Outline of Empirical Research on Securities Finance Transactions using Distributed Ledger Technology
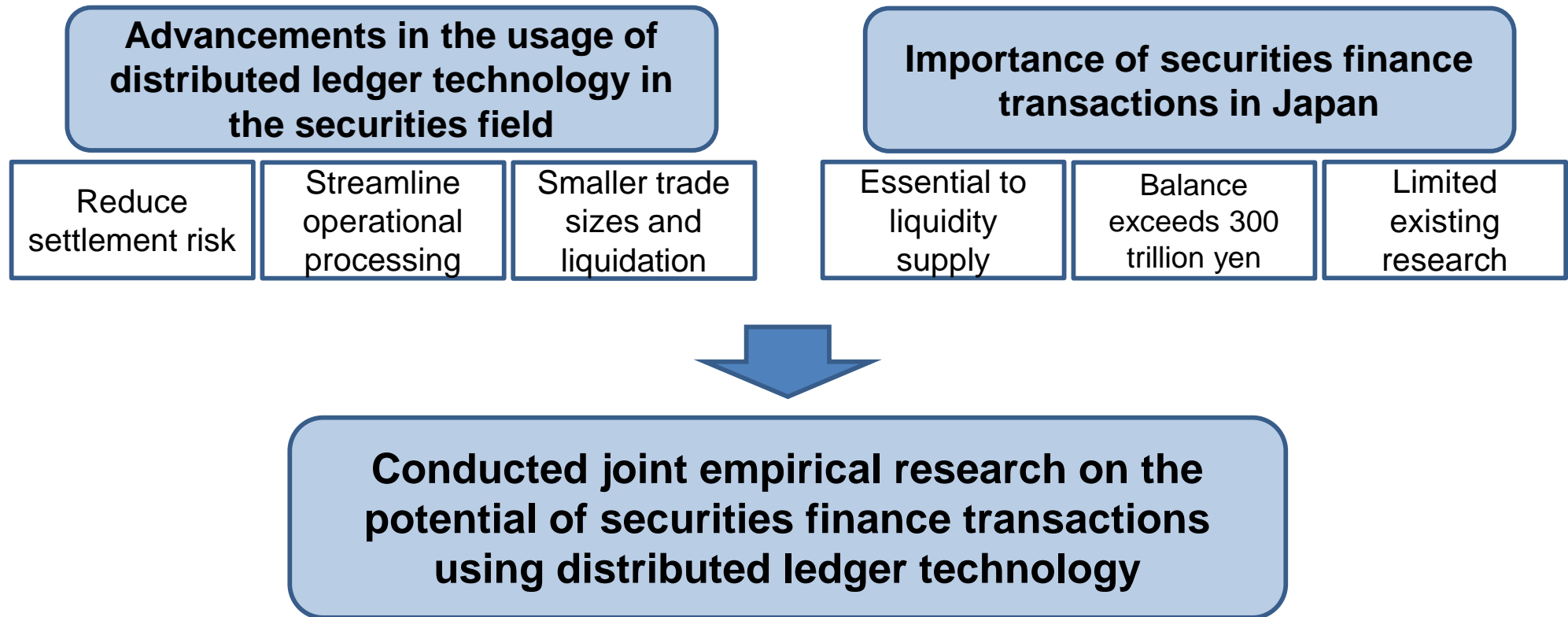
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And
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1. Background and Purpose of this Empirical Research

Advancements in the usage of distributed ledger technology in the securities field			Importance of securities finance transactions in Japan		
Reduce settlement risk	Streamline operational processing	Smaller trade sizes and liquidation	Essential to liquidity supply	Balance exceeds 300 trillion yen	Limited existing research

Conducted joint empirical research on the potential of securities finance transactions using distributed ledger technology

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USD UNITED SYSTEM DESIGN

- Conceptualization and scheme planning
- Research of related market practices
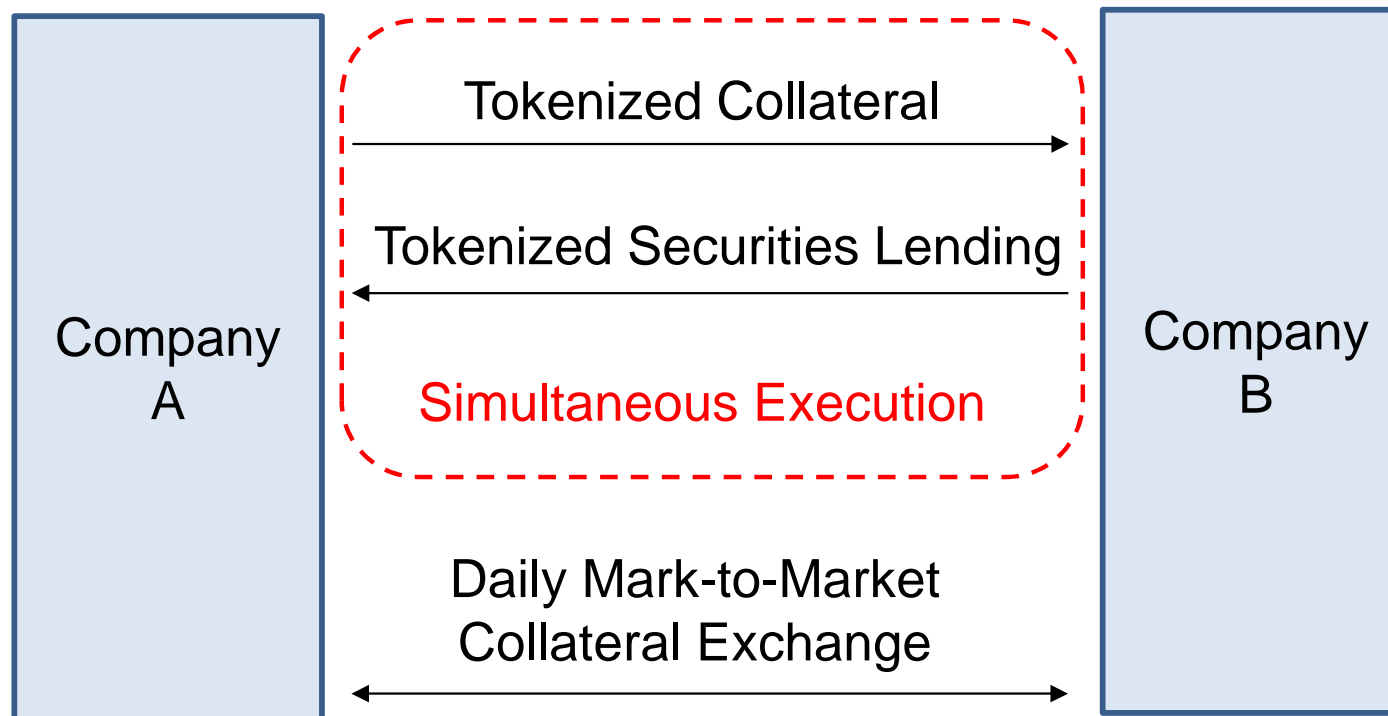- Compilation of reports

- Data analysis
- Review of basic technologies and systems concerning distributed ledger technology

- Development of system and smart contracts using distributed leger technology

1. Background and Purpose of this Empirical Research

Conceptual Diagram of Empirical Research

1. Approach to this Empirical Research

The following approaches were taken from the viewpoint of effective project management in cutting-edge field.

1. The research did not consider replacing the existing trading and settlement infrastructure but focused on the bilateral relationships between transaction parties.

2. The research focused on practical feasibility excluding review of the related laws and regulations.

3. The research excluded review of token issuance schemes and instead focused on transactions using tokens already issued.

4. Transaction settlements in the research refers to the exchange of tokens and does not indicate the transfer of assets underlying the tokens such as cash or securities.

2. About Securities Finance Transactions

- Securities finance transactions involve the exchange of securities and funds or securities and securities, with redemption after a predetermined period. There are general collateral (GC) transactions in which securities are collateralized for funds management and procurement needs, and special collateral (SC) transactions in which funds are collateralized for specific securities management and procurement needs. These transactions are growing around the world.

- Trends in the balance of securities finance transactions in Japan
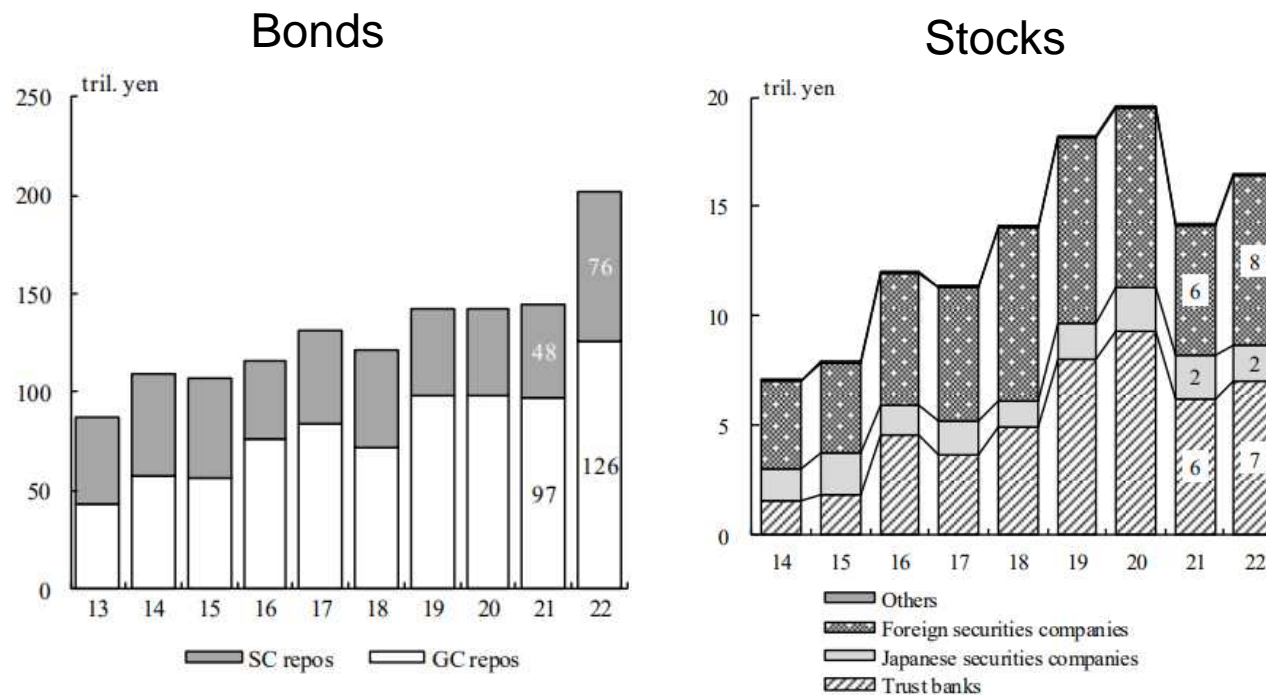
Source: *Trend in the Money Market in Japan – Results of Tokyo Money Market Survey (August 2022)* published by the Bank of Japan

(1) Structure of securities finance transactions in empirical research

Subject of tokenization

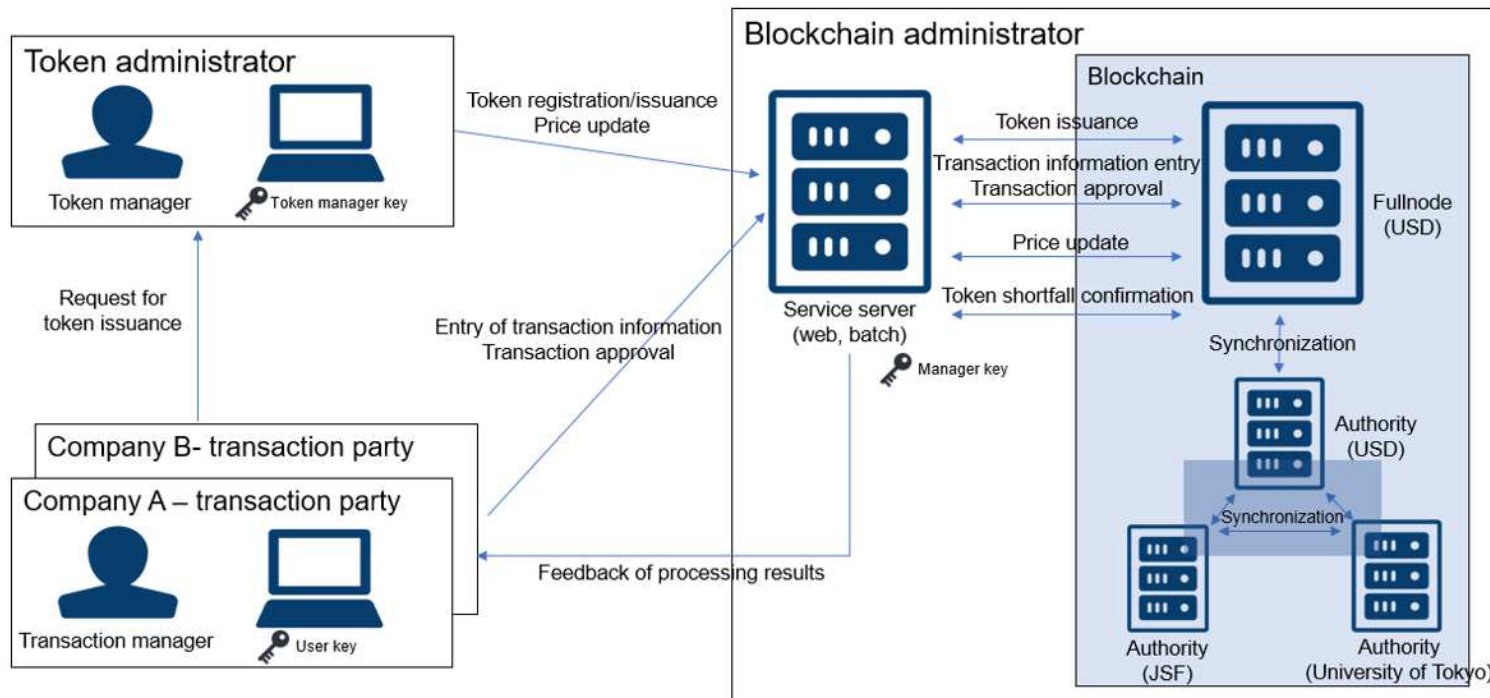| Type	Tokenization	Estimation of market value
Security token (ST)	Government bonds and listed stocks of Japan, US and Germany	Closing price of each market
Cash token (CT)	Currencies such as Japanese yen, US dollar, Euro	Same as each currency

Calculation of net credit amount

Based on the above market value, in the case of transactions of tokens denominated in different currencies, the net credit amount of all securities finance transactions was calculated by using the exchange rate after the close of the US market on the day. The exchange rate is acquired and currency conversion is conducted before the start of trading on the Japan market the next day. If there was any excess or shortage, margin call was implemented.

Transaction workflow

| Tokens granted to each company from token administrator | → | Contract between parties and registration/approval of transaction info | → | Automatic settlement on start date | → | Automated mark-to-market and margin calls following changes in market value | → | Automatic settlement on end date |

(2) System composition

Overview of each actor

Name	Overview
Token administrator	Based on the request of the transaction parties, instructs the blockchain administrator to issue tokens and then issues the tokens
Transaction party	Following token issuance, registers and approves transaction information in the system and executes the transaction for exchanging tokens
Blockchain administrator	Receives information sent from the token administrator or transaction parties and administers the service server that sends the transaction to blockchain Manages the blockchain for processing transactions, forming blocks and recording transactions

(1) Feasibility of securities finance transactions execution (individual bilateral transactions)

Evaluated transaction types

Type	Specific examples
Exchange of ST and CT of the same currency	Procurement of JPY CT collateralized by Japanese stock ST or JGB ST
Exchange of ST and CT of different currency	Procurement of USD CT collateralized by JGB ST
Exchange of ST and ST of the same currency	Procurement of US Treasury Bond ST collateralized by US stock ST
Exchange of ST and ST of different currency	Procurement of German Bunds ST collateralized by US stock ST

*Evaluated various trading periods, such as intraday, overnight, 1 or 3-weeks (carrying over to the next month), etc.

Sample transaction

	19 April 2023 (start of transaction)		20 April 2023 (after margin call)	
	B borrows	A accepts	B borrows	A accepts
	ST (German Bunds)	ST (US Stock)	ST (German Bunds)	ST (US Stock)
Unit	50,000,000	335,240	50,000,000	333,450
Price	98.8110	161.01	98.7590	162.53
EURUSD	1.09253	–	1.09753	–
Market value (USD)	53,976,991	53,976,992	54,195,483	54,195,629

1,790 shares automatically returned from Company A to Company B

German Bunds price is per 100 Euro face value

Each transaction was settled automatically from the start of transactions through margin calls to the end of the contract period after registration and approval of the contract.

4. Evaluation Results

(2) System performance when processing transactions in market-wide scale

- Input transactions occurring in the entire market and evaluated performance after estimating market-wide scale of securities finance transactions.

- How resilient the developed system is in case of high concentration of transactions during market stress or recovery from system interruptions, and how resilient it is to the anticipated large system workload when marking to market and implementing margin calls every business day though it is anticipated to have large system workload .

▶ **Evaluation results**

- Regarding the start of transactions, registration and approval processing was executed smoothly even during times of market stress when daily market-wide transactions concentrated in one hour.

- Regarding mark to market and margin calls, generally they were able to be processed even based on the scenario when one-third of market-wide active transactions (before redemption) concentrated at the blockchain administrator.

  *However, this is considered to depend on the machine specifications, etc.

4. Evaluation Results

(3) Impacts of collateralized securities diversification and threshold setting for margin call on net credit amount and necessary liquidity, including the evaluation upon market turmoil

- Simulations were conducted for each market scenario (during normal times and market turmoil such as sharp increases, sharp decrease, and high volatility) depending on the number of tokens to be collateralized and whether or not a threshold is set when implementing a margin call

▸ Evaluation results (indexed with one collateralized securities and no threshold set at 1.00)

	Normal times				Market turmoil			
	1 collateral		5 collaterals		1 collateral		5 collaterals	
	no threshold	2% threshold	no threshold	2% threshold	no threshold	2% threshold	no threshold	2% threshold
Net credit amount	1.00	1.23	0.96	1.11	1.00	0.99 1.06	0.81* 0.94	0.90 0.95
Number of margin calls	1.00	0.21	1.00	0.20	1.00	0.43 0.49	1.00 1.00	0.39 0.54
Amount of margin calls	1.00	0.65	0.96	0.64	1.00	0.85 0.91	0.81* 0.94	0.70 0.92
Number of tokens transferred	1.00	0.65	0.95	0.65	1.00	0.85 0.91	0.78* 0.93	0.67 0.90

*Declined particularly during market spikes

▸ Considerations
- From the perspective of the collateral receiving party in securities finance transactions, it is desirable that the collateral securities are as diversified as possible from the viewpoint of improving liquidity and reducing net credit. On the other hand, the larger the number of collateral securities the greater the increase in operational burden of evaluation, management, and collateral replacement in the current operational flow.
- In the case of tokens, these issues are avoided because all processes are automated, and the appropriate combination of securities diversification effects and threshold setting may create the possibility of efficiently and effectively controlling net credit amount and liquidity requirements, especially in times of market turmoil.

5. Implications obtained from the Empirical Research

(1) Transaction feasibility

- Various types of securities finance transactions, including those involving the exchange of assets denominated in different currencies and securities tokens to securities tokens, can be smoothly implemented from the start of transactions through margin calls to the end of the transaction period.

(2) Reduction of settlement risks and simultaneous execution of transactions denominated in different currencies

- Token-to-token exchanges can be automatically conducted simultaneously without time difference, even if the underlying assets are denominated in different currencies. In addition, margin calls can be automatically implemented without the need for operations by transaction parties.

(3) Reduced credit risk and economized liquidity

- Automation of margin calls reduces operational burden, making it easier to make margin calls, and credit risk may be reduced. In addition, the appropriate combination of collateralized securities diversification effect and margin call threshold setting can reduce credit risk and economize liquidity, especially during market turmoil.

(4) Streamlining of operation

- Automation of settlement and margin call makes it possible for straight through processing (STP) and improving the efficiency of securities finance transactions operation and managing operational risk. In particular, this has the potential to significantly reduce the operation and its time required to exchange transaction information and check status with counterparties located in foreign countries, thereby improving the efficiency of transactions.

(5) Utilization of assets with low liquidity

- Since it will become easier to transfer rights of low-liquidity assets by tokenization, there is the potential to not only hold these assets, but also utilize them as collateral for securities finance transactions (the valuation of the underlying asset itself may improve as the utilization value increases).