>.
- 12 Kevin Helms. “South Korea Passes Bill to Regulate Cryptocurrency in Line With FATF Standards: Regulation Bitcoin News.” Bitcoin News. March 22, 2020. Accessed December 04, 2020. <https://news.bitcoin.com/south-korea-bill-cryptocurrency/>

TABLE 1.
Blockchain Technologies Exploration/Pilot for Public Service Delivery Innovation

Year	Sector	Organisation	Project
2020	Agriculture	Rural Development Administration	The Rural Development Administration piloted blockchain-based crop production and logistics management
	Safety	National Police Agency (NPA)	NPA developed a blockchain-based digital evidence management platform to ensure the integrity of the digital evidence
	Social Safety Net	Ministry of Health and Welfare of South Korea	Ministry of Health and Welfare of South Korea constructed a blockchain-based welfare benefit management platform to prevent duplicate payments
	Food Safety	Ministry of Food and Drug Safety	Ministry of Food and Drug Safety established a blockchain-based food safety data platform
	Health	Gangwon Provincial Government	Gangwon-do provincial government created a blockchain-based integrated chronic disease management platform
	ID/Certificate	South Gyeongsang Province	The province Gyeongsang-do has built a local public service platform based on Decentralized Identity (DID)
	Transport	Sejong Special Self-Governing City	The city established Sejong City has created a blockchain-based platform for identification of autonomous vehicles
	Transport	Korea Expressway Corporation (KEC)	KEC piloted a blockchain-based toll settlement platform
	Environment	Jeju City	Jeju City established a battery life cycle management system for electric vehicles
	Environment	Busan Metropolitan City	Busan Metropolitan City piloted a blockchain-based water quality management system
2019	Tourism	North Jeolla Province	The province built a blockchain-based tourism design system.
	Contact	Defense Acquisition Program Administration (DAPA)	The DAPA announced that they will construct a blockchain-based proposal acceptance and evaluation system
	Food Safety	Ministry of Food and Drug Safety	Ministry of Food and Drug Safety developed a national HACCP(Hazard Analysis Critical Control Points) platform by applying blockchain technology
	Health	Seoul Medical Center	The Seoul Medical Center constructed blockchain-based medical service system
	ID/Certificate	Military Manpower Administration	The Military Manpower Administration provided blockchain based platform for civil petition services without certificates
	Disaster	Busan Metropolitan City	The Busan Metropolitan City piloted blockchain-based disaster response service
	Electronic Document	Korea Post	The Korea Post applied blockchain for their electronic mailbox

	Electronic Document	National Archives of Korea	The National Archives of Korea conducted a pilot project to build a blockchain-based records management platform
	Electronic Document	Seoul Metropolitan Government	The Seoul Metropolitan Government applied blockchain solutions for labour contract management and administrative activities
	Environment	Ministry of Environment	The Ministry of Environment built a blockchain-based carbon credit history management system
	Environment	Jeju City	The city conducted a pilot for waste battery management system for distribution
	Environment	Korea Southern Power	Korea Southern Power worked on blockchain-based management platform for renewable portfolio standards (RPS)
2018	Customs	Korea Customs Service (KCS)	The KCS launched blockchain-based personal customs clearance System which shares order and transport information by applying blockchain solution
	Livestock Management	Ministry of Agriculture, Food and Rural Affairs	Blockchain-based livestock product history management system was established
	Real Estate	Ministry of Land, Infrastructure and Transport (MLIT)	The MLIT piloted blockchain project for smart contract-based real estate trade platform
	Voting	National Election Commission	The National Election Commission created a blockchain-based online voting system
	Certificate	Ministry Of Foreign Affairs	The Ministry of Foreign Affairs has established a notarized issuance system for diplomatic missions abroad using blockchain
	Supply Chain	Ministry of Oceans and Fisheries	The Ministry of Oceans and Fisheries developed a block chain-based container carry-in/out certificate issuance service

Source: Lee (2018)¹³ and The Ministry of Culture, Sports and Tourism (2019,2020)^{14,15}

13 Lee, Duckhee. "[블록체인 2018] 대한민국 블록체인 공공사업 총정리." Bloter. December 25, 2018. Accessed January 22, 2021. <http://www.bloter.net/archives/326927>.

14 Ministry of Culture, Sports and Tourism. "2019년 블록체인 사업 통합설명회 개최(12.26)." 대한민국 정책브리핑. Accessed January 22, 2021. <https://www.korea.kr/news/pressReleaseView.do?newsId=156310140>.

15 Ministry of Culture, Sports and Tourism. "2020년도 블록체인 사업 통합설명회 개최." 대한민국 정책브리핑. Accessed January 22, 2021. https://www.korea.kr/news/pressReleaseView.do?newsId=156371458&call_from=naver_news.

2. PRIVATE SECTOR INITIATIVES

Korea Private Sector has been a driver in developing the blockchain technology ecosystem.

2.1. Enterprise Adoption and Digital Transformation

Korean largest corporations and start-ups have embarked on developing Blockchain Technology Protocols and Platforms to facilitate Enterprise adoption and Digital Transformation.

- **Blocko:** Blocko provides an enterprise blockchain solution. Blocko provides services to adopt blockchain solution on existing cloud or existing Information Technology system. They have developed an open source hybrid Blockchain Enterprise Platform 'AERGO' and launched a product called 'Coins Stack' based on a private blockchain. Blocko also collaborated with Bank of Korea, Samsung Card, Lotte Cards and the Korea Electronics and Telecommunications Research Institute to provide blockchain-based biometric user authentication, wallet management, transaction validation and micro-payment solutions.^{16,17}
- **Bloom Technology:** Developed the LOCUS CHAIN to break new grounds for the practical use of the blockchain system.¹⁸
- **Carry Protocol:** Carry Protocol aims to create an ecosystem where all consumers, stores, and advertisers can benefit, with a sustainable purchase data platform on the blockchain. Carry empowers consumers by giving them the control of their purchase data and its monetization, and enables businesses to send targeted ads to the right consumers using the shared data.¹⁹
- **CodeChain:** CodeChain is a blockchain platform specialized for tokenized assets where users can issue tokens and trade them in a regulatory compliant way. CodeChain provides the Asset Exchange Protocol, which facilitates low friction peer-to-peer exchange of assets on the CodeChain Network.²⁰
- **Haechi Labs:** Haechi Labs focuses on smart contract audits and provides security audits on blockchain companies. The Hachi Lab also developed their blockchain SaaS solution called Henesis.²¹
- **ICONLOOP (Icon foundation):** Iconloop introduced blockchain-based services: Blockchain DID service "ZZEUNG" based on independent DID (Decentralized ID) technology MyID Platform, blockchain-based certificate issuance service "broof", and blockchain visitor management service "VisitMe" with the vision to make a convenient, transparent, and trustworthy society.²²
- **Kakao:** Kakao developed Klaytn, a global public- and service-centric blockchain platform for businesses and developers.²³

16 BLOCKO. "Platform Player for Everyones Blockchain." BLOCKO. Accessed January 26, 2021. <https://en.blocko.io/>.

17 Jiyoon, Kim. "삼성 선택한 '블록체인 스타트업 4곳'...에 투자했다 살펴보니." 블록인프레스. April 25, 2019. Accessed December 03, 2020. <https://blockinpress.com/archives/16332>.

18 Bloom Technology. Accessed January 26, 2021. <https://www.bloomtechnology.co.kr/en/business>.

19 Carry protocol. Accessed Jan 26, 2021. <https://www.carryprotocol.io/about>.

20 Kwang Yul Seo. (2018). White paper title [CodeChain: an end-to-end asset tokenization system]. Retrieved from: https://codechain.io/CodeChain_white_paper_v0.1.0.pdf

21 HAECHI LABS. Accessed January 26, 2021. <https://haechi.io/en/>.

22 ICONLOOP. Accessed January 26, <https://www.iconloop.com/en/about-iconloop/>

23 Russell, J. (2018, March 06). Korean internet giant Kakao is launching a blockchain company. Retrieved January 26, 2021, from <https://techcrunch.com/2018/03/05/korean-internet-giant-kakao-is-launching-a-blockchain-company/>

- **LG CNS:** LG CNS introduced a number of blockchain projects through its blockchain platform Monachain, such as local currency service and product supply chain management, linked to local governments and universities, electric vehicles' battery history management and local gift certificate issuance.²⁴
- **Samsung SDS:** Samsung SDS partnered with the Seoul Metropolitan Government to establish an Information Strategy Plan (ISP) for Innovation and build a blockchain-enabled platform for the city of Seoul. Samsung SDS made an alliance with Syniverse (a communications solutions company) to develop a mobile payment platform that combines its blockchain platform Nexledger and Syniverse's blockchain solution Universal Commerce.

FIGURE 2.
Protocols and Platforms for Enterprise and Digital Transformation



2.2. Korea Blockchain Associations

- **Blockchain and Law Organization (BLO):** BLO was established in 2018 as a forum for various professionals to get together to study, research and discuss legal issues relevant to blockchain.
- **Korea Blockchain Association:** It was established in 2017 to maintain business rules among members, fair trade order of cryptocurrencies and build sustainable blockchain ecosystem. The Korea Blockchain Association aims to secure the growth engine of the 4th industrial revolution by strengthening the global competitiveness of the blockchain industry.
- **Korea Blockchain Enterprise Promotion Association (KBPEA):** KBPEA was has set up in 2018 to promote revitalizing the blockchain industry, enhancing blockchain technology, and advancing blockchain-related regulations.²⁵
- **Korea Blockchain Industry Association (KBCIA):** KBCIA advocates for policies, initiatives and projects to enable the mainstreaming of blockchain technology across other industries to improve the national competitiveness of Korea.²⁶

24 Moon-hee, Choi. "Major Korean Companies Disclose Ongoing Blockchain Projects." Businesskorea. October 02, 2019. Accessed December 04, 2020. <http://www.businesskorea.co.kr/news/articleView.html?idxno=36601>

25 "한국블록체인기업진흥협회-KBPEA-Korea Blockchain Enterprise Promotion Association." (사)한국블록체인기업진흥협회. Accessed December 07, 2020. <http://www.kbepa.kr/>.

26 Kbcia. "한국블록체인산업협회." (사)한국블록체인산업협회(KBCIA). Accessed December 07, 2020. <http://kbcia.or.kr/>.

- **Korea Blockchain Startup Association (KBSA):** KBSA brings together Korean blockchain and cryptocurrency startups. It has 170 Korean blockchain startups as members.²⁷
- **Korea Society of Blockchain:** Korea Society of Blockchain is an academic society which was established in 2016, focusing on development of global blockchain technology and academic research.²⁸

FIGURE 3.
Korea Blockchain Associations



2.3. Korea's Universities, Academia and Think Tanks Blockchain Research Agenda

Korean universities and think tanks conduct training program and research on the applications of blockchain technology capabilities and its impact on economy:

- **Dongkuk University:** Dongkuk University started new study on Fintech, blockchain, big data, and cloud computing.
- **Electronics and Telecommunications Research Institute (ETRI)** focuses on distributed trust data transaction technology, distributed self-sovereign identity information management, and the network traffic. The ETRI researches blockchain technology potential in enhancing security and shaping new business models based on tokenization of assets (money, real estate, physical, personal data, etc.).²⁹
- **Hanyang University:** Hanyang University built blockchain convergence major with the focus on blockchain business model analysis and blockchain technology.
- **Korea Advanced Institute of Science and Technology (KAIST):** KAIST has published papers about blockchain and provides courses for public and private institutions.³⁰
- **Korea Blockchain Institute (KBCI):** KBCI is a non-profit foundation which focuses on blockchain research and provides educational courses.³¹
- **Korea University:** Korea University Partnered with KEB Hana Bank to develop blockchain-based data sharing and financial services.

27 "협회소개," KBSA, www.kbsa.kr/greeting.
 28 한국블록체인학회. "한국블록체인학회." Ksblockchain.or.kr. Accessed December 07, 2020. <http://www.ksblockchain.or.kr/home/>.
 29 "제2의 인터넷을 꿈꾸는 4차 산업혁명의 핵심인프라, 블록체인." ETRI Webzine VOL.127_Interview. Accessed December 03, 2020. <https://www.etri.re.kr/webzine/20190329/sub02.html>.
 30 "KAIST-SysSec- Publications." SysSec. Accessed March 10, 2021. <https://www.syssec.kr/publications>.
 31 "한국블록체인연구교육원." Wtbi.or.kr. Accessed December 07, 2020. <http://www.wtbi.or.kr/main/>.

- **Science & Technology Policy Institute (STEPI):** The Office of Future Industry Research of STEPI researches on blockchain technology fundamentals and its applications, to inform future policy directions for financial sector, logistics and distribution, as well as public and administrative services.
- **Seoul National University (SNU):** SNU initiated the Blockchain Technology and Decentralized Application Practice Project Course in 2020 with the participation of students, professors, companies, and other blockchain experts. SNU also signed an industry-academic cooperation business agreement with Hanwha Life Insurance in 2020. By collaborating with the Global Engineering Education Center and Blockchain Professional Association Decipher at the Seoul National University, they will develop blockchain based projects and education courses to Hanwha Life Insurance staffs.³²

FIGURE 4.
Korea Universities, Academia, and Think Tanks Blockchain Research



2.4. Blockchain Technology Adoption by Sector

2.4.1. Energy, Infrastructure and Smart City

- **DoubleChain:** DoubleChain provides blockchain-based software, which includes IoT security solutions, consensus algorithms, virtual account platforms, and security authentication systems.³³
- **Hyundai BS&C:** Hyundai BS&C announced the launch of Hdac blockchain main net, which will integrate with the Internet of Things (IoT) ecosystem and create blockchain-based data management processes.³⁴
- **Korea Electric Power Corporation(KEPKO):** KEPKO announced that they will establish a blockchain-powered system for transacting renewable energy certificates.³⁵
- **WeHome:** WeHome provides blockchain based home-sharing platform. Guests and Host can book and manage their property by using their token.³⁶

32 Ryu, Young Sang. “한화생명, 서울대와 블록체인 협업키로.” 매일경제. September 23, 2020. Accessed December 04, 2020. <https://www.mk.co.kr/news/economy/view/2020/09/980723/>

33 DoubleChain. “블록체인 기술 전문 - 더블체인.” Accessed December 07, 2020. <http://www.doublechain.co.kr/>.

34 Moon-hee, Choi. “Major Korean Companies Disclose Ongoing Blockchain Projects.” Businesskorea. October 02, 2019. Accessed December 04, 2020. <http://www.businesskorea.co.kr/news/articleView.html?idxno=36601>

35 KDI. “블록체인으로 이웃 간 전력거래 한다: 경제정책자료: KDI 경제정보센터.” 블록체인으로 이웃 간 전력거래 한다 | 경제정책자료. Accessed January 26, 2021. <https://eiec.kdi.re.kr/policy/materialView.do?num=171698>.

36 Wehome. Wehome. Accessed January 26, 2021. <http://wehome.foundation/en/>.

FIGURE 5.
Energy, Infrastructure, and Smart City



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2.4.2. Health, Traceability and Supply Chain

- **BlockOdyssey:** BlockOdyssey develops and maintains authenticity service and distribution management system through blockchain technology. BlockOdyssey’s solution ‘Scanus’ checks the authenticity of manufactured goods through blockchain-based logistics and distribution history management. Each good is given a unique identification value, and is linked to the blockchain through the electronic signature QR code.³⁷
- **ICONLOOP:** ICONLOOP partnered with the Jeju Special Self-Governing Province to introduce infectious disease prevention system to fight against COVID-19. The contact tracing system is serviced through ICONLOOP’s Decentralized Identity (‘DID’) blockchain technology and their mobile application.³⁸
- **KL Net:** KL Net is a logistic related information technology (IT) company, which developed a blockchain-based container dock-to-portable issuance system (digital logistics platform). They focus on exchanging document between companies and government agencies based on the electronic document relay service (EDI).³⁹
- **Medibloc:** Medibloc developed a blockchain-based health information platform that integrates and assemble patients’ medical information in real-time.⁴⁰
- **m2cloud:** M2cloud focuses on SCM and immunization management and selected by Korea Disease Control and Prevention Agency for the COVID-19 vaccine distribution management system construction and operation project’
- **NDS:** NDS provides a livestock product history management system based on a private blockchain. It helps to track the history and distribution of agricultural and livestock products, food materials, and processed foods.⁴¹ NDS also plans to develop a medical information platform that can safely integrate and utilize sensitive personal medical data by applying blockchain-based distributed identification (DID).⁴²

37 제2회 글로벌혁신성장포럼. Accessed December 07, 2020. <https://eng.gigf.kr/niabbs5/bbs.php?bbstable=engupche&category11=39>.

38 ICONLOOP: “South Korea’s Jeju Island Selects ICONLOOP Blockchain Technology for Private, Secure COVID-19 Contact Tracing.” Globenewswire News Room. August 19, 2020. Accessed December 04, 2020. <https://www.globenewswire.com/news-release/2020/08/19/2080612/0/en/South-Korea-s-Jeju-Island-Selects-ICONLOOP-Blockchain-Technology-for-Private-Secure-COVID-19-Contact-Tracing.html>.

39 “Kyungwon Kook, 케이윌넷 강범구 대표에게 묻다.” 쉬퍼저널. Accessed December 07, 2020. <http://www.shippersjournal.com/mobile/article.html?no=26335>.

40 Medibloc. “Medibloc.” 메디블록, 의료정보의 무한한 가능성을 열어보세요. Accessed January 26, 2021. <https://medibloc.org/en>.

41 Gunhan Lee, KT-NDS, 블록체인으로 식품 유통 신뢰성 개선한다.” 테크월드뉴스. July 19, 2019. Accessed December 07, 2020. <http://www.epnc.co.kr/news/articleView.html?idxno=91302>.

42 “NDS, 블록체인 활용 의료 마이데이터 실증서비스 사업자 선정.” 디지털데일리. Accessed December 07, 2020. http://m.ddaily.co.kr/m/m_article/?no=197356.

- **Samsung Electronics (Samsung Health):** Samsung Electronics announced to apply blockchain technology to Samsung Health (Health Mobile application).⁴³
- **TEMCO:** TEMCO applies blockchain technology and smart contract to develop supply chain management system. Supply Chain information is stored on blockchain based peer-to-peer (p2p) network and the system provides information to customers and vendors.⁴⁴

FIGURE 6.
Health, Traceability, and Supply Chain



2.4.3 Education

- **Edubloc:** Edubloc platform helps schools and institutions to collect and utilize data from public educational institutions, village learning centers, academies and etc.⁴⁵ Edubloc enhances the reliability of students' learning history information by leveraging blockchain technology capabilities.
- **Ziktalk:** Ziktalk offers a language learning and sharing platform that matches people who want to teach and learn foreign languages. It allows students to find tutors and experts by using Ziktalk coins. By using ZIK coins, students of Ziktalk can make payments to tutors/teachers via ZIK Coins.⁴⁶

FIGURE 7.
Education



43 Samsung. "Samsung Blockchain- Build." Samsung Developers. Accessed March 10, 2021. <https://developer.samsung.com/blockchain/keystore/understanding-keystore/blockchain-on-mobile.html>.

44 Temco. "TEMCO." TEMCO. Accessed January 26, 2021. <https://temco.io/#/>.

45 "왜 블록체인인가." 에듀블록 EDUBLOC, 18 Oct. 2019, edubloc.io/.

46 Ziktalk. "블록체인과 소셜네트워크로 만드는 글로벌 재능 공유 플랫폼 Global Gig Economy with Social Network and Blockchain." Ziktalk. Accessed January 26, 2021. <https://www.ziktalk.com/>.

2.4.4 Digital Identity

- **CoinPlug:** CoinPlug provides blockchain technology solutions for governments and enterprises. CoinPlug platform includes the following components: a Decentralized Identity Management Platform, Enterprise solutions (B2B), DCDPAX (Digital Asset Exchange) and Decentralized Identity (DID) platforms.
- **INITECH:** INITECH developed an INISAFE Nexess, a blockchain based product combined with the Korea Telecom(KT) blockchain technology. The solution aims to overcome the shortcomings of the existing centralized authentication system by applying blockchain certification management system.⁴⁷
- **KakaoPay:** Kakao has developed KakaoPay Certificate service which is based on blockchain technology and PKI (the public-key infrastructure). More than 15 million certificates were issued through the 'Kakao Pay Certification'.⁴⁸
- **Metadium:** Metadium is a blockchain ID start-up that provides all in one identity solutions. The information of verified users will be saved on the Metadium public blockchain.⁴⁹
- **Samsung Electronics:** Samsung Electronics adopted blockchain technology for identity authentication services for smart phone users. Samsung created a secure processor that is dedicated to protect the user's PIN, password, and blockchain private keys.⁵⁰
- **SGA Blockchain:** SGA Blockchain provides a blockchain-based cryptography and authentication solution and participated in the "Bank Joint Blockchain Authentication System Construction Project" with Samsung SDS.⁵¹
- **SK Telecom/Korea Telecom(KT)/LG U+:** The three mobile carriers connected their identity authentication servers to Korean National Police Agency's driver's license system and applied blockchain technology with the objective to confirm the authenticity of the information on the driver's license.⁵²

FIGURE 8.
Digital Identity



47 이지영. "아이콘루프-이니텍, DID 기반 사설인증 공동 구축." 매일경제. September 07, 2020. Accessed March 10, 2021. <https://www.mk.co.kr/news/economy/view/2020/09/924921/>.

48 "Naver, Kakao, Mobile Carriers Vie for Digital Certificate Market." Koreatimes, 24 May 2020, www.koreatimes.co.kr/www/tech/2020/05/133_290039.html.

49 Metadium. "About." Metadium. Accessed January 26, 2021. <https://www.metadium.com/about#technology>.

50 Samsung. "Samsung Blockchain- Build." Samsung Developers. Accessed March 10, 2021. <https://developer.samsung.com/blockchain/keystore/understanding-keystore/blockchain-on-mobile.html>.

51 "Sga비엘씨(주)." SGABIC_에스지에이비엘씨. Accessed December 07, 2020. <http://www.sgabc.kr/>.

52 SK Telecom. Sktelecom.com. Accessed March 10, 2021. https://www.sktelecom.com/en/press/press_detail.do?idx=1466.

2.4.5 Fintech and Financial Inclusion

- **TESSA (ARTBLOC)** created a marketplace platform where you can purchase and sell fractionalized ownership interests in investment-grade private artworks. Users can invest in a diverse portfolio of art pieces. Their aim is to make art investing easier for the next generation of buyers.⁵³
- **Directional:** Directional is the blockchain-based P2P exchange platform for SBL (Securities Borrowing & Lending) activities, which allows retail investors to have fair opportunities to participate in the SBL market. Directional was approved to be a part of South Korea's FSC's regulatory sandbox program.⁵⁴
- **Kasa Korea:** Kasa Korea is a Korean blockchain real estate platform. Kasa Korea has been working on building a blockchain platform to issue digital asset-backed securities (DABS) with real estate as the collateral. FSC provided special exception to sell real estate certificates to investors through its blockchain platform.⁵⁵
- **KEB Hana Bank:** KEB Hana Bank is collaborating with Korea University to apply blockchain-based solutions for data sharing and financial services and products.^{56,57}
- **MOIN:** MOIN developed cross-border remittance service not using SWIFT (Financial Telecommunications) method, but using its own technology based blockchain and non-blockchain remittance mechanisms.⁵⁸
- **Nonghyup Bank:** Nonghyup Bank started to use blockchain technology to authenticate the identity of their employees. By partnering with SK Telecom, they created a distributed ID blockchain that is driven by an ID card system.^{59,60}
- **OKCoin Korea:** OKCoin Korea has over 60 digital currencies that can be traded against the Korean won.⁶¹
- **Shinhan Bank:** Shinhan Bank plans to implement blockchain solutions for speeding up the loan approval process and verification of items required for credit lending.^{62,63}
- **Dunamu (UPbit):** UPbit is one of the biggest Korean cryptocurrency exchange and was established by Dunamu. They have approximately 3 million users and a daily maximum transaction volume of over KEW 10 trillion.⁶⁴
- **Woori Bank:** Woori Bank tried to apply blockchain solutions to oversee remittances and partnered with Ground X in developing blockchain financial services.^{65,66}

53 Meyer, R. (2019, August 30). Seoul's Artbloc to Offer High-End Art Using Blockchain-Based Fractional Ownership. Retrieved January 27, 2021, from: <https://www.coindesk.com/seouls-artbloc-to-offer-high-end-art-using-fractional-ownership-blockchain>

54 Korea Fintech Week 2020-Directional Inc. (n.d.). Retrieved January 27, 2021, from:

https://www.fintechweek.or.kr/eng/online/online-exhibition02.php?cate=2010&mem_idx=61

55 Insights, Ledger. "SK Securities Joins Kasa Korea for Real Estate Blockchain Tokenization." Ledger Insights- Enterprise Blockchain. September 04, 2019. Accessed January 27, 2021.

<https://www.ledgerinsights.com/sk-securities-joins-kasa-korea-for-real-estate-blockchain-tokenization/>.

56 KEB Hana Bank. KEB Hana Bank. Accessed January 27, 2021. https://www.kebhana.com/easyone_index_en.html.

57 김소라. "블록체인 선점나선 금융권, 새 금융상품 속속 출시." 파이낸셜뉴스. February 12, 2020. Accessed March 10, 2021. <https://www.fnnews.com/news/202002121332108834>.

58 "MOIN: Global Remittance." 모인(MOIN). Accessed January 26, 2021. <https://www.themoin.com/en>.

59 Nonghyup Bank. 함께하는 100년 농협. Accessed January 27, 2021. <https://www.nonghyup.com/main/psniMain.do>.

60 이지영. "NH농협은행, 블록체인 DID 기반 '모바일 사원증' 선보여." 매일경제. February 25, 2020. Accessed March 10, 2021.

<https://www.mk.co.kr/news/economy/view/2020/02/195051/>.

61 OKCoin Korea. "OKEx Korea." OKEx Korea. Accessed January 27, 2021. <https://okex.co.kr/kr/view>.

62 Shinhan Bank. 신한은행. Accessed January 27, 2021. <https://www.shinhan.com/hpe/index.jsp#051100009999>

63 이지영. "신한은행, 디지털 금융 선도할 '열쇠'로 블록체인 주목." 매일경제. August 27, 2020. Accessed March 10, 2021.

<https://www.mk.co.kr/news/economy/view/2020/08/882313/>.

64 Dunamu. Accessed January 27, 2021. https://dunamu.com/views/02_wedo_upbit.html.

65 Woori Bank. 우리은행. Accessed January 27, 2021. <https://www.wooribank.com/>.

66 이태규. (2020, November 26). "디지털 자산이 뜬다" 시중銀, 시장진출 시동. Retrieved March 10, 2021, from <https://www.sedaily.com/NewsView/1ZAK4CYMGK>

FIGURE 9.
Fintech and Financial Inclusion



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