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Initiatives toward Using Blockchain and Encouraging Open Innovation in the Securities Industry[1]

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Contents

I. Introduction

In recent years, under the movement called "fintech," a portmanteau word combining "finance" and "technology," the financial industry has seen new business models and proposals for enhancing existing services using new technologies. Fintech highlights not only cutting-edge technologies but also a variety of techniques such as externally opened APIs or usage of various types of cloud services that have not been widely deployed in the financial industry. Through such initiatives, startups are seeking out new financial services that are not offered by existing financial institutions, while existing financial institutions by overcoming the relative delay in information technology at once are increasing convenience and generating new customers.

Blockchain was proposed in 2008 as the core technology for virtual currencies (Bitcoin). Subsequently, different kinds of platform software for a broader variety of use cases were developed. Blockchain also continues to be a focal point in the financial industry as a leading fintech technology. Initially, there were many claiming that it would revolutionize existing financial services from the ground up, but presently, the existing institutions are collaborating with large IT vendors or startups with blockchain expertise to solve inefficiencies and other problems across the industry. For example, in Japan, the Japan Bankers Association selected multiple partner vendors to conduct proof of concept experiments[2], in addition to which a consortium of 51 companies (as of August 2018), including securities companies and large IT vendors and startups, launched a working group to discuss anticipated implementations of blockchain in the securities industry[3]. These initiatives by the existing financial institutions envision using so-called consortium-type platform software[4], such as the open source Hyperledger Fabric. Since these kinds of platform software differ in their design concepts and technical features from the blockchain that supports Bitcoin, they are sometimes called distributed ledger technology (DLT) to distinguish them, but in this paper, we call all of them "blockchain."

The novelty of blockchain lies in how it proves the existence and integrity of data at past points in time without depending on the reliability of specific companies or organizations (below "entities") by means of large numbers of people storing data connected by hash values in time series order incentivized by virtual currencies as compensation. The author believes, however, there are few actual use cases that qualify the novelty of blockchain as breakthroughs in the various blockchain experiments going on around the world. Some have pointed out that consortium-type platform software used only among specific stakeholders could conceivably allow past data to be rewritten by joint agreement, sacrificing the novelty of blockchain.

On the other hand, it is a fact that in a variety of industries, blockchain has highlighted issues that has been difficult for an individual company to solve (Fig. 1), thus stimulating joint studies between related parties to find a solution. In addition, while blockchain is a combination of previously existing technological features (Fig. 2), it is eminently possible that there remains room to utilize some of them in

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[2] Japan Bankers Association: for selection of partner vendors for the blockchain collaboration platform: https://www.zenginkyo.or.jp/news/2017/n8407/

[3] SBI Ripple Asia: Announcement of Launch of "Securities Consortium": 35 securities firms and other companies to participate," http://www.sbigroup.co.jp/news/2018/0419_11062.html

[4] Masafumi KONDO, Go HOSAKA, Nobushige DOI, Atsushi SANTO: The Trend of Exploring the Use of Distributed Ledger Technology in the Capital Market, https://www.jpx.co.jp/english/corporate/research-study/working-paper/b5b4pj000000i468-att/E_JPX_working_paper_Vol20.pdf

particular industries. However, rebuilding business processes using new technologies across an industry requires consensus among various stakeholders including entities that will incur system upgrade costs in short-term or obsolescence of existing knowledges. The emergence of fintech and blockchain has had the effect of initiating various studies, but as we move toward implementation, it will be indispensable to make progress in open innovation by building a collaborative relationship founded on a medium- and long-term perspective. This paper presents a case study of an initiative currently underway involving securities companies, institutional investors, and IT vendors.

Fig. 1. Criteria for use cases that blockchain might solve

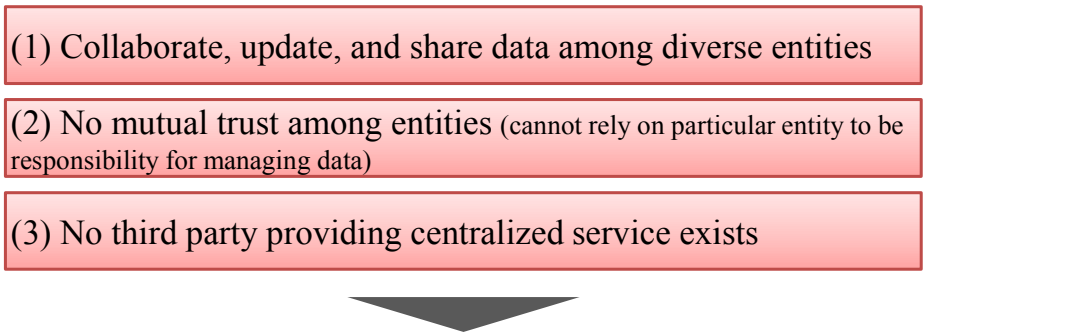
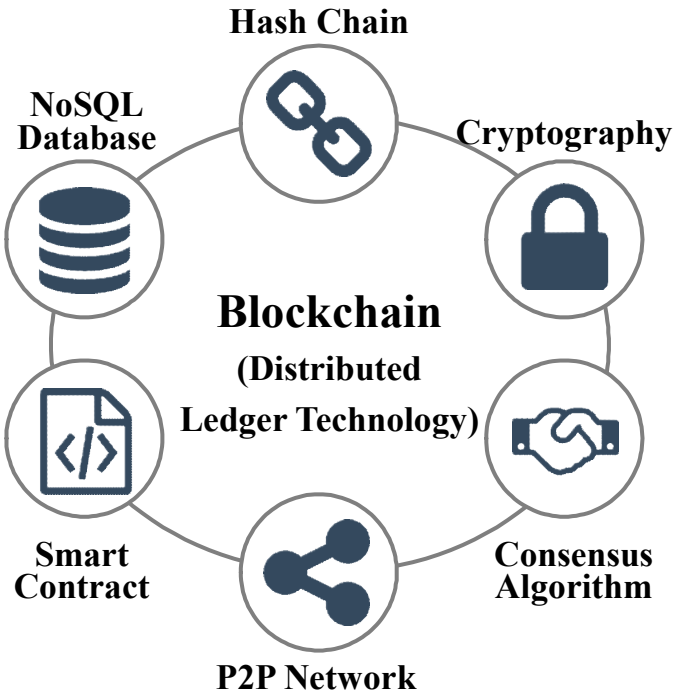


Fig. 2. Technological features of blockchain



II. Possibility of using blockchain for post-trade processing of securities transactions

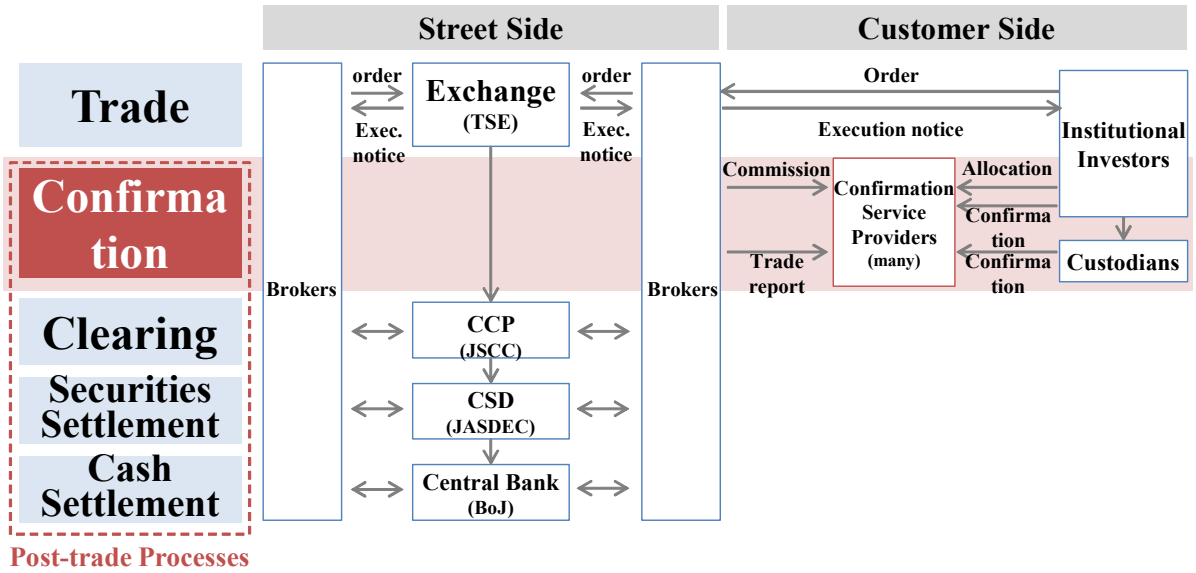
Post-trade processing of securities transactions is one area of the securities industry in which the use of blockchain appears promising.

Security transactions can be divided broadly into gathering orders to execute and post-trade processing, an umbrella term for multiple processes subsequent to the execution. With regard to the former, trading such as listed equities is primarily processed through trading system operated by exchanges. The progress in electronic trading in recent years has demanded lower latency and higher capacity from the standpoint of the number of orders handled. Another feature is the frequent occurrence of amendments and cancellations of orders. In this kind of use case, the existing technologies would continue to appear to be superior as compared to blockchain.

Post-trade processing, on the other hand, involves a processing flow where different entities capture and share information among themselves based on an execution notices generated through trading, and finally, settle and record the funds and the securities on the settlement date. Since securities transactions involve funds and securities flowing in two directions, they are more complicated than money transfers of virtual currencies, and since the party directly participating in the trading at the exchange is the broker, it is necessary to confirm and share information among multiple entities through the post-trade processing, making it relatively more amenable to the blockchain. In addition, at the time of this writing, the settlement date for listed equities in Japan is three days following execution, but starting from July 16, 2019, this will be shortened to two days, giving rise to an industry-wide issue of how to make post-trade processes more efficient in order to reduce overall processing time and how to mitigate operational risk.

In particular, in the process known as confirmation (Fig. 3), at present, multiple service providers (such as IT vendors, hereinafter “SPs”) provide systems with different specifications, in addition to which there are various customs that have been formed for each combination of broker and institutional investor, making this one of the more onerous parts of the process. It is conceivable that a certain degree of optimization could be achieved by means of an entity providing centralized services based on a unified specification, but this has yet to be achieved. Blockchain promises to act as a trigger in standardizing specifications and achieving more efficiency in data sharing while preserving the existing competitive landscape. In addition, in contrast to other processes in securities transactions, there are relatively fewer legal and institutional regulations concerning specific procedures to the confirmation process, which means it is amenable to enhance the process using advanced technologies. The cross-industry study project presented in detail in Chapter 4 also addresses this confirmation process.

Fig. 3. Processes in securities transactions



Central banks of various countries are researching the application of blockchain to the clearing and settlement process as well[5]. While large institutional investors trade on major exchanges throughout the world, viewed globally, it is safe to say that their clearing and settlement process is structured in a noncentralized way similar to the domestic confirmation process, and is not based on a unified specification. Since the exchanges and the settlement agencies are viewed as crucial state infrastructure, in many cases it will be difficult for a single entity to provide a unified service across national boundaries. The use of blockchain has a potential to construct collaborative international relationships in hitherto unknown forms for at least some part of the clearing and settlement processes.

[5] Bank of Japan: Project Stella: Bank of Japan: Report on Joint Study of Distributed Ledger Technologies by the European Central Bank, https://www.boj.or.jp/en/announcements/release_2017/rel170906a.htm/

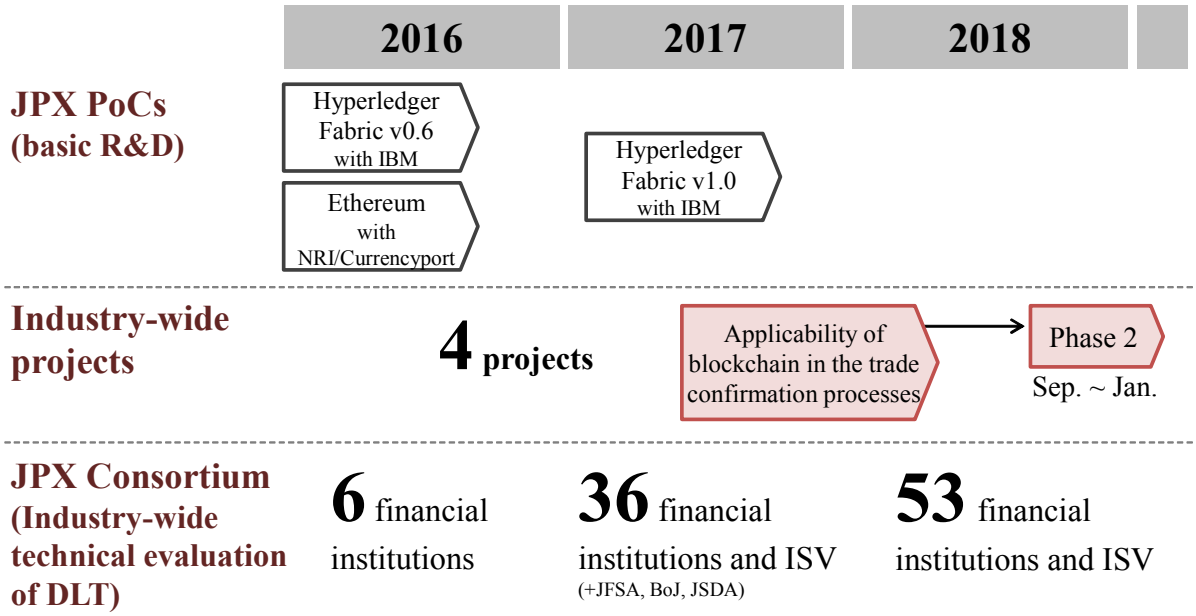
III. Initiatives at the JPX Group

This chapter presents the status of blockchain initiatives at the Japan Exchange Group (JPX Group).

1. Moving from proprietary proof of concept tests to industry-wide initiatives

JPX Group formed an internal research team in 2015 to study and analyze the applicability of blockchain to financial market infrastructure and conducted its own proof of concept tests in 2016 and 2017. We published working papers in August and September of that year, reporting on the insights gained from these technical validations[6]. Due to the lack of publicly available reference materials on blockchain, particularly at the time the research team was established, and the uneven nature of the information obtained, we performed the test in 2016 jointly with six Japanese financial institutions and shared each knowledges. Based on the insights gained, and cognizant of the fact that continuous technical evaluations and industry-wide discussion would be necessary to move toward using blockchain in the financial markets, we launched a collaborative initiative in March 2017 to jointly carry out a proof of concept, inviting broad participation from financial institutions ("Industry-wide technical evaluation of DLT") (Fig. 4).

Fig. 4. Blockchain initiatives at JPX Group



2. Industry-wide technical evaluation of DLT

Industry-wide technical evaluation of DLT aims to promote ongoing technology validation, sharing of insights, and creation of use cases for the application of blockchain, with the participation of 53 financial

[6] Atsushi SANTO, Ikuo MINOWA, Go HOSAKA, Satoshi HAYAKAWA, Masafumi KONDO, Shingo ICHIKI, Yuki KANEKO: Applicability of Distributed Ledger Technology to Capital Market Infrastructure, https://www.jpx.co.jp/english/corporate/research-study/working-paper/b5b4pj000000i468-att/E_JPX_working_paper_No15.pdf *For the working paper published in 2017 see note 4

institutions as of the time of this writing. Participants can use a dedicated communication site to share information and exchange ideas on blockchain. In addition, they can propose specific use cases for using blockchain and conduct research on needs toward other financial institutions. To date, the following three proposals have been developed into study projects carried out jointly by interested financial institutions.

- Trade confirmation process (described in detail in Chapter 4)
- KYC/Anti-money laundering process[7]
- Post-trade Processes of Cross-Border Securities Transaction[8]

JPX Group supports these projects in terms of human resources, and provides IT infrastructure for implementing blockchain, conference rooms for meetings, and communication tools as necessary. In addition, in the 2017 technical validations by the JPX Group, we published the experimental applications running various basic features of the securities markets in a simplified form on the blockchain for the benefit of the participants (as of March 31, 2018, the applications were temporarily made unavailable, but demonstration videos continue to be available to the public[9]).

[7] Takayuki KIHARA, Yoshitaka YOSHIMURA, Tomohisa SHIMIZU, Shota ONO, Shinichi TORIYAMA, Masahiro KIYOSAWA, Tatsuya KANEKO, Mamoru FUJIMOTO: Proof of concept of applicability of blockchain technology in the KYC process, https://www.jpx.co.jp/english/corporate/research-study/working-paper/b5b4pj000000i468-att/E_JPX_working_paper_No23.pdf

[8] Japan Unisys: Launch of proof of concept for contract information sharing using blockchain technology; examining the effectiveness of collaboration on information sharing across corporate and industry boundaries jointly with financial institutions, https://www.unisys.co.jp/news/nr_180330_dlt.html

[9] JPX Group: Blockchain/distributed ledger technology (DLT) demonstration (beta version), https://www.youtube.com/watch?v=Gqbjp4JlqRk

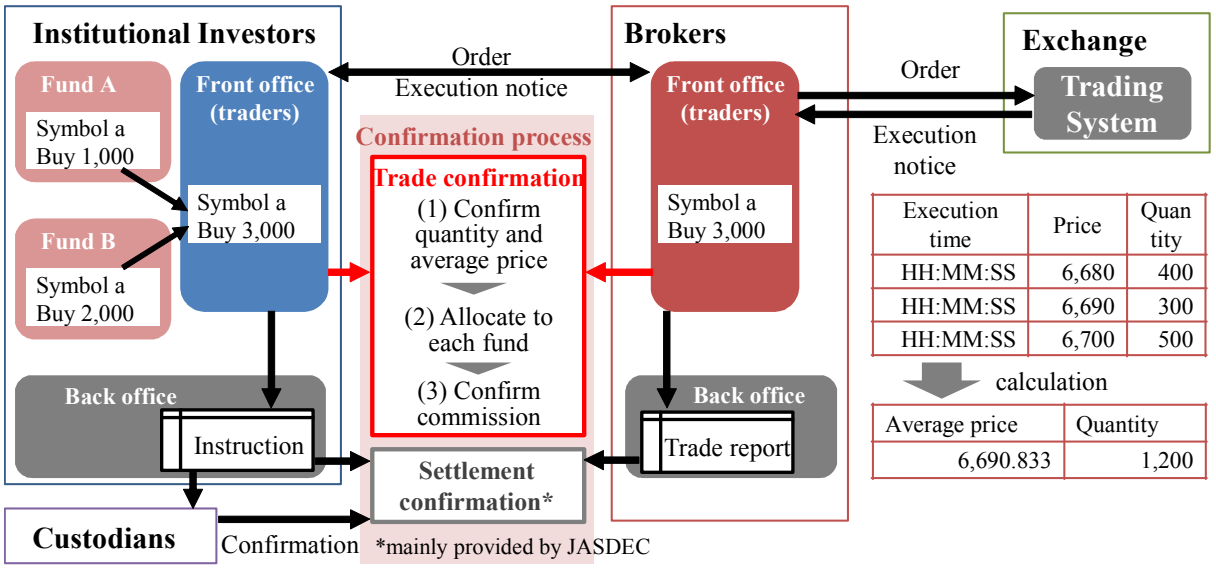
IV. Project to study on applicability of blockchain in the trade confirmation processes

This chapter describes in detail the project to study on applicability of blockchain in the trade confirmation processes proposed by the Daiwa Securities Group.

1. Project background and progress to date

Trade confirmation refers to the step in the confirmation process for securities transactions described in Chapter 2 in which the brokers and the institutional investors identify the price of the order, the quantity, and commission amount (Fig. 5). Prime examples of institutional investors are asset managements or investment advisers who are legal entities that take fund from customers and invest and manage it. There may exists multiple funds with different providers of capital and management strategies within any single-institutional investor, which, in general, are managed separately. In trade confirmation, the total quantity and average price are confirmed for each institutional investor, and then the allocation of quantity and commissions to the securities companies are confirmed for each fund. Since the institutional investors managing their customers' assets are required to calculate a reference price for each fund (the total market value of cash and securities) on the end of each business day, it is necessary to calculate the expected amount of cash and securities for the settlement of trades for the day promptly following the end of trading on the exchange at 3 pm.

Fig. 5. Overview of the confirmation process



Currently, the main issues in making trade confirmation more efficient are the following.

i) Standardizing system specifications

A variety of SPs provide system functions for trade confirmation. Since the specifications are not adequately standardized, there is an undue burden on brokers who have multiple institutional investors using different SPs as customers.

ii) Cleaning up the thicket of customary practices

Brokers offer many modes of execution (order formats)[10] with differing commission rates. Since institutional investors outsource trading to brokers by combining various order formats based on each fund's demands, the calculation of commission fees can often be complex. Moreover, various business practices exist in the calculation and allocation methods, giving rise to differences in the computation results.

iii) Improving fault tolerance and disaster recovery

Manual work such as emails and faxes designed as a backup for times when the system fails still remain, and specific methodologies also differ from company to company.

This project began its study with the participation of 17 financial institutions, mainly security companies, in September 2017, and published a working paper with results to date in January 2018[11]. That working paper raises the issue faced by securities companies with regard to deficiencies in compatibility between different SP services, and documents with the potential to use blockchain as a foundation for sharing common functionalities and sharing data across SPs. Based on these results, in September 2018, 26 participants including institutional investors and SPs began a deeper investigation of issues involved in the practical implementation and solutions as phase 2 of the project, and published a summary of their work in February 2019[12]. The next section presents an overview of it. As we move toward implementing these concepts, it will be necessary to study in more detail that who will be in charge of system maintenance and operation, as well as estimating necessary costs and raising the required funding. In the future, we intend to continue this initiative toward the realization with discussing the framework of consultation and collaboration among all the companies involved, as we move toward putting the ideas into practice[13].

2. Concept of applying blockchain to trade confirmation

The concept of applying blockchain to trade confirmation in this project is as follows.

i) System functionality and composition

Each SP has a node, which forms the blockchain network, and the system functionalities for trade

[10] In addition to the basic format in which the investor specifies the price and the securities company relays the order to the exchange, there are discretionary orders in which the traders of the securities company are granted a certain discretion, algorithmic orders in which orders are made automatically based on certain rules, and principal transactions in which the securities company acts as the counterparty to the transaction instead of relaying it to the exchange.

[11] Daiwa Securities Group Project Team: Study of applicability of blockchain (DLT) to the order matching process, https://www.jpx.co.jp/english/corporate/research-study/working-paper/b5b4pj000000i468-att/E_JPX_working_paper_Vol22.pdf

[12] Daiwa Securities Group Project Team: Study of applicability of DLT in order matching, Phase 2; results and future directions, https://www.jpx.co.jp/english/corporate/research-study/working-paper/b5b4pj000000i468-att/E_Summary_JPX_working_paper_No22sup.pdf

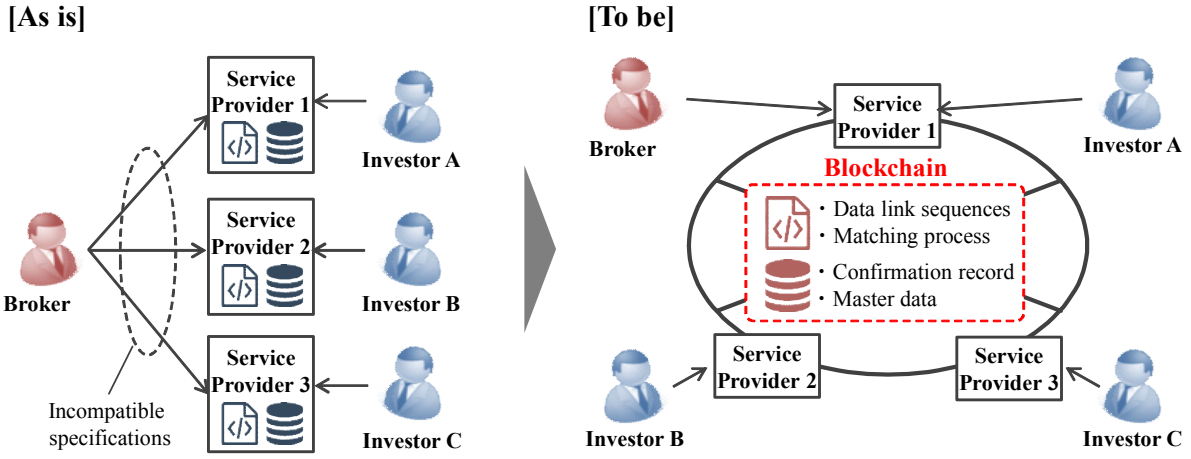
[13] Daiwa Securities Group Headquarters: Publishing vision for greater convenience through fintech technology jointly with 26 companies; approaching completion of phase 2 of the study of applicability of blockchain/distributed ledger technology (DLT) to the securities post-trade process http://www.daiwa-grp.jp/data/attach/2737_017_en20190219a.pdf

confirmation developed in-house by the SPs at present are to be implemented on the blockchain as smart contracts and shared. In addition, besides the run-time input records and computation results from each function, the various types of master data for trade confirmation will be recorded on the blockchain and shared as a distributed ledger (Fig. 6).

ii) System maintenance and operation

Future changes to the specification in conjunction with changes to laws and ordinances, and revisions to past data stemming from some kind of malfunction or fault, need to be handled promptly, making it appropriate to have a specific entity instead of unspecified individuals responsible for maintenance and operation. It is also possible to set up a new legal entity to serve as the basis for a user consortium allowing the opinions of the SPs and other users to be reflected appropriately. Note that we are using the dcentralized aspect of blockchain to prevent arbitrary changes by specific users to the shared functions and data, but we do envision the ability to make such changes based on the agreement between users who are identifiable stakeholders when necessary.

Fig. 6. Concept of applying blockchain to trade confirmation



	Legacy system	Blockchain
Functions	Developed individually by SPs following standard specification	Implemented as smart contracts on blockchain and shared among SPs, thereby maintaining uniformity of specification and reducing maintenance costs
Data	Each SP or user builds and manages data	Sharing among SP nodes ensures compatibility among different SPs, consistency among users, and enhanced fault-tolerance

Since various functionalities executed as smart contracts, regardless of the SP, are identical at the source code level, trade confirmation can be conducted with a standardized specification even between users of different SPs. In addition, financial institutions can use multiple SPs together as a backup for when there is system trouble in a SP. Moreover, providing various functionalities on the blockchain to financial institutions as open APIs should make it easier to build system functions proprietary for trade confirmation by financial institutions. Of course, it is imperative to continue to study the impact on the business models of the SPs due to advances in standardization, sharing, and open architecture.

The specific steps to realize this vision are as follows. First, implementing functional group 1 described

below serves as the foundation. On the basis of it, functional group 2 or functional group 3, which will have a relatively major effect while it is more difficult to implement, could be implemented.

Functional group 1: data standardization and sharing

We implement the unified data linkage sequence for trade confirmation on the blockchain, which allows communication between the securities firm and the institutional investor regardless of the SP used. Since it is necessary to standardize the data layout at the same time, each SP either enhances its service to match the standard specification or converts the data layout at the interface to the blockchain. At the same time, by means of encryption using a secret key tied to each financial institution, we achieve referential control preventing unwanted parties from being able to view various types of data.

Functional group 2: matching process

We implement the matching process on the blockchain, which compares the computation results of both of the expected settlement amounts, including commissions. At the same time, we also implement some tolerance functions based on prior agreement on rules, such as using the institutional investor's result if there are minor discrepancies at the fractional level on commissions. This process expects a certain level of automation in handling unmatched calculations (where the two sides' calculations disagree).

Functional group 3: standardization of calculation logic

Commissions and other calculations are implemented on the blockchain as smart contracts and shared by both sides. This makes it possible to avoid an unmatched calculation occurring, but commission calculations are at the core of the securities companies' business of intermediating orders for investors and, in general, are currently thought to be carried out in their core in-house systems, thereby requiring more thorough consideration of outsourcing.

3. Encouraging open innovation

Let us introduce several focal points for encouraging open innovation in this project. First, normally, this type of industry-wide study would be run by neutral organizations such as the exchanges or Japan Securities Dealers Association, but this time Daiwa Securities Group, the proposer of the use case, has kindly agreed to serve as the secretariat. We hope this will allow all parties to involve themselves in the discussions and not be mere onlookers or critics. JPX Group is also assisting with examining the agenda of each meeting as well as making various arrangements, but progress on this project has been largely due to the efforts made by Daiwa Securities Group, who have contributed greatly by serving as the secretariat regardless of the significant burden. In addition, although blockchain involves a decentralized infrastructure, in practical terms, some entity needs to be responsible for its maintenance and operation. In our case, this issue remains open-ended for the time being. This prevents a situation in which participants are forced to cooperate in investigating the business of a particular service provider, while also opening up a discussion about the governance of this new industry infrastructure regarding who will build or run it in accordance with the agreement of the stakeholders, with the aim of increasing participant engagement for each type of service to be provided on it.

Next, we met twice every week during the detailed examination period on the project, in which the participants from each company were the trade-confirmation practitioners rather than executives, and discussions were carried out mainly in groups of five to ten (Fig. 7). In conjunction with this, by defining rules for discussions within the group, we have attempted to encourage honest discussions transcending the interest of each member, with the intent of honing in on the essence of the issues (Fig. 8). In addition, we have allocated and divided the characteristics of each group member, whether they were securities companies, institutional investors, or SPs, in line with the themes of each meeting to ensure in-depth exploration of the issues and airing of points of contention. To stimulate the discussions in the limited timeframe, we are actively incorporating various techniques related to workshops (Figs. 9 and 10). These techniques are common practice for brainstorming, but it is likely exceedingly rare to use them to overcome barriers between companies in initiatives related to real businesses in the financial industry.

Fig. 7. Discussions in progress

Fig. 8. Ground rules for discussions in the project

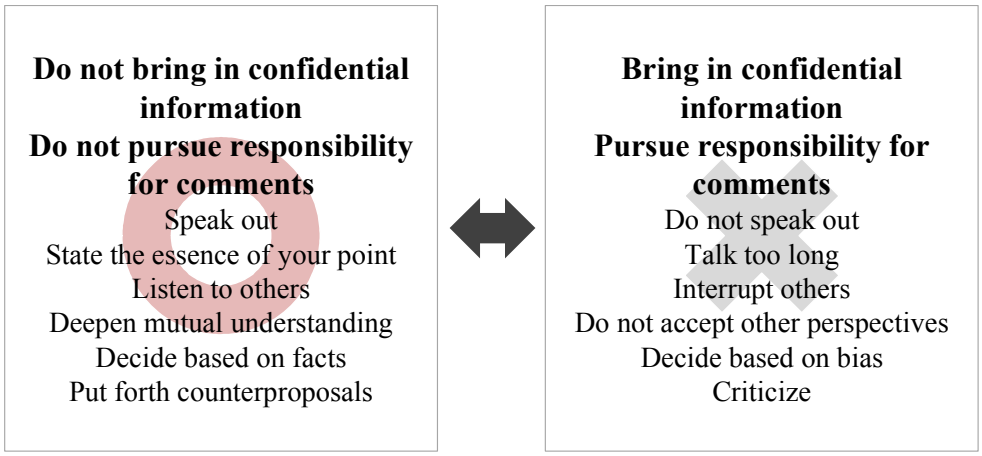

Do not bring in confidential information
Do not pursue responsibility for comments
Speak out
State the essence of your point
Listen to others
Deepen mutual understanding
Decide based on facts
Put forth counterproposals
Bring in confidential information
Pursue responsibility for comments
Do not speak out
Talk too long
Interrupt others
Do not accept other perspectives
Decide based on bias
Criticize

Fig. 9. Workshop technique example 1: interview role-play

1. **Divide each table into a "brokers group" and an "interviewing group."**
2. **Members in the "interviewing group" should pretend to be reporters and gather information on the current trade confirmation process from brokers.**

Examples of questions:

- **Processing flow, systems used, etc.**
- **Differences in requirements between investors**
- **Problems/issues**
- **In which area they feel pressure**
- **What is necessary to speed things up (make them more efficient)**
- **How you think future systems will evolve**

Fig. 10. Workshop technique example 2: KJ Method (brainstorming and organization of issues using post-its)

Summarize the benefits and challenges of applying blockchain separately for securities companies and institutional investors.

Brokers or Investors

First, identify benefits and challenges.

Next, categorize and layout each opinion and consider ways to address it.

	Details	Benefits	Challenges	Ways to address challenges
Step 1	Standardization of data formats and usage of blockchain to share data among SP's	Example) Reduce operational risk	Example) Require changes in data layout	Example) Justify changes by cost-benefit analysis
Step 2	Streamline by standardizing confirmation process and implementing it on blockchain	Example) Reduce operational risk, conserve human effort, go to STP	Example) Require coordination between institutional investors and brokers	Example) Publish industry-wide guidelines

V. Conclusion

In the “Project to study the applicability of blockchain in the trade confirmation process”, some participants appeared puzzled at first by the difference in the mood at the meetings held with other companies about everyday work, but we achieved active discussions focused on addressing industry-wide challenges at each meeting. This may require more time than a centrally directed process, but we believe it will lead to the discovery of better solutions for the users. This was also a valuable opportunity for practitioners at securities companies, institutional investors, and SPs to have a candid exchange of opinions, on which many participants commented. We are only halfway through the project, but we hope the horizontal connections and relationships of trust between the practitioners fostered here will develop into a foundation for various discussions relating to enhancing business processes and not just those using blockchain.

Blockchain has moved from the initial idea of sharing large amounts of data among various parties to a method to collaborate in noncompetitive fields, such as overall optimization of business processes by means of more efficient data linkages. The tightening of regulations to prevent a reoccurrence of the financial crisis of 2008 has made post-trade processing more onerous in the securities industry, which makes it a priority for the entire industry to connect various efforts to specific results. However, we felt keenly from this project that for the relevant parties to use new technologies actively in extensive and diverse ways requires a variety of efforts, not just useful technology. The fintech movement has provided a explicit perspective on past inability to fully leverage technology to improve efficiency and convenience in financial industry, and it is now attracting many people in the industry to address challenges similar to our project. We hope the content of this paper may be of some value to such readers.