2024 BOK Knowledge Partnership Program

Nepal

BANK OF KOREA

Regulatory and Oversight Framework of Payment System

BANK OF KOREA

dongguk UNIVERSITY

Nepal Rastra Bank

2024 BOK Knowledge Partnership Program with Nepal

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Contents

List of Tables

List of Figures

List of Boxes

Executive Summary

The 2024 Nepal Knowledge Partnership Program (KPP), jointly conducted by the Bank of Korea (BOK) and the Nepal Rastra Bank (NRB), focuses on the "Regulatory and Oversight Framework of Payment Systems." Given the rapidly evolving payment landscape, the program aims to enhance NRB's capacity in formulating policies, managing risks, and ensuring the effective oversight of payment systems. Initially broad in scope, the focus was narrowed to the following three key issues:

1. Electronic Funds Transfers: Large Value and Retail Payments
2. Risk-Based Regulation and Supervision of PSPs and PSOs
3. Cross-Border Payments: Modality and Procedure

Chapter Ⅱ is about the first issue of electronic funds transfers. Nepal's payment system, traditionally cash- and cheque-based, has advanced significantly in digital payments post-COVID-19. The adoption of systems like connectIPS and IBFT for retail payments and the NRB-operated Real-Time Gross Settlement System (RTGS) for high-value transactions highlights this progress. RTGS ensures real-time settlements using ISO 20022 standards and involves direct, indirect, and special participants.

Retail Payment Systems in Nepal include electronic cheque clearing, fund transfers, card-based payments, QR codes, and e-wallets. Payment-related institutions are categorized as Payment System Operators (PSOs) and Payment Service Providers (PSPs), both regulated by NRB. Despite significant achievements, there are many areas needing improvement.

While Korea and Nepal share similarities, notable differences exist. For instance, Nepal's RTGS lacks multilateral liquidity-saving mechanisms, and intraday liquidity facilities are limited to banks. However, Nepal's National Payment Board and standardized QR code initiative are commendable steps toward enhancing digital payments. NRB must further strengthen payment

system safety and efficiency by clarifying settlement finality, improving risk monitoring, and promoting digitalization.

Chapter Ⅱ concludes with the following key recommendations:

strengthening the RTGS system, integrating net settlement across retail payment systems, enhancing IT resilience and reducing downtime, and improving digital financial inclusion and interoperability across systems.

Chapter Ⅲ is about risk-based supervision and oversight. The Bank of Korea's payment system oversight framework, established in 2003, includes five stages: designation, monitoring, assessment, improvement recommendations, and emergency measures. Real-time monitoring is facilitated through the Payment and Settlement Information System (2020), which visualizes payment networks, tracks risk indicators, and analyzes settlement liquidity using stress tests. Assessments are conducted every three years based on the Principles for Financial Market Infrastructures (PFMI).

In Nepal, the NRB's Payment Systems Department (PSD) oversees PSPs and PSOs through on-site and off-site inspections. The framework primarily follows compliance-based supervision but is transitioning toward risk-based supervision. Existing regulations include the Payment and Settlement Act (2019) and other guidelines such as AML/CFT frameworks.

Chapter Ⅲ provides the following policy recommendations: differentiated licensing, PFMI adoption, automation to improve monitoring and reduce reliance on manual processes, enhancing risk monitoring, cyber resilience. By implementing these measures, NRB can balance innovation with risk management, ensuring a resilient and efficient oversight framework.

The last chapter is about cross-border payments. Cross-border payments play a crucial role in supporting globalization, trade, and financial inclusion. Nepal's cross-border payment ecosystem involves commercial banks, PSPs, and PSOs utilizing systems like SWIFT, card networks, and QR codes for remittances and trade transactions. Global initiatives such as G20 Roadmap, SWIFT GPI, ISO 20022, and Project Nexus aim to make cross-border payments faster, cheaper, and more efficient.

Cross-border payments foster economic growth, tourism, and trade while

enhancing financial inclusion. However, they face challenges such as:

- AML/CFT compliance and regulatory fragmentation
- Cybersecurity risks and data privacy concerns
- Operational complexities and reconciliation issues

Nepal has made progress by standardizing QR codes and initiating a National Retail Payment Switch to enhance cross-border payment integration. However, risks must be managed carefully to ensure robust and secure transactions. Chapter Ⅳ suggest the following policy recommendations:

- Conduct end-user and operator surveys to align payment systems with demand.
- Prioritize cross-border partnerships with major trade and economic partners.
- Ensure interoperability and technical readiness for integration into global systems.
- Promote central bank-led initiatives to strengthen governance and regulatory cooperation.
- Focus on AML/CFT compliance, system interoperability, and infrastructure resilience.

The BOK-NRB collaboration highlights the need for robust regulatory and oversight frameworks to support Nepal's payment systems. Key areas of focus include:

- Strengthening RTGS and retail payment systems to enhance efficiency and safety
- Implementing risk-based supervision and adopting PFMI standards
- Addressing challenges in cross-border payments while leveraging opportunities for financial inclusion and trade growth

By adopting international best practices, strengthening regulatory frameworks, and investing in digital infrastructure, Nepal can modernize its payment systems, improve financial stability, and enhance economic growth.

I. Introduction

The topic of 2024 Nepal KPP is “Regulatory and Oversight Framework of Payment System.” As the payment landscape continues to evolve, it is crucial for regulators in the payment industry to have a solid understanding of regulatory and oversight framework. The knowledge partnership program between the Bank of Korea (BOK) and the Nepal Rastra Bank (NRB) on regulatory and oversight framework of payment systems will enhance and strengthen the regulatory and supervisory capacity of NRB and facilitate in formulating effective policies, managing risks, and adapting to the fast-evolving landscape of payment systems.

At first, the scope of this year’s KPP was broad, including the following issues:

- Overview of Payment Systems including institutional framework, payment instrument, clearing, settlement, and risk management in Korea.
- Evolving global and regional regulatory landscape for Payment Systems.
- Implementation of principles for financial market infrastructure (PFMI)
- Significance of Payment Systems Regulation in maintaining financial stability.
- Impact of technological advancements on regulatory approaches.
- Provisions regarding Systematically Important Payment Systems (SIPS)
- Risk factors associated with Payment Systems and BOK’s experience on strategies for effective oversight and risk management.
- Risk-based Oversight of Payment Systems
- Real-world case studies highlighting regulatory challenges and successes in Payment Systems Oversight.
- Payment Systems challenges and planned measures.

The Korean research team and the NRB research team agreed that these issues are too broad and narrowed down to the following three issues:

- Electronic Funds Transfers: Large Value Payments and Retail Payments
- Risk Based Regulation and Supervision for Payment Activities of PSPs and PSOs
- Cross Border Payments: Its Modality and Procedure

The next chapter is about the first topic, electronic funds transfers: large value settlement system and the retail payment system, which are electronic funds transfer systems. We have looked at the cases of Korea and Nepal and explored the future development direction of the Nepalese payment and settlement systems.

The Nepalese payment system, which is a predominantly cash and cheque-based system, has witnessed remarkable achievement in the adoption of digital payments, especially after the Covid-19 pandemic. Fast payment systems like connectIPS and interbank fund settlement system (IBFT) are widely used, with Quick Response (QR) code-based person-to-merchant payments experiencing exponential growth. For time-critical and high value payments, NRB has been operating the Real Time Gross Settlement System (RTGS).

NRB-RTGS is an interbank fund transfer system that allows real-time or instantaneous settlement of funds and/or securities, based on ISO 20022 messaging standards. NRB-RTGS allows three types of participants viz., direct, indirect and special.

The retail payment systems include instruments and systems facilitating the general public to make payments for availing various services. Nepal's retail payment systems include electronic cheque clearing, electronic fund transfer, card-based payment systems, QR code-based payment system, and e-Wallets.

In Nepal, payment related institutions are categorized as PSO or PSP. PSOs facilitate the switching and settlement tasks and PSPs provide payment solutions to their customers. Both PSO and PSP need to obtain prior approval from NRB for their operation. Though, Nepal has achieved remarkable development in the field of large value payment systems and retail payment systems, some areas still need further improvements, viz, provision to have the Payment and Settlement Act preceding over the insolvency laws, prohibition of retroactive effects of zero hour rule, upgrading messaging standards, interoperability of

payment systems, promotion of cross-border integrations, AML/CFT considerations, investment in digital public infrastructure, digital financial literacy, focus on financial inclusion, digital consumer protection, incentivize digital payments, digitalization of person-to-government payments, national ID and centralized KYC system, automation interest charging for OLF, continuous improvement of regulatory framework etc.

Nepal and Korea show similar aspects in many ways such as payment and settlement systems and payment instruments, but they show differences in several aspects.

First of all, in the case of the central bank RTGS system, NRB has a tiered participant structure and has not yet implemented a multilateral simultaneous offsetting procedure for liquidity savings. The NRB' intraday liquidity facility is available only for banks. In terms of the retail payment systems, Nepal appears to be proactively introducing new payment instruments and channels in the private sector, such as BFIs. However, it is noteworthy that Nepal has established the National Payment Board and is leading the standardization of national QR codes to expand digital payments.

The advancement of digital payments has transformed the lives of Nepali end-users in recent decades. Thanks to these efforts, innovative payment instruments have brought about significant changes in the payment ans settlement ecosystem. These include QR codes, ConnectIPS, cardless withdrawals, smart POS, contactless cards based on NFC technology, and virtual cards. Despite all the recent achievements, It seems that NRB still has room for improvement in terms of safety and efficiency in payment and settlement systems.

In light of Korea's experience, the following policy issues are recommended for review by the NRB. First, a solid legal framework needs to be established. Payment and settlement systems defined by the NRB as SIPS must guarantee the finality of settlement, and this legal basis should be specified in law, not in regulations or rules. Second, the operation of the NRB-RTGS system should be strengthened in terms of safety and efficiency. Some of them are clarifying the legal basis for the finality of settlement, refining the queuing mechanism, reviewing the introduction of a hybrid mechanism, improving the intraday liquidity facility system, strengthening risk-based monitoring and analysis using

settlement data, and adjusting the net settlement time for the NCHL's DNS system, etc.

Third, it is to strengthen the management of settlement risk arising from retail payment systems. To this end, the possibility of a single integrated net settlement time covering the all retail payment systems of NCHL can be examined. Besides, most of the net settlements between participating institutions of individual PSOs, except NCHL, are likely to be made through settlement accounts opened at commercial banks, but it is necessary to guarantee the final settlement in central bank account. NRB will need to closely monitor the downtime of IT systems in order to analyze the root cause of system failures in both PSO and PSP cases.

In the meantime, in addition, policy implications and suggestions for improving the payment systems from the perspective of the NRB can be presented as follows. First, improvement of the legal and regulatory system. This includes securing grounds for preferential application of the Payment and Settlement Act over the Bankruptcy Act, providing grounds for excluding possible retroactive application of the zero-hour rule, and continuous improvement of the regulatory framework. Second, improvement of interoperability and scalability of the system. For example, upgrade of messaging standards, strengthening interoperability of payment and settlement systems, promotion of cross-border integration of payment and settlement systems, improvement of the method of imposing interest on intraday overdrafts, etc. Third, digital payments should be promoted. To this end, expansion of investment in digital public infrastructure, promotion of digital financial literacy, provision of incentives for digital payments, and promotion of digitalization of P2G payments are suggested. Lastly, protection of end-users and prevention of criminal activities. This includes AML/CFT considerations, digital consumer protection, establishment of national ID and centralized KYC systems, etc.

The topic of Chapter Ⅲ is risk-based supervision and oversight. The first objective of this chapter is to provide knowledge and information on the supervision and oversight activities of the Bank of Korea to the Nepal Rastra Bank in line with the purpose of the BOK-KPP project. The second objective is to understand the supervision and oversight activities of the Nepal Rastra Bank,

identify areas for improvement, and then provide policy advice and implications to the Nepal Rastra Bank to improve the risk-based supervision and oversight activities.

The Bank of Korea was granted the function of oversight the payment and settlement system by the revision of the Bank of Korea Act in 2003, and the current oversight framework consists of i) designation of payment and settlement systems subject to monitoring, ii) monitoring, iii) assessment, iv) improvement recommendations, and v) emergency measures. The second stage, monitoring, focuses on real-time monitoring and includes tasks such as managing risk indicators and analyzing payment data. The Payment and Settlement Information System, which the Bank of Korea established in 2020, enables real-time monitoring in an effective way. This system visualizes real-time payment status as a network across participating institutions, calculates the Payment System Liquidity Index, detects operational risks and abnormal transactions, and is equipped with a stress test analysis function for settlement liquidity. In addition, the Bank of Korea has developed 11 risk monitoring indicators to actively conduct risk-based monitoring. These monitoring indicators mainly measure the size of intraday liquidity risk.

The third stage, the assessment of safety and efficiency, focuses on whether the payment system under oversight meets the core principles of the PFMI. The assessment cycle is three years. The Bank of Korea has so far made 42 improvement recommendations to the Bank of Korea, 59 to the KFTC, 106 to the Korea Exchange, and 76 to the Korea Securities Depository. Since 2012, the Bank of Korea has made 217 improvement recommendations, most of which were related to operational risk, financial risk, and organizational operation. For example, in the assessment of BOK-Wire+ in 2023, the Bank of Korea recommended securing IT professionals working at the disaster recovery center and dualizing the power supply system to minimize the time required for system disaster recovery. In addition, the Bank of Korea conducts joint inspections with the Financial Supervisory Service, and mainly conducts joint inspections of banks and financial investment companies about 3 to 5 times a year. Monitoring and assessment of payment and settlement systems account for the main activities of the Bank of Korea’soversight. The Financial Services Commission, which is in

charge of financial supervision, also performs monitoring functions, and mainly targets non-bank payment service providers and securities settlement systems for monitoring and supervision. It is characteristic of Korea that the small payment system in charge of fund settlement falls under the supervision of the Bank of Korea rather than financial supervision.

The Payment Systems Department (PSD) of the NRB has been entrusted with the dual responsibility of regulating and supervising payment related institutions in Nepal. Some the legal provisions which have specified the regulating and supervisory right of PSD include, but not limit to: Payment and Settlement Act, 2019, NRB Act, 2002, Licensing Policy for Payment Related Institutions, 2016, Payment Systems Oversight Framework, 2018, Standard Operating Procedure for Daily Liquidity Facility, 2018, Retail Payment Strategy, 2019, National Payment System Development Strategy, 2019, RTGS System Rules, 2019, Payment & Settlement Bylaws, 2021, Payment System Oversight Manual, 2021, Digital Lending Guidelines, 2021, Nepal QR Standardization and Framework Guidelines, 2021, Payment System Inspection & Supervision Bylaws, 2022, Cyber Resilience Guidelines, 2023, Unified Directives, 2023.

PSD has been conducting both on-site inspection - comprising of periodic inspections, special inspection, and follow-up/monitoring inspections and off-site inspection of the licensed institutions. At present, PSD basiscally follows compliance based prudential supervision practices for PSPs and PSOs. However, some parts of inspection also cover identifying risks and oversight of those risks.

While conducting onsite examination, NRB, PSD also considers and reviews the risk related policies, its implementation, discussion and oversight status of the concerned payment related entities. PSD has issued AML/CFT Supervisory Framework and Risk Based AML/CFT Supervision Manual for PSOs and PSPs focusing on the ML/TF/PF related risks associated with payment system.

Furthermore, realizing the growing importance of risk-based supervision, PSD is in process of drafting a risk-based supervision framework. Some of the key policy implications for NRB regarding risk-based regulations and supervision for PSPs and PSOs include: Dynamic oversight and regulatory approach; improved risk management practices; liquidation, merger and acquisition; increased consumer protection; transparency and accountability; balancing innovation and

risk; systemic risk reduction and resilient payment; regulatory cooperation in cross-border payments and regulations; regulatory adaptation; assurance of cyber security etc.

The policy suggestions or recommendations for the Nepal Rastra Bank are as follows. First, it is necessary to subdivide the licenses for payment service providers or differentiate the level of supervision by function. For example, the same supervision cannot be applied to an electronic money institution that holds and controls customer funds in the payment and settlement process and a payment gateway (PG) that simply provides payment agency or IT services. Naturally, the former should be subject to stricter supervision standards because the former involves greater risks. In this regard, it is necessary to carefully refer to the case of the Reserve Bank of India introducing a license called "payment aggregator (PA)." In short, the licensing system should be subdivided according to the principle of "same function-same risk-same supervision." If payment aggregators or payment gateways are not included in the scope of supervision (and oversight), supervision of these payment service providers should begin.

Second, an assessment based on PFMI should be conducted by the Nepal Rastra Bank. To do this, PFMI should first be adopted as an assessment standard, and the main contents of PFMI can be incorporated into the oversight and supervision framework of the NRB. For instance, in the case of a deferred net settlement system, credit exposure occurs during the payment and settlement process, and financial resources should be maintained sufficient to cover the net debt of the two participating institutions that incur the maximum credit exposure during the day. In addition, a business continuity plan should be secured to deal with incidents that cause significant operational disruption. The plan should include operating a second processing center and restoring IT systems within two hours.

Third, the Nepal Rastra Bank should automate the payment data collection process as much as possible. There are several things to consider regarding the automation of information collection. Above all, not only the Nepal Rastra Bank but also the banks participating in the RTGS system operated by the Bank should automate data processing. Also, the proportion of inter-bank settlements processed using the "General Ledger" system should be minimized and the

proportion of settlements through the RTGS system should be increased. Furthermore, information on indirect participants should also be collected, which is necessary to control systemic risk originated from those participants

Fourth, the risk-based monitoring function should be expanded and risk analysis capabilities should be fostered. There is a need to conduct periodic risk monitoring. It is also very important to collect payment & settlement data through monitoring or other channels and analyze it. In order to learn about Korea's experience in systemic risk analysis, the Bank of Korea can be requested for related know-how and software codes used for systemic risk analyses.

Finally, IT security and cyber resilience should be strengthened. The operator of the payment system and the participating institutions should comply with the cyber resilience guidelines. For example, even if the RTGS system operated by the Nepal Rastra Bank complies with a high level of cyber security, if the IT system of the participating institution is vulnerable to cyber risks, the RTGS system of the Nepal Rastra Bank may become under cyber threats. Therefore, a business continuity plan should be established with a focus on cyber resilience, and education and training should be strengthened to practically secure business continuity.

Chapter IV discusses cross-border payments. Cross-border payments refer to transactions between individuals, companies, or financial institutions across different countries. The demand for efficient cross-border payments have surged due to globalization, international trade and the growth of e-commerce. Cross border payments have become an essential component of the global financial ecosystem, with a significant push in Asia, especially in countries like India, China, Nepal and others. These initiatives are driven by both the private sectors (fintech companies) and national governments, aiming to enhance economic connectivity, facilitate international trade, and promote financial inclusion. There has been notable advancements in the rise of mobile payments and the expansion of cross-border payment networks, especially in the South-East Asian region, integrating systems like QR codes for easier cross-border transactions.

Nepal's cross-border payments ecosystem involves several financial institutions including commercial and development banks, payment system operators and

payment service providers that uses various methods such as SWIFT, card networks and QR codes which facilitate remittances and trade-related transactions. Similarly, various initiatives by India have paved the way for deeper integration of Indian payment infrastructure into the global payment ecosystem and nearby countries, with a focus on simplifying remittance flows, merchant payments and providing cost-effective, instantaneous payment options across borders.

The cross border payments in China in driven by two major fintech giants Alibaba and We Chat Pay which have revolutionized the way payments are made, moving away from traditional cash systems to mobile-based solutions, thus facilitating smoother transactions. In Sri-Lanka and Bangladesh too the digital payments across borders have allowed for seamless remittance flows in the nations. The initiatives such as G20 Roadmap, Swift GPI and Swift Go, ISO 20022 Standard, Fast Payment Systems (FPS), Project Nexus have been introduced and these initiatives are set to make the future of cross-border payments faster, cheaper and more efficient.

The benefits of cross-border payments are huge that include economic growth and foreign investment, financial inclusion through the use of digital payments systems, and boosting of tourism, consumer spending and enhanced global trade. The growing integration of national payment infrastructures across Asia has the potential to further streamline cross-border payments. By reducing cost, improving transparency, and enhancing speed, these initiatives are helping to foster economic growth in the region and support the needs of both consumers and businesses in an increasingly globalized economy.

While the benefits of cross-border payments are substantial, there are inherent risks and challenges associated with it. The major challenges includes compliance and reconciliation issues, dispute resolution and management, cybersecurity risk, and potential economic instability. The key concerns are related to regulatory compliance along with AML/CFT risks, cybersecurity and data privacy, the economic risks that affect foreign exchange and capital flows, and regulatory fragmentation and operational complexity. These risks and challenges need to be carefully managed to make cross-border payments robust and resilient. By adopting international collaboration and standards, investing in payment infrastructure, and ensuring strong regulatory oversight in consumer protection

and foreign exchange and capital flows, countries can maximize the benefits of cross-border payments while mitigating the risks associated with cross-border payments. With the right policies in place, Nepal, like many other nations, can leverage the benefits of cross-border payments to strengthen its economy.

It was confirmed that the cross-border payment systems of Korea and Nepal are not fundamentally different, as both countries utilize cross-border payment methods that have long been established as international practices, such as the correspondent banking system, SWIFT, and remittance systems. However, there are differences in several aspects, and it was recognized that this topic is currently being pursued in many countries and that it is an area that both Nepal and Korea should continue to develop in the future.

In particular, in the case of Nepal, the NRB-led QR code standardization initiative and the establishment of a national retail payment switch encompassing most retail payment systems are evaluated as noteworthy policies in response to the recent rapid expansion of QR-based payment systems in major countries due to their cost and ease of use. This is because QR-based payment system and the retail payment switch will provide a very useful foundation for cross-border payments linkages.

Meanwhile, while enabling cross-border payments opens the door to global opportunities, it also accompanies risks, requiring a careful approach. Key risks to consider include anti-money laundering and counter-terrorism financing (AML/CFT), compliance, payments, settlement and reconciliation, dispute resolution, interoperability, cyber security, data privacy, fraud, foreign exchange abuse, and negative impacts on national balances. However, cross-border payments could help promote financial inclusion by extending financial services to the unbanked in rural Nepal, where remittances are a major source of income. A streamlined cross-border payment system could also increase Nepal's attractiveness to foreign investors and companies, leading to economic growth opportunities.

Since remittances from overseas Nepali workers are a major source of foreign exchange income for Nepal, the development of cross-border payments can improve the speed of remittances and related costs. Cross-border transactions have significant potential to improve Nepal's payment infrastructure and promote

economic development at the same time. Nepal seems to have the potential to create a progressive and accessible financial environment through strategic policy implementation while resolving raised issues.

In conclusion, in order to successfully promote the linkage of payment systems between countries with economic and financial cooperation relations with Nepal, the following points should be kept in mind from a strategic perspective. First, it is important to base it on a survey of the needs of end-users and payment system operators of both countries. Second, it would be desirable to prioritize the promotion of countries with which there is a deep level of exchange in terms of human and trade.

Third, the domestic system should be improved to a linkage model that ensures interoperability with cross-border payment systems. Fourth, it is urgent for the public sector, such as the central bank, to play a leading role in this regard. Fifth, it is necessary to focus on meeting domestic conditions related to the four targets set by the FSB. In addition, it is considered important to secure domestic laws, payment system rules, messaging standardization, and system technical capabilities to meet the prerequisites for interlinking multilateral cross-border payment systems in the form of hub-and-spoke, such as Project Nexus.

II. Electronic Funds Transfers: Large Value Payments and Retail Payments

1. Overview

The Financial Action Task Force (FATF) Recommendations defines a wire transfer as "any transaction carried out on behalf of an originator through a financial institution by electronic means with a view to making an amount of funds available to a beneficiary person at a beneficiary financial institution, irrespective of whether the originator and the beneficiary are the same person[1]."

There are two types of wire transfers: domestic ones and cross-border or international ones. The FATF Recommendations continues to define domestic wire transfers as "any wire transfer where the ordering financial institution and beneficiary financial institution are located in the same country[2]", and cross-border wire transfers as "any wire transfer where the ordering financial institution and beneficiary financial institution are located in different countries[3]".

In this sense, wire transfers could be interpreted as electronic funds transfers as most of funds transfers are processed electronically in terms of payment instruments, channels, clearings, and settlements. All the flow of information and messages are transmitted in an electronic way.

As will be observed in the later part of this report, payment ecosystem in Nepal and Korea have something in common in the way that both countries boast of diverse payment instruments and channels including mobile banking, QR codes, Smart POS, Virtual cards, let alone large value payment systems operated by respective central banks. It would be worthwhile to discuss characteristic features of payment and settlement systems of two countries in order that any meaningful policy implications are drawn for the safety and efficiency of

1) The Financial Action Task Force (2023).
2) It additionally explains that domestic wire transfers include any chain of wire transfer that takes place entirely within the borders of a single country, even though the system used to transfer the payment message may be located in another country.
3) Likewise, wire transfers where the originator and beneficiary are in the same jurisdiction, but where one or more correspondents in a third country are used, would consequently be considered a cross-border wire transfer.

payment systems as a whole. This is of particular importance since central banks are confronted by challenges posed by ever-evolving payments landscape. To that end, both countries are to share their past success stories as well as failure experiences through the following parts.

The Nepalese payment system is predominantly a cash and cheque-based system; nonetheless, there has been a remarkable stride in the adoption of digital payments, especially after the Covid-19 pandemic. The onset of electronic payments can be traced back to 1990 when credit cards were issued for the first time in Nepal. In 1995, ATM machines were introduced, and with this development, the adoption of card as a medium of payment started in Nepal. Along with card-based payments, other electronic payment systems like internet banking (in 2002) and SMS banking (in 2004) began from early 2000s. In 2010, e-Wallets entered the payments industry. With this, non-bank players were allowed to undertake payments-related activities in Nepal.

The NRB, as part of its responsibility to develop a secure, healthy, and efficient payment system, has empowered Nepal Clearing House Limited (NCHL) to operate the Electronic Cheque Clearing (ECC) System in 2011. Considering the rapid evolution of the payment systems in Nepal, the National Payment System Development Strategy (NPSDS), 2014 was issued, based on which there have been efforts to modernize the payment system by identifying key areas/ infrastructures for development and prioritizing fintech and digital economy development strategies.

Today, fast payment systems like connectIPS and interbank fund settlement system (IBFT) are widely used, with Quick Response (QR) code-based person-to-merchant payments experiencing exponential growth. For time-critical and high value payments, NRB has been operating the Real Time Gross Settlement System (RTGS) since 2019. The RTGS system is the central infrastructure of the national payment system.

NRB is further tasked with the implementation of the National Payment Switch (NPS) to facilitate domestic settlements of all payment related transactions accomplished within the domestic territory or using the instruments issued within the domestic territory. The Retail Payment Switch, which is the non-card component of the NPS and is responsible for the switching and settlement of

payments through digital instruments except for cards, has been operational since 2021. The card component of the NPS is under-development. As part the first pillar of the NPSDS, 2014, the following act and policies have been formulated:

- Payment and Settlement Act, 2019
- Retail Payment Strategy, 2019
- RTGS System Rules, 2019
- Payment and Settlement Bylaws (First Amendment, 2023), 2020
- Digital Lending Framework, 2021
- Nepal QR Standardization Framework and Guidelines, 2021.

The Payment Systems Department (PSD) was established in 2015, after which the NRB started issuing licenses to Payment System Operators (PSOs) and Payment Service Providers (PSPs). As of Mid-July, 2024, there are 9 licensed PSOs and 26 licensed PSPs in Nepal. Moreover, all 20 commercial banks, 17 development banks, 15 finance companies, and 11 microfinance financial institutions have also been licensed as PSPs.

In 2016, the Interbank Payment System (IPS) was launched by NCHL, facilitating fund transfer between multiple banks without the need of a cheque. The interbank payments were further simplified with the introduction of real time, fast payment systems: connectIPS in 2018 and Fonepay IBFT in 2019.

Furthermore, for the development of retail payment systems, NRB implemented the Retail Payment Strategy, 2019. Based on the strategy, the existing legal frameworks have been reviewed and revised. The NRB I/O PSD has amended and/or implemented new polices such as Payment and Settlement Bylaw (First Amendment, 2023), 2020; Licensing Policy for Payment Related Institutions, 2023; Simplified KYC for Small Merchants, and Nepal QR Standardization Framework and Guidelines, 2021, Procedure for Onsite Inspection of Payment-related Activities of Banks and Financial Institutions, 2024, among others.

Nonetheless, NRB is wary of new forms of risks, technical, operational, and risks related to money laundering/ terrorism financing/proliferation financing, using new payment methods and digital financial services. In this regard, NRB issues directives, circulars, and policies and undertakes the supervisory/ oversight

function for the licensed institutions. To strengthen the oversight capabilities, NRB has formulated the following policies:

- Payment System Oversight Framework, 2018
- Payment System Oversight Manual, 2021
- Payment System Inspection and Supervision Bylaws, 2021
- Cyber Resilience Guidelines, 2023
- Procedure for Onsite Inspection of Payment-related Activities of Banks and Financial Institutions, 2024.

Moreover, the electronic payment ecosystem is multi-disciplinary in nature, requiring stakeholders from various industries, such as banking, telecommunication, technology development, fintech companies, various department of the Government of Nepal (GON), etc. For collaborative decision making and redressal mechanism, PSA has a provision of the National Payment Board with the representation from the Ministry of Finance, Nepal Telecommunication Authority, and Financial Comptroller General Office (FCGO). On a need basis, the Board may invite representatives from any licensed institutions or related departments of the GON. The primary responsibilities and duties of the Board are as follows:

- To make the payment system secured, managed and effective, and to arrange for policies for financial stability, risk mitigation, promotion of reliability of payment system and modernization of payment system;
- To co-ordinate among companies related with payment system;
- To regularly monitor, surveil and oversee work related with payment system;
- To give direction to the companies and Communication Service Providers in order to secure and manage the activities relating to payment system;
- To take-action against the institutions acting in contrary to this Act or to direct the concerned department of the bank to write to the concerned agency to take-action; and
- To form different technical committees and subcommittees in order to

monitor, regulate and oversee that the payment system is operated in secured and managed way.

2. Large Value Payment System in Korea: BOK-Wire+

Bank of Korea Financial Wire Network (BOK-Wire+, hereafter referred to as BOK-Wire) is the one and only large value, real-time gross settlement (RTGS) system developed and operated by the Bank of Korea (BOK)[4]. It allows participating financial institutions to access their current accounts held at the BOK online and deposit or withdraw funds from these accounts. BOK-Wire also provides funds transfer services for short-term financial market transactions such as call transactions between financial institutions, for designated-time net settlement of obligations cleared through retail payment systems, for the cash-leg of securities settlement, and for KRW-denominated settlement of FX transactions.

BOK-Wire had been initially developed and put into operation in 1994 and the 2nd generation BOK-Wire, equipped with a hybrid mechanism to save participating institutions' intraday settlement liquidity through a bilateral and multilateral simultaneous offsetting algorithm, became on stream in 2009.

The BOK has continuously expanded the services of BOK-Wire and made processes more sophisticated as well since the commencement of RTGS system. Furthermore, the BOK has been improving the BOK-Wire in response to the development of the payment ecosystem such as the evolvement of financial innovation, the advancement of IT, and the growth of settlement volume and value in the financial markets. For example, the delivery versus payment (DVP) service for securities settlement was first introduced in 1999 and the payment versus payment (PVP) service for FX settlement was started in 2004.

All of these have led to the development of the 3rd generation BOK-Wire. The current system, the 3rd generation BOK-Wire, has been launched in 2020 after five years of overall refurbishment[5].

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4) The most conspicuous feature of RTGS system is that it guarantees the irrevocability of transactions with central bank money and contributes to the reduction of settlement risks as a result.

5) The 3rd generation development project set three main goals: enhancing settlement efficiency for participants, offering greater convenience to participants, and making the system capable of

Major features of BOK-Wire by generation is briefly discussed in Table 2-1.

<Table 2-1>

Major Features Of Bok-Wire By Generation

	1st Generation	2nd Generation	3rd Generation
Mechanism	- RTGS	- RTGS and Hybrid	- RTGS and Hybrid
Settlement Account	- Current Account	- Current Account: RTGS - Settlement only Account: RTGS & Hybrid	- General Current Account: RTGS - Current Account for Settlement: RTGS & Hybrid
Queuing Arrangement	- FIFO - Bypass FIFO	- FIFO - Bypass FIFO	- FIFO - Bypass FIFO
Payment Order	- Reordering	- Priority Payment Order: FIFO - Normal Payment Order: Bypass FIFO	- Priority Payment Order: FIFO - Normal Payment Order: Bypass FIFO
Liquidity Savings	-	- Multilateral offsetting (every 30 minutes) - Bilateral offsetting (every 5 minutes)	- Multilateral offsetting (every 5 minutes)
Liquidity Management	-	- Net Payment Limit for Normal Payment Orders	- Net Payment Limit for Normal Payment Orders
Liquidity Supply	- Intraday Overdraft	- Intraday Overdraft - Intraday Repo	- Intraday Overdraft - Intraday Repo
Monitoring & Analysis	- Account & Settlement inquiry - Queue management	- Payment & Settlement Information System	- Data warehouse for Payment & Settlement Information System
Network Connection	- Client-Server	- Client-Server - Server-to-Server (STP)	- Client-Server - Server-to-Server (STP)

being flexibly adjusted in response to changes in the payment and settlement industry. These goals have been realized as: simplifying settlement algorithm, shortening multilateral simultaneous settlement intervals, improving intraday overdraft, realigning settlement accounts, improving the DVP settlement structure, enhancing Payment and Settlement Information System, etc.

A. Legal Basis

A direct legal ground for the BOK to develop and operate BOK-Wire can be found in the BOK Act and the Regulation on the Operation and Management of the Payment and Settlement Systems.

The BOK Act provides a legal ground for the operation of BOK-Wire. As per Article 81 of the Act, the BOK may determine all necessary matters concerning BOK-Wire in order to promote the safety and efficiency of overall payment and settlement systems. The provision makes it clear that the purpose of the payment-related tasks performed by the BOK is to promote the safety and efficiency of all Korean payment and settlement systems as a whole. It also stipulates that the BOK shall determine matters related to the safety and efficiency of the systems for which final settlements are made through, or which are connected to, BOK-Wire. Besides, according to Article 81-2 of the Act, the BOK may provide temporary intraday liquidities to participating institutions to sort out any shortage of funds.

In the meantime, in accordance with Article 28 of the BOK Act, the Monetary Policy Board of the BOK sets out detailed regulations and sub-regulations in its Regulation on the Operation and Management of the Payment and Settlement Systems. The Regulation has provisions for the operation of BOK-Wire: basic principles, businesses, eligible participants, net settlement, operating hours, types of transaction, fee schedule, business continuity plan, interconnection of domestic or overseas systems, sanctions, etc[6].

With regard to the finality of settlement, the Debtor Rehabilitation and Bankruptcy Act guarantees the settlement finality of BOK-Wire[7]. Payment instructions sent through BOK-Wire, and clearing or settlement procedures conducted through BOK-Wire, are not be cancelled or rescinded under any circumstances, including the insolvency of participants in the BOK-Wire system.

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6) In accordance with the Regulation, BOK-Wire has been designated as one of 10 Systemically Important Payment Systems (SIPS) in the country and put under the oversight framework of central bank as a result.

7) According to the Act, BOK-Wire has been designated as the payment and settlement system that subject to settlement finality in August 2006.

B. Basic Rules for Operation

(1) Operating Organization

The Payment and Settlement Systems Department is responsible for operation policy on BOK-Wire, while Information Technology Department is in charge of the IT operation of the system. The Payments Policy Division of the Payment and Settlement Systems Department deals with overall issues on payment and settlement policy including BOK-Wire. Besides, the Office of Treasury and Debt Securities manages daily operation of BOK-Wire. Furthermore, the Payment Oversight Division of the Payment and Settlement Systems Department takes charge of overseeing payment and settlement systems.

(2) Participation

The institutions which want to participate in BOK-Wire are required to enter into an agreement for current account transactions with the BOK. To get permission to participate, the applicants should meet participation standards relating to financial soundness, the number of staff responsible for BOK-Wire, and estimated transaction volume. The requirements explained in participation standards are as follows:

- Having a current account with the BOK,
- Having more than 50 expected monthly transactions,
- Having more than 4 dedicated staff members,
- Meeting financial soundness (Management Guidance Ratio) set by supervisory authorities, and
- Having separated terminals or places for business continuity.

A more detailed participation standards are explained in Table 2-2.

The BOK assesses the requirements every year to reconfirm the eligibility of participating institutions. If certain institutions fail to meet these standards, BOK recommends institutions concerned take corrective measures, withdraw from participation, or terminate the relevant contract.

Main participants are domestic banks, branches of foreign banks, financial investment companies, insurance companies, Korea Exchange, Korea Securities Depository, Korea Deposit Insurance Corporation, Continuous Linked Settlement (CLS), etc.

<Table 2-2>

Participation Standards For BOK-Wire

Classification	Details of standards
1. Financial Solvency[1)]	a. Bank: Total capital ratio under the Regulation on Supervision of Banking Business should be over 8%. b. Merchant Bank and Securities Finance Company: Equity capital ratio against risk-weighted assets under the Regulations on Financial Investment Business should be over 8%. c. Financial Investment Company - Type 1: Net capital ratio under the Regulations on Financial Investment Business should be over 100%. - Type 2: Equity capital under the Regulations on Financial Investment Business should be over the minimum capital requirement. d. Insurance Company: Solvency margin ratio under the Regulations on Supervision of Insurance Business should be over 100%. e. Other Institutions: Financial solvency standards that Director General of Payment and Settlement Systems Department specify.
2. Expected Usage	Monthly average usage above 50 for one year.
3. Dedicated Staff	OTP[2)] Users: no less than 2 Terminal[3)] Users: no less than 2 (Total: 4+)
4. Business Continuity	Terminals be installed in two or more separated buildings in preparation for any system failure or disaster.

Note:1) Should there be no supervisory institutions or financial solvency standards, these standards shall not be applicable. The specified financial solvency standards are based on the ratio, etc. that the relevant institution specify immediately before the day of application for participation. As to a newly created institution, the expected ratio, etc. at the end-day of the year in which participation begins.
2) Refers to an instrument that generates a one-time password for important transactions.
3) Participant's PC registered with the BOK solely for the purpose of BOK-Wire.
Source: BOK (2024b, 2024c)

In the beginning, the number of participants was 115 and increased to 158 in 1997. The number, however, has dropped due to the reorganization of the financial industry after the Asian financial crisis. As of the end of 2023, the number of participants stands at 133, comprising 20 domestic banks, 33 branches of foreign banks, 44 financial investment companies, 19 insurance companies, and 17 other institutions.

(3) Operating Hour

Participating financial institutions can send funds transfer messages between 09:00 and 17:30 during business days. Nevertheless, the BOK may temporarily change or extend operating hours in case of any disruptions in the system, concentration of multiple funds settlement, or any other inevitable circumstance s[8]. In addition, the closing times for message inputs in relation to significant transactions are set for the smooth operation of the system. Those transactions and the closing times are as follows:

- 14:20 DVP settlement for repayment of electronic short-term bonds
- 15:50 Deposit for payment for government bonds issuance
- 16:00 Request for current account debit for Treasury Funds payment
- 16:00 Application for funds to resolve temporary shortages of settlement funds
- 17:00 Request for funds transfers for a designated beneficiary
- 17:00 Request for funds transfers for linked settlement (with Electronic Banking System of Korea Financial
- 17:05 Telecommunications and Clearings Institute (KFTC))
- 17:20 Repayment of funds to resolve temporary shortages of settlement funds
- 17:50 Request for funds transfers for DVP settlement Intraday overdraft repayment

8) For example, the closing time of BOK-Wire has been postponed 12 times with 70 minutes of the average extended time during 2023.

- 18:00 Deposit in, withdrawal from, liquidity adjustment of deposit accounts
- 18:30 Funds transfers involving CLS Bank International as either a requesting participant or receiving participant, or for intraday overdraft repayments related to such funds transfers (from the last Sunday of October to the last Sunday of March of the following year)
- 18:40 Deposits in, withdrawals from, and liquidity adjustment of deposits related to CLS settlements (from the last Sunday of October to the last Sunday of March of the following year)

The standard operating hours have been extended several times in response to issues arising from the concentration of funds transfer messages during closing time and to process a simultaneous PVP settlement for the CLS system.

(4) Settlement Account

Participants maintain two separated current accounts at BOK for all the transactions of financial market activities. Transactions are settled through Current Account for Settlement or General Current Account depending on the nature of transactions.

The Current Account for Settlement is used for funds transfers between participants, net settlements, and CLS funds transfers. It is to provide participating institutions with the convenience of funds management in dealing with routine transactions, such as ordinary funds transfers or transfers of call funds, within the same account. The General Current Account is for funds transfers between BOK and participants that occur in relation to BOK loans or the issuance or redemption of government and public bonds.

Table 2-3 summarizes the settlement account, applied transactions and settlement type in BOK-Wire.

<Table 2-3>

Settlement Account, Transaction and Type in BOK-Wire

Account	System	Transactions	Type
General Current Account	Treasury	Treasury funds transfers	pure RTGS
	Securities	Issuance/redemption of MSBs, government bonds, and public bonds	
	Deposits	Funds transfers between HQ and branches of BOK	
	Loans	Provision/repayment of collateralized loans Provision/withdrawal of intraday overdraft	
Current Account for Settlement	Large value payments	Net settlement CLS PVP funds transfers General funds transfers Call transfers DVP settlement Linked settlement (with EBS of KFTC) Funds transfers between HQ and branches of BOK	Hybrid
	Loans	Provision/repayment of intraday overdraft	

Source: BOK (2024b, 2024c)

(5) Usage Fee

All participating financial institutions and payment system operators that use BOK-Wire are required to pay fees and other related costs. Fees are determined based on a policy of subsidized pricing in order that the direct costs of the development, maintenance, and operation of the system can be redeemed. Fees are divided into monthly fixed fees of KRW 100,000 and per transaction fees between KRW 200 and 4,000, with the latter varying with the time of transaction. Relatively lower per transaction fees (KRW 200) are applied to funds transfers sent prior to 16:00, and relatively higher ones (KRW 4,000) on those sent after 16:00, for the purpose of encouraging participants to put in their payment instructions as early as possible.

However, since linkages of other payment and settlement systems with BOK-Wire have been established for the policy purpose of the BOK, the BOK

bears the cost.

A detailed usage fee charged to participants are summarized in the following Table 2-4.

<Table 2-4>

Usage Fee Schedule of BOK-Wire[1)]

(Unit KRW / Transaction)

Transactions	Before 16:00	From 16:00 to 17:30[2)]	After 17:30[3)]
Fixed fees (monthly)[4)]	100,000		
KRW funds transfers[5)]	200	700	4,000
KRW funds transfers for CSL settlement	2,000	2,500	5,500
Foreign currency transfers	200	700	4,000
Government bonds transactions[6)]	200	700	4,000
Cancelation[7)]	1,000	1,000	1,000

Note:1) Applied based on application time. However, based on the settlement completion time for funds transfer business settled after 17:30.
2) In case of funds transfers related to the transactions listed, 17:30 changed to times below: a. Repayment of intraday overdraft: 17:50, b. Deposit in/withdrawal from and liquidity adjustment of deposit: 18:00.
3) When funds transfer occurs after 17:30 because of BOK system failure or any other specified reasons, fees for the period of 16:30~17:30 are charged. If a BOK system failure occurs before 16:00 and is resolved after 17:30, fees for before 16:00 are applied to all funds transfers.
4) In case of new participation, calculated daily from the starting day.
5) Exemption in case of linked settlements with EBS of KFTC.
6) MSB of BOK issuance and repayment, purchase of government and public bonds, and government bonds issuance and repayment.
7) Not applicable to transfer applications canceled by BOK.

Source: BOK (2024c)

C. Arrangements for Smooth Settlement[9)]

(1) RTGS and Hybrid Mode

BOK-Wire provides two kinds of settlement services: a pure RTGS mode and a hybrid mode. The hybrid mode is operated based on a combination of RTGS

9) The 3rd generation BOK-Wire has adopted various features to enhance the efficiency as well as the safety of the system. Outstanding improvements are: i) simplification of settlement algorithm, ii) realignment of settlement accounts, and iii) enhancement of Payment and Settlement Information System.

and a multilateral netting with a view to making the most of liquidity saving features.

The funds transfers made through BOK-Wire are all KRW transactions between BOK-Wire participants with their current accounts at BOK, regardless of the nature of transactions. The primary types of transactions available through BOK-Wire are as follows:

- Settlement for call transactions: both the supply and repayment of call funds among participants' accounts with the BOK.
- Beneficiary-designated funds transfers: a third-party transfer service by which BOK-Wire participants can transfer large value funds of their individual or corporate customers.
- DVP settlement: executing transfers of funds and delivery of securities simultaneously.
- PVP settlement: executing funds transfers of KRW by BOK and funds transfers of the corresponding foreign currency by the counterparty central bank simultaneously.
- Designated-time multilateral net settlement: final settlement of net obligations arising from transactions in retail payment systems operated by KFTC.
- Management of Treasury Funds: collecting Treasury Funds from financial institutions and conducting government and public bond-related businesses such as issuance of bonds, the establishment of the rights of pledge, changes in registration of ownership of title, and repurchases of and repayments of bonds at maturity.

As shown in the above Table 2-3, transactions pass through the pure RTGS or the hybrid channel depending upon their nature.

(2) Queuing Algorithm

When the available balance in the general current account of a requesting participant is insufficient, the funds transfer request message shall be stored in a

queue file. Later on, the process will be executed in sequence based on the "first in, first out" (FIFO) principle as soon as the balance becomes sufficient.

However, if any funds transfer request remains in a queue even though the requesting participant's general current account balance is sufficient for settlement, as the requests for larger amounts of funds wait ahead of it in a queue, then it may be processed on a by-pass FIFO basis. The request that remains pending until the closing times of the system may not be processed.

(3) Liquidity Saving Mechanism

There can be two different settlement mechanisms that provide a liquidity saving: bilateral and multilateral simultaneous settlement. In a bilateral simultaneous settlement, when a new payment order enters into BOK-Wire, the system extracts any payment orders of the counterparty from its queue and carries out the settlement. In a multilateral simultaneous settlement, all the queued payment orders are offset against one another at a certain time interval to calculate the projected amount of outflow and inflow of funds. Then all payment orders that can be offset are settled simultaneously.

The multilateral simultaneous settlement is the only liquidity saving mechanism adopted in the 3rd generation BOK-Wire system[10]. Instead, the time interval for multilateral simultaneous settlement has been shortened to five minutes from the previous 30 minutes to further improve the efficiency of settlements.

On the other hand, the settlement procedures apply to different processes depending on the type of payment orders. When a participant initiate a funds transfer by submitting a Priority Payment Order, the gross settlement is applied if the liquidity in the Current Account for Settlement is sufficient, otherwise, the payment instruction goes into a queue file and is processed through a multilateral simultaneous settlement every five minutes.

When a funds transfer is submitted in a Normal Payment Order, the settlement is not processed immediately regardless of the amount of liquidity in the settlement account. The payment instruction is saved in a queue file and then

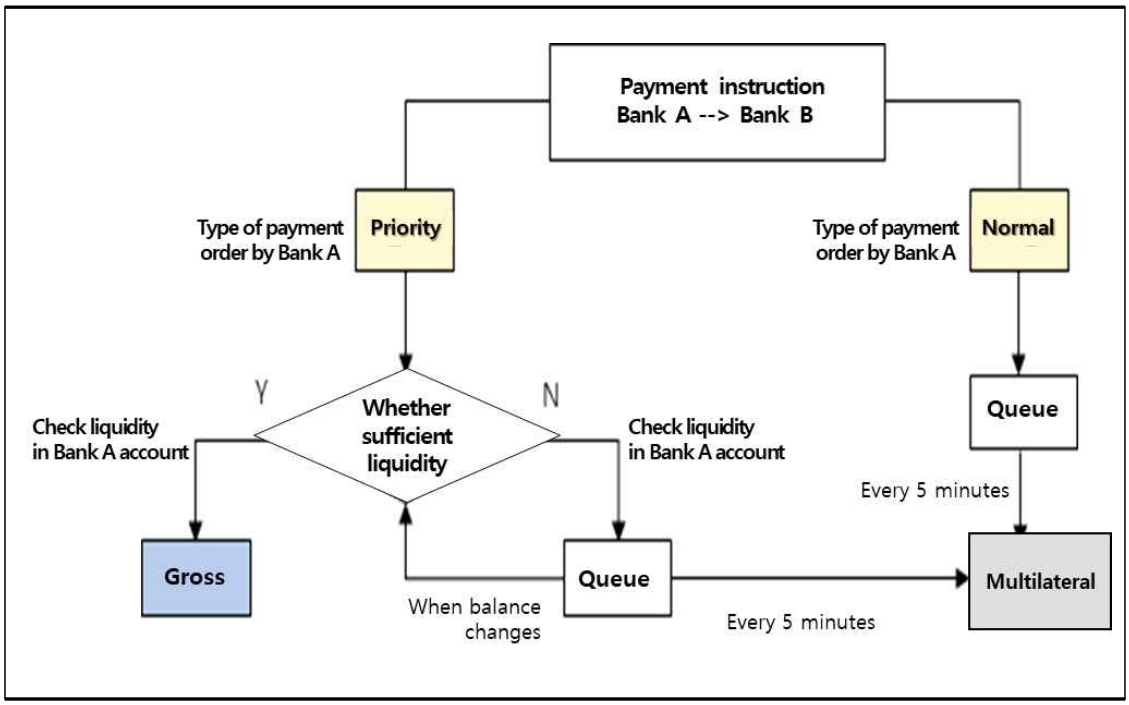
10) The bilateral simultaneous settlement has been abolished in the 3rd generation as per analyses that the method provides no additional liquidity saving benefit whereas it makes net settlement algorithms too complex to be executed smoothly.

processed in five minutes through multilateral settlements instead.

These two different modes of payment instructions are illustrated in Figure 2-1.

<Figure 2-1>

Two Modes of Payment Instructions: Priority and Normal



Source: BOK (2020)

(4) Designated Time Arrangement

BOK-Wire manages a designated time arrangement for funds transactions that need to be completed at a certain fixed time during the operating hours.

Funds transfers requested by participants during the operating hours are processed according to established procedures immediately upon receipt. However, the multilateral net settlement obligations, arising from retail payment systems, cleared and requested by KFTC for final settlement is processed at a relevant designated time. In addition, repayment of call funds with a specified repayment date and retrieval of treasury funds collected by financial institutions are also processed at its designated time.

This is to enable participants to manage liquidity predictably and efficiently by processing a large number of transactions in which multiple participants are

interlinked together at a specific point in time, while promoting convenience in settlements as well.

In relation to the application of the designated time processing, processing priority is pre-determined in case the designated processing time is the same in order to support the time-specific liquidity management of participants[11]. Besides, pre-arranged funds transfers for net settlement, which are used as a means of raising insufficient funds for net settlement, are processed simultaneously with net settlement, allowing RTGS to operate in a more smooth way.

The designated times and relevant transactions are shown in Table 2-5.

<Table 2-5>

Designated Times and Relevant Transactions in BOK-Wire

Settlement time	Transactions
11:00	Net Settlement: - Giro - ATM Network - Interbank Remittance Network - EFT/POS System - CMS - Local Bank Shared System - B2C Electronic Commerce Payment & Settlement System - B2B Electronic Commerce Payment & Settlement System - Electronic Banking System (including Open Banking System) - Electronic Bill transactions and transactions through KFTC - Cross-border Payment Network
11:00	Morning pre-arranged funds transfers
11:05	Repayment of overnight call transactions
14:00	Collection of treasury funds received
14:05	Repayment of morning half-day call transactions
16:00	Deposit of foreign currency (for JPY following day 09:30)
16:05	Repayment of afternoon half-day call transactions

Source: BOK (2024c)

11) The processing priority for the same designated time is as follows: (1) net settlement among participants, pre-arranged funds transfers between participants including the HQs and branches of a participant, (2) other remaining pre-arranged funds transfers, and (3) retrieval of collected treasury funds.

(5) Provision of Intraday Liquidity

The BOK supplies intraday overdrafts and intraday repos to prevent settlement delays and gridlocks. If any participant's balance on its current account at BOK is insufficient, the BOK automatically extends loans, up to a predetermined limit, in order to support intraday settlement and thus reduce liquidity risk. This intraday overdraft loan is extended only to banks that are subject to reserves requirements, and interest is charged on any overdraft loan exceeding 25% of the equity of the bank receiving it.

In the mean time, non-bank participants such as securities companies, which are ineligible for intraday overdraft, can use intraday repo transactions to make up for their shortages of funds only for securities settlement. Both intraday liquidity facilities are fully collateralized by government bonds, government-guaranteed bonds, etc. Main features of intraday liquidity facility are summarized in Table 2-6.

<Table 2-6>

Intraday Overdraft and Intraday Repo

	Intraday Overdraft	Intraday Repo
Purpose	Provide intraday liquidity for all types of settlements	Provide intraday liquidity only for securities settlement
Eligible participants	Banks	Korea Exchange (KRX) and qualified securities companies
Interest and limit	Interest-free (in case of loans exceeding 25% of participant's capital, a certain level of interest is applied)	Interest-free (KRX: No limit, securities companies: 25% of capital)
Available time	Supply: 09:00 ~ 17:50 Redemption: by 17:50	Supply: 09:00 ~ 16:00 Redemption: by 17:05
Late or no redemption	Conversion to Liquidity Adjustment Loan	Reduce limit, penalty RP rate, suspension of participation, etc.

Source: BOK (2024b, 2024c)

(6) Net Payment Limit

The participants of BOK-Wire are able to set and operate, on their own, the upper limit of the daily net funds outflow from their current accounts for settlement in relation to their normal payment orders, which is called the net payment limit.

When a normal payment order is entered, even if the balance of current account for settlement is sufficient, it will be directly saved in the queue file. However, when processing a priority payment order newly entered by any participant, if the balance of current account for settlement is sufficient, it will be settled regardless of the preset net payment limit. Instead, in case of insufficient balance of current account for settlement, it will not be settled and will be moved to the queue file.

Later, even if multilateral simultaneous processing is carried out for normal payment orders waiting in the queue file, if the net payment amount during the day exceeds the net payment limit, they will not be settled. Since any normal payment orders exceeding the net payment limit will not be settled, participants can enter normal payment orders early without worrying about a certain amount of outflow of settlement liquidity.

There are two types of net payment limits: a bilateral net payment limit set for any specific participant and a total net payment limit set for all participants. The net payment limit between the two parties refers to the maximum net payment amount that an individual participant can pay to a specific individual participant through the hybrid mode using normal payment orders for the day, and the total net payment limit refers to the maximum net payment amount that an individual participant can pay to all other participants using normal payment orders during one day. Table 2-7 is showing the application of net payment limit for payment orders.

<Table 2-7>

Application of Net Payment Limit (NPL)

		Sufficient Balance		Insufficient Balance	
		Under NPL	Over NPL	Under NPL	Over NPL
Priority Payment Order	RTGS	Settle		Queue	
	Hybrid				
Normal Payment Order	RTGS	x	x	x	x
	Hybrid	Settle	x	Queue	x

D. Net Settlement Risk Management[12)]

Most of funds transactions made through retail payment systems by KFTC are immediately credited to the recipients' accounts while the corresponding interbank net obligations are settled at the designated settlement time (11:00 AM) on the following business day through BOK-Wire. A participant's settlement failure could cause a materialization of systemic risk in BOK-Wire because of the time lag between funds transfers to customers and final settlement between financial institutions concerned. To control such settlement risk, the BOK has implemented a series of risk management arrangements for the deferred net settlement systems: net debit cap, collateral requirement and loss-sharing arrangement[13)].

The following is a brief outline of net settlement risk management since more detailed framework will be discussed in Chapter III.

12) Net settlement risk management may not be a business of BOK-Wire in the strict sense. However, BOK-Wire is not free from the spillover effect in the event of any failure of net settlement systems since the final settlement is carried out via BOK-Wire. This potential scenario led to the introduction of net settlement risk management arrangements in 1997.

13) In addition to this, as one of measures taken by the BOK to reduce credit exposures arising from retail payment systems, BOK-Wire has been interlinked to Electronic Banking System for the RTGS processing of large value funds transfers by corporate and individual customers of participants over KRW 1 billion (NPR 0.1 billion) since March 2016. The measure has been instrumental in reducing the amounts of multilateral net settlement as well as in relieving collateral burdens on participants.

(1) Net Debit Cap

Net debit cap, the first line of net settlement risk management, is to limit credit exposure of any one participant to retail payment systems. Every participant is required to set a ceiling of its own unsettled net obligation against the transactions settled on a net basis and for which funds transfer orders are sent on a real-time basis.

The unsettled net obligation is a participant's accumulated amount of unsettled outgoing funds transfer orders sent to other participants minus the accumulated amount of incoming funds transfer orders received from other participants. Suppose the unsettled net obligation of a participant reaches its net debit cap during a business day. In that case, the participant is not allowed to send any additional payment orders before it raises its net debit cap or receives enough incoming payment orders from other participants.

Retail payment systems that are subject to net debit cap comprise Interbank Remittance System, Local Bank Shared System, Electronic Banking System, Cross-border Payment Network, and Open Banking System[14].

Participants are asked to determine their net debit caps at their own convenience. However, the BOK has linked the net debit cap with the amount of collateral required by respective participant to avoid the setting of excessively high level. Moreover, the BOK may ask a participant to adjust its net debit cap when it deems the net debit cap excessive or insufficient compared to the value of any individual participant's unsettled net obligations in the past.

As of the end of 2023, the total value of net debit caps established by all participants stood at KRW 97.1 trillion, which is equivalent to NPR 9.45 trillion.

(2) Collateral Requirement

The purpose of collateral requirement is to complete the net settlement of retail payment systems in case of any participant's default. To this end, each participant is required to put up securities as collateral for meeting its settlement

14) In fact, the net debit cap is also applicable to a part of Check Clearing System, CD/ATM Network, and B2C E-Commerce System, through which payment orders are sent and received in real time and payment to customers are completed before net settlement among participants.

obligations. In the event of a participant's default, the BOK may dispose of the defaulting participant's collateral or use them as collateral for extending loans to complete the net settlement.

Securities eligible as collateral have to be highly liquid such as government bonds, government-guaranteed bonds, Monetary Stabilization Bonds (MSBs) of BOK, and special purpose bonds. The type of eligible securities has been continuously expanded to lighten the collateral burden on participants.

Two types of collateral requirements are applied based upon the characteristics of transactions. As of August 2024, the required collateral is 90% of the net debit cap for transactions subject to net debit cap. The ratio of collateral pledged relative to net debit cap has been gradually raised from the initial 10% over a long period of time and is planned to reach 100% after August 2025 to bolster credit risk management. In fact, the target year has been postponed because of the outbreak of COVID-19.

Market values of pledged collateral are evaluated daily to ensure proper maintenance of collateral values. Evaluation of haircut ratio is carried out on a monthly basis. As of the end of 2023, the total amount of pledged collateral is KRW 82.2 trillion (NPR 8.03 trillion), increased from the previous year's KRW 57.6 trillion.

(3) Loss-sharing Arrangement

Loss-sharing arrangement, the third line of net settlement risk management, is a mechanism of collective responsibility. When any participant defaults on net settlement, the BOK shall complete the settlement using the collateral posted by the defaulting participant. Loss-sharing arrangement is to finalize net settlement when posted collateral of the defaulting participant is still insufficient to fully cover net obligation of the defaulting participant. Allotment of each participant's share shall be determined based on the amount of respective collateral. Afterward, the defaulting participant has to repay other participants their loss-share contributions, including interest charged at the maximum rate of interest on the BOK's loans.

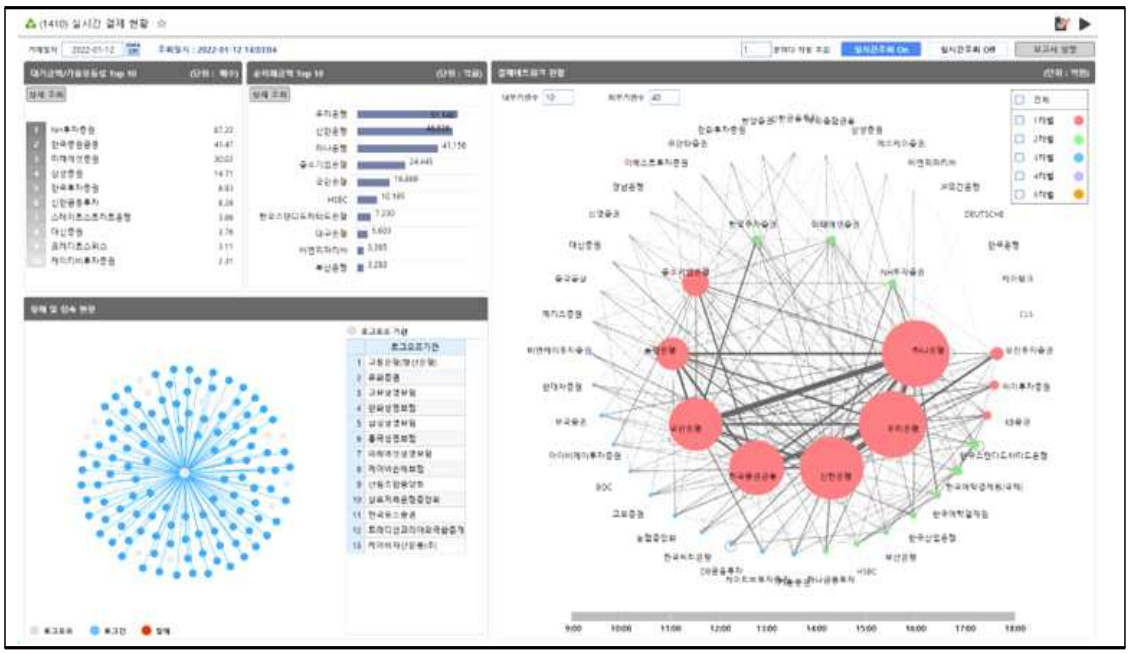
E. Payment and Settlement Information System

One of salient features of the 3rd generation BOK-Wire is the enhancement of Payment and Settlement Information System. To ensure a smooth operation of BOK-Wire as well as stable management of settlement risk, the previous monitoring system has been completely overhauled and been developed based on a data warehouse. Users of BOK-Wire have become able to effectively conduct real-time monitoring, analyze settlement data, and manage statistics including a range of operating information of BOK-Wire.

- Real-time settlement monitoring: new indicators such as available intraday liquidity and the intraday liquidity usage rate have been added for more effective real-time monitoring. (see Figure 2-2)

<Figure 2-2>

Example of Real-Time Settlement Monitoring



Source: BOK

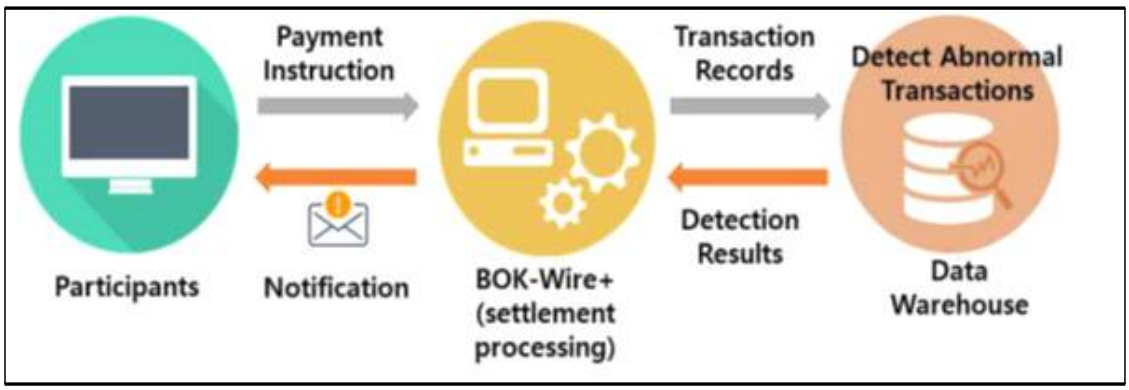
- Settlement risk monitoring: a liquidity stress test model has been implemented to analyze the impact of stress conditions, such as the potential default of some participants and its effects on other participants

as well as on the overall payment system[15].

- Abnormal transaction detection: the system sends an alarm to both BOK and participants concerned when it detects funds transactions that exceed a certain range or beyond past transaction history, or when it detects new funds transactions to a participant that has no record of transactions with the originating participant. (see Figure 2-3)
- Warning indicator dashboard: the function is to support early identification of the overall risk level of BOK-Wire.

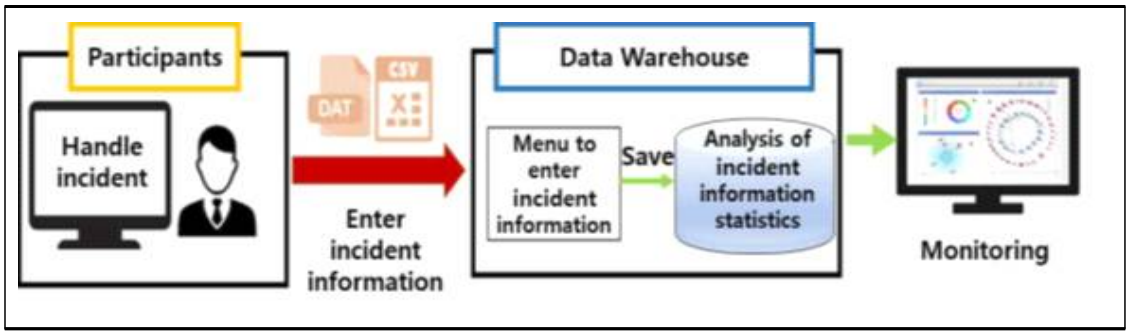
<Figure 2-3>

Abnormal Transaction Detection Function



<Figure 2-4>

Reporting Incident Information



Source: BOK (2020)

15) In case of a failure in a participant's system related to BOK-Wire, participants are required to immediately report details of the incident to BOK. Participants are also able to be notified of the details via BOK-Wire, and then the BOK can monitor and analyze the information more conveniently. (see Figure 2-4).

There also have been adopted other functions to bolster the safety features of the system, for instance, blind checks for funds transfers exceeding a certain threshold, restrictions on counterpart of funds transfers, and implementation of the process for cancellation of transactions reserved or in queue by consent. With regard to blind check, any funds transfer exceeding KRW 200 billion will require participants to re-enter the amount with the approval by the person in charge to ensure that participants check the right amount of the funds transfer one more time and to prevent possible mistakes in advance.

F. Recent Settlement Trend in BOK-Wire

The amount of large value funds transferred through BOK-Wire has been on a continuous upward trend year after year as it is shown in Table 2-8. The daily average volume of funds transfers made through BOK-Wire has recorded 23,289 transactions during 2023. The share of funds transfers for securities settlement, having 16,426 transactions, takes up 70.5% of total volume. In terms of daily average settlement value, a total of KRW 554.6 trillion have been settled through BOK-Wire in 2023. The share of securities settlement funds among total settlement value has shown 54.3%.

<Table 2-8>

Recent Settlement Trend of BOK-Wire (daily average)

(number of transactions)	2018	2019	2020	2021	2022	2023
Call Settlement	564	468	387	342	335	400
Securities Settlement	12,143	13,967	14,828	15,989	16,757	16,426
FX Settlement	689	594	549	514	528	615
Customer settlement[1)]	2,398	2,668	2,769	2,978	3,205	3,309
Net Settlement[2)]	244	241	239	237	240	238
Others[3)]	852	874	875	967	983	1,007
BOK-Participants	1,072	1,128	1,159	1,179	1,244	1,294
TOTAL Volume	17,962	19,939	20,806	22,206	23,290	23,289

(billions of KRW)	2018	2019	2020	2021	2022	2023
Call Settlement	23,531	21,070	21,579	20,603	23,058	28,047
Securities Settlement	187,890	214,591	236,056	257,375	269,895	301,201
FX Settlement	15,943	14,561	14,831	14,464	16,822	19,163
Customer settlement[1)]	45,329	50,228	63,162	73,602	79,462	79,164
Net Settlement[2)]	18,056	18,112	22,451	25,889	27,466	26,957
Others[3)]	34,056	35,295	46,930	73,435	80,560	78,790
BOK-Participants	15,911	16,064	18,543	23,124	27,067	21,290
TOTAL Value	340,716	369,920	423,552	488,491	524,331	554,611

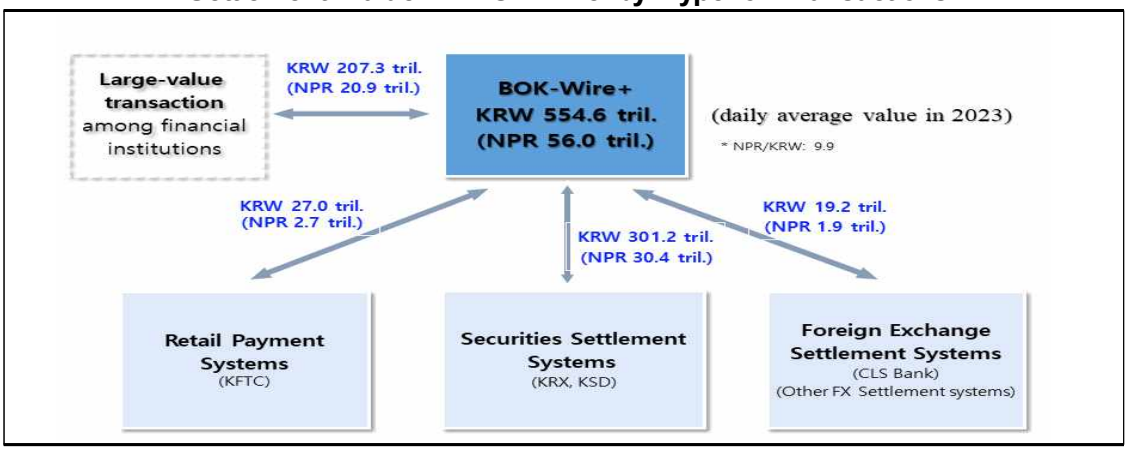
Note: 1) Large-value funds transfers by individuals or corporate customers of participants, processed through BOK-Wire, including payments through the linked settlement.
2) Settlement of multilateral net obligations arising from retail payment systems of KFTC.
3) Including Treasury funds transfers, BOK loans and discounts, and government and public bond transactions.

Source: BOK (2024a)

When it is viewed by type of transactions, out of KRW 554.6 trillion, KRW 301.2 trillion has been processed for securities settlement, KRW 207.3 trillion handled through large-value transactions, and KRW 27.0 trillion has come from retail payment systems. Foreign exchange settlement funds was KRW 19.2 trillion as shown in Figure 2-5.

<Figure 2-5>

Settlement Value in BOK-Wire by Type of Transactions



Source: BOK (2024a)

When it comes to intraday liquidity facilities supplied by the BOK to prop up the smooth settlements during 2023, the daily average value of settlement liquidity provided via BOK-Wire reached to KRW 3,343. Among this amount, intraday repos utilized by Korea Exchange (KRX) and securities companies occupied 74.8% (KRW 2,510 billion) and intraday overdrafts for banks took up the remaining 25.2% (KRW 842 billion). Moreover, KRX had 71.6% of total intraday repos and branches of foreign banks held 86.8% of total intraday overdrafts during 2023. Table 2-9 is showing a recent supply of intraday liquidity on a daily average basis.

<Table 2-9>

Supply of Intraday Liquidity (daily average)

(billions of KRW)

	2020	2021	2022	2023
Intraday Overdrafts [1]	603.0	633.2	881.1	841.9
Domestic banks	147.6	76.0	76.0	110.8
Foreign bank brances	455.4	557.2	805.1	731.0
Intraday Repos	2,883.2	2,858.9	2,143.6	2,510.0
KRX [2]	1,742.5	1,910.9	1,520.7	1,790.0
Financial Investment Companies	1,140.8	948.0	622.9	711.0
TOTAL	3,486.2	3,492.1	3,024.7	3,342.9

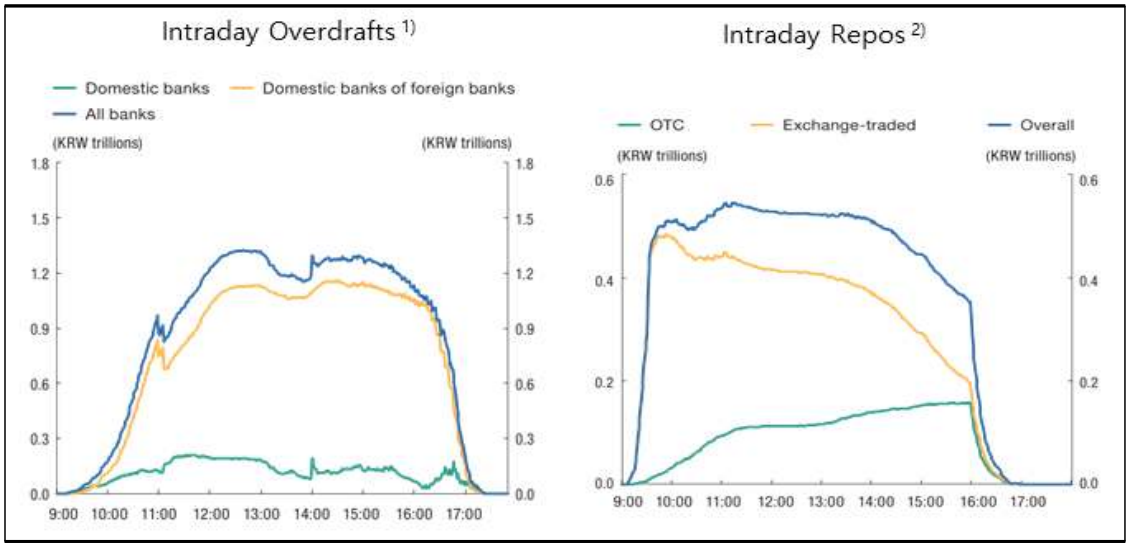
Note: 1) Based on the net intraday overdraft balance (gross balance less current account balance).
2) Korea Exchange has been designated as eligible for intraday repo transactions according to its CCP role for government bonds market.

Source: BOK (2022a, 2023, 2024)

As for changes in intraday overdrafts and intraday repos during operating hours in 2023, the intraday overdraft balance sharply increased during the morning session, driven by domestic branches of foreign banks, then decreased markedly from around 16:00, and was fully repaid by the end of operating hours. The average daily peak of intraday overdraft balance (KRW 1.3 trillion) was reached at 12:39 as shown in Figure 2-6.

<Figure 2-6>

Changes in Balance of Intraday Overdrafts and Repos During Operating Hours (daily average in 2023)



Note: 1) Net balance (gross balance less current account balance) per minute.
2) Net supply per minute (intraday cumulative supply minus intraday cumulative repayment).
Source: BOK (2024a)

Similarly, the outstanding intraday repo balance drastically rose during the morning session to hit a daily peak (KRW 0.5 trillion) at 11:14. The balance steeply decreased from around 16:00 near closing time and was fully repaid by the end of the operating hours of BOK-Wire.

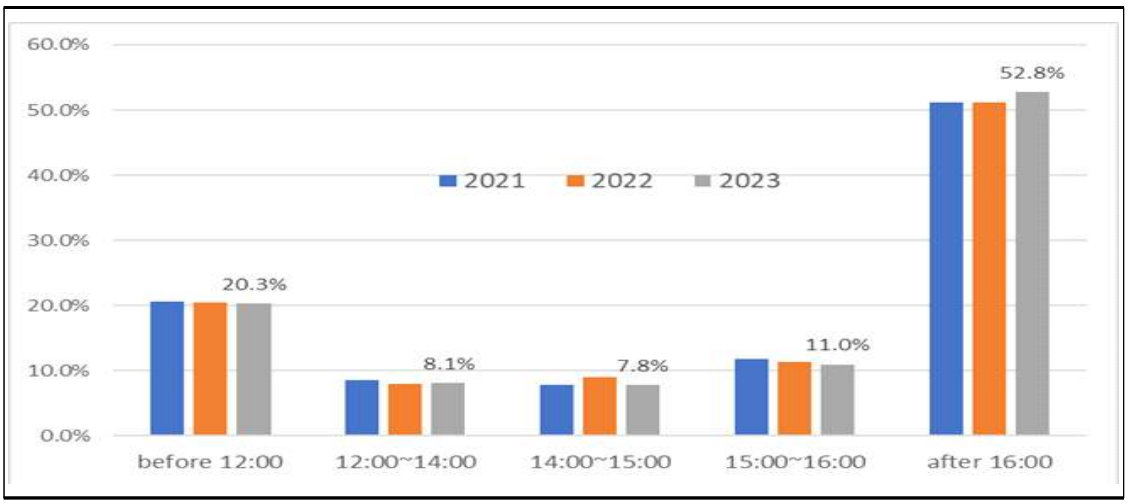
As to key indicators of the settlement liquidity in BOK-Wire participants during 2023, the proportion of queued payment orders for settlement showed a tolerable 4.9%[16] and the utilization rate of the maximum intraday overdraft cap was a stable 20.9%[17]. In addition, the proportion of the value of payment orders settled after 16:00, during the final 30 minutes before the closing time of BOK-Wire, steadily maintained the manageable level of 52.8% as shown in Figure 2-7.

16) Total value of payments in queue relative to gross settlement value during 2023, excluding payments processed through multilateral netting for liquidity savings.

17) Average ratio of the daily maximum intraday net overdraft amount to the intraday overdraft cap.

<Figure 2-7>

Proportion of Settlement Value in BOK-Wire by Time Slot[1)]

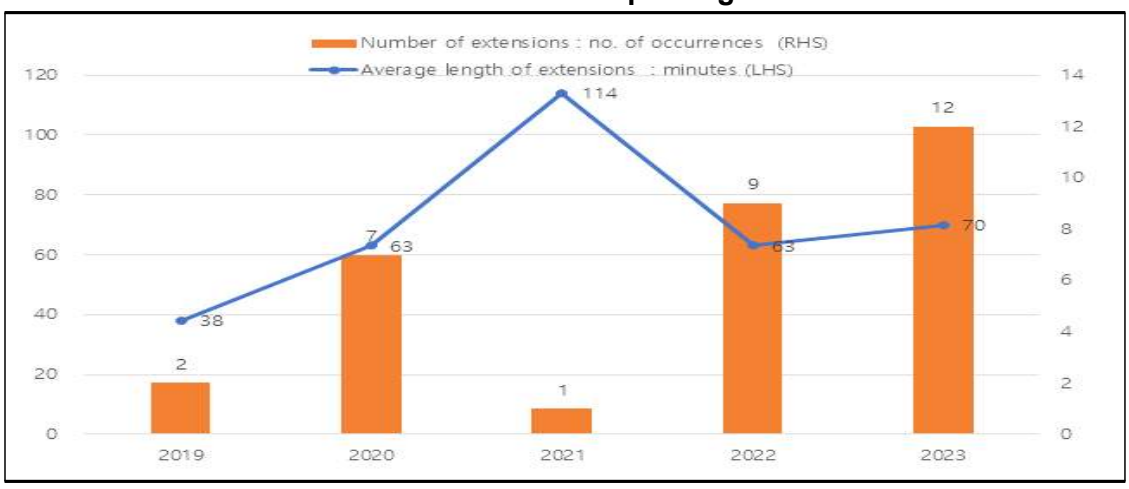


Note: 1) Value settled in each time period relative to gross settlement value.
Source: BOK (2024a)

As one of indicators gauging a stable operation of the system, the frequency of extension of BOK-Wire operating hours needs to be regularly monitored as well. In 2023, the extension of BOK-Wire operating hours has occurred 12 cases. The instances were mainly caused by IT system incidents of participants, a temporary liquidity shortage of participants, and open market operations by the BOK. Figure 2-8 shows the recent cases of extension of BOK-Wire operating hours.

<Figure 2-8>

Extension of BOK-Wire Operating Hours[1)]



Source: BOK (2024a)

G. Ongoing Issues

As has been shown in the past the BOK has been putting in a great deal of effort in improving the safety as well as efficiency of BOK-Wire. Moreover, the global landscape of payments interconnectedness brings on policy actions of the BOK, in tandem with other central banks. Examples of such advancement are the development of RTGS-based fast payment system and the application of ISO 20022.

(1) Introduction of RTGS-based Fast Payment System

The Committee on Payments and Market Infrastructures (CPMI) defines that a fast payment is "a payment in which the transmission of the payment message and the availability of final funds to the payee occur in real time or near-real time on as near to a 24-hour and seven-day (24/7) basis as possible[18)]". In practice, Korea has been operating the world's first fast payment system, named Electronic Banking System (EBS), since 2001. The services for fast payment features have been subsequently added. For instance, the operating hours of CD/ATM System has been extended to a 24/7 basis in 2004 and Open Banking System which harnesses fintech innovations was launched in 2016.

However, these retail payment systems are based on a deferred net settlement mechanism, in which customers' funds are paid to recipients in real time while net settlement occurs between sending and receiving participants the following business day. Participants are exposed to credit and liquidity risk until the time their credits and debits are settled because of this time lag.

As previously discussed, net settlement risk management has been put in place to contain credit and liquidity risk embedded in deferred net settlement. Again, a continued increase in fast payment transactions via above-mentioned retail payment systems has led to an upward adjustment of net debit caps as well as collaterals borne by participants consequently. From the perspective of external factors, the advancement of IT has made possible large-scale transactions with small-value in real time. Furthermore, central banks need to be prepared for the

18) CPMI (2016).

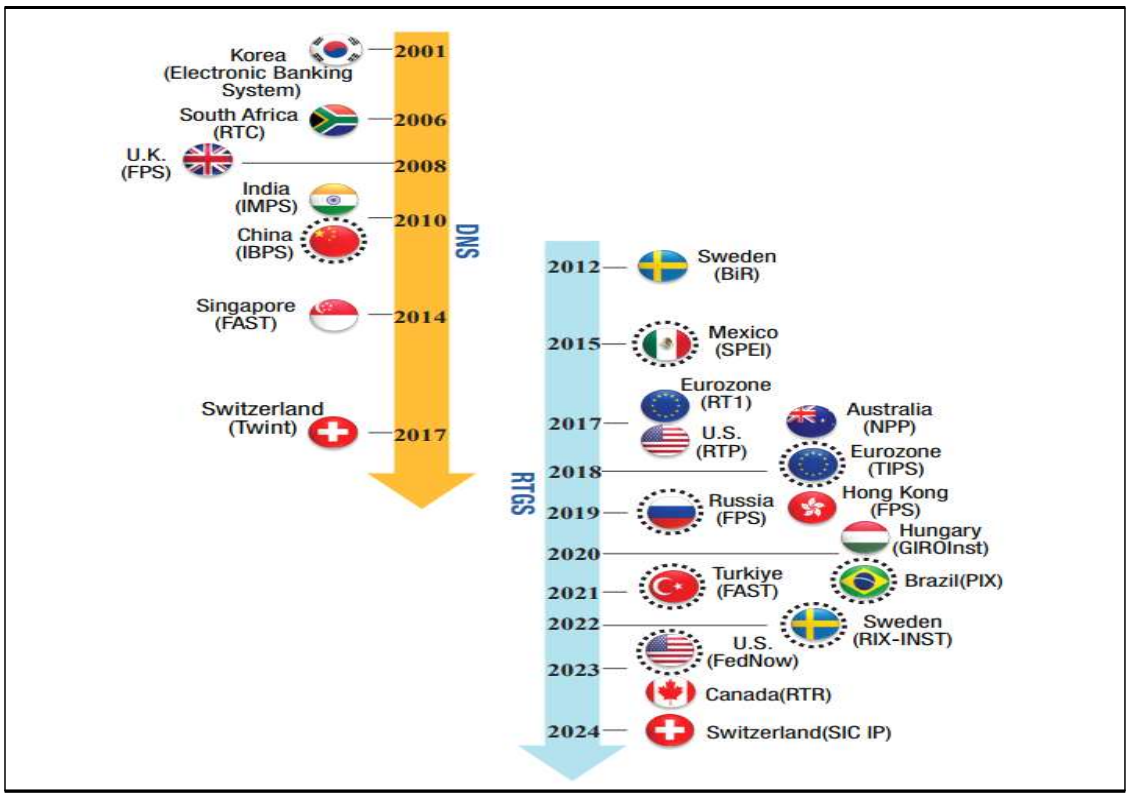
cross-border interlinking of fast payment systems which is now in progress as a global agenda[19].

Those changes of both domestic and international environment have brought the BOK to initiate an RTGS-based fast payment system for the safety and global competitiveness of Korean payment service. The project for the RTGS-based fast payment system will require a substantial system development by the central bank and financial institutions and will incur considerable changes in the way intraday liquidity is managed. There needs a close cooperative work among stakeholders to address issues such as liquidity management, governance, message format, human resource for 24/7 operation, etc.

Figure 2-9 illustrates various fast payment systems by settlement method.

<Figure 2-9>

Fast Payment Systems By Settlement Method[1)2)]



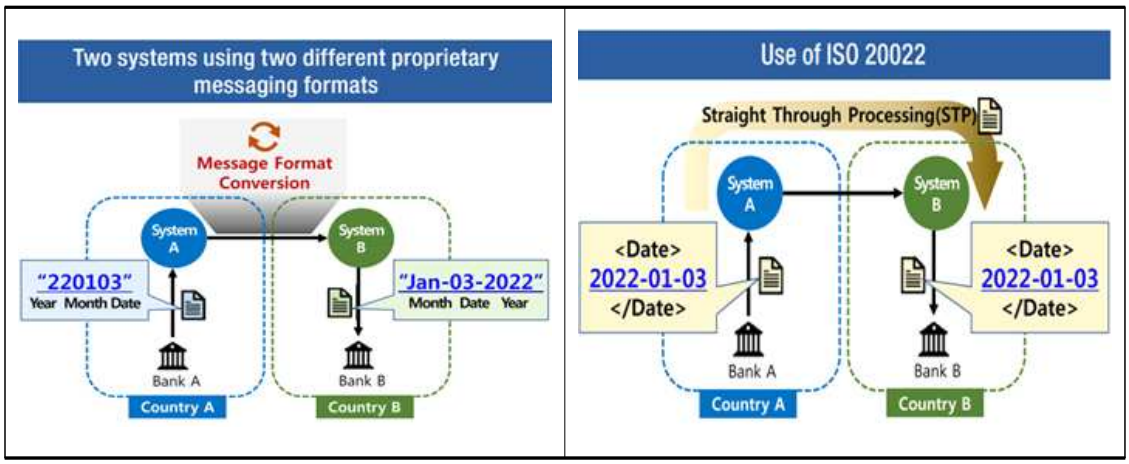
Note: 1) A fast payment system operated by the central bank is marked by a black dotted circle.
2) The name of each system is provided in parentheses.
Source: BOK (2024a)

19) No less than 10 countries have implemented RTGS-based fast payment systems since Sweden first completed fast payment system based on an RTGS mechanism in 2012. Besides, RTGS-based fast payment systems are to be launched in Canada and Switzerland during 2024.

(2) Migration to ISO 20022 [20]

BOK-Wire has been operated through a telecommunication network of proprietary messaging system suitable for transmitting financial messages between domestic financial institutions in KRW. This proprietary messaging system is featured by conventional text format which permits around 300 different messages. However, the system is unsuitable for interoperability as well as flexibility in terms of scalability. An example of proprietary messaging format and that of ISO 20022 in cross-border payments is shown in Figure 2-10.

<Figure 2-10>
Comparison of Messaging Formats in Cross-Border Payments



Source: BOK (2023)

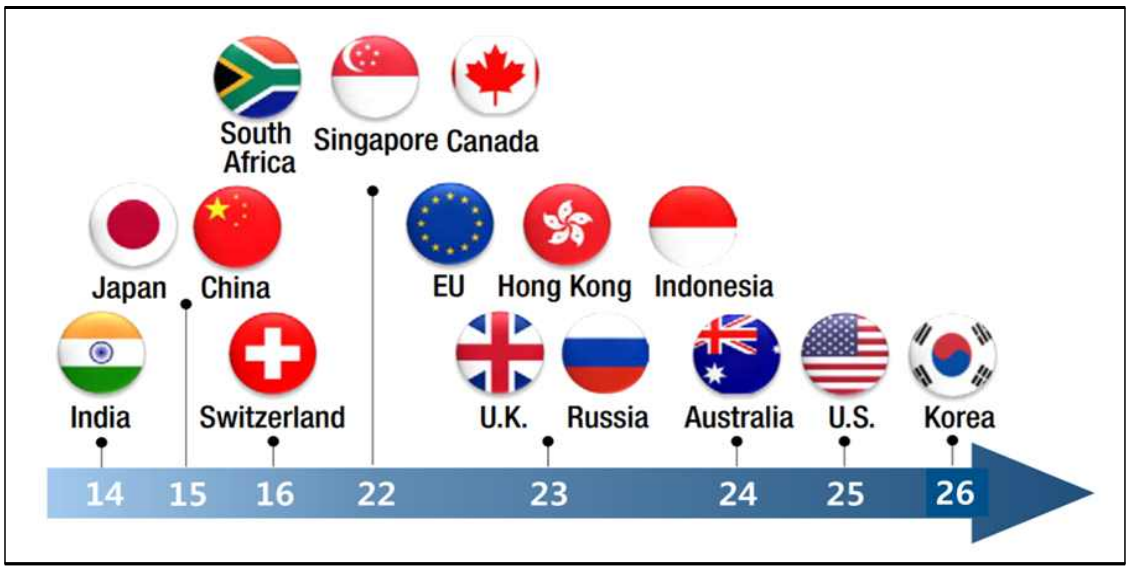
As the volume and value of global financial transactions have sharply increased and at the same time the interconnectedness of financial market infrastructures has been extended, the BOK has initiated the adoption of ISO 20022 in BOK-Wire, in preparation for the implementation of cross-border

20) ISO 20022 is a global message standard for communications across financial sectors, including payment and settlement, securities transactions, and foreign exchange, etc. The application of ISO 20022 increases the international interoperability of financial messages and enables straight through processing (STP) as well. It is due to ISO 20022 message format based on (extensible markup language) XML, which allows easy expansion and extraction of data in a message. This feature makes it possible to include more information on senders and recipients of funds in a financial message and as a result to comply more effectively with global regulations such as regulation on anti-money laundering and combating the financing of terrorism (AML/CFT).

interlinking of payment systems. The migration to ISO 20022 will also be contributing to the efficiency of settlement process and the extensibility of financial messages.

Moreover, a task force consist in 2020 by the BIS, the FSB and other international organizations started on the adoption of a harmonized ISO 20022 version for message formats as a cooperative task for enhancing cross-border payments. Most of member countries of the BIS's CPMI in this regard either have already adopted or are in the process of adopting ISO 20022 in the large value payment systems operated by their central banks. The adoption of ISO 20022 in large value payment systems in leading countries are shown in Figure 2-11.

<Figure 2-11>
Adoption of ISO 20022 in Large Value Payment Systems in Leading Countries



Note: Numbers in the arrow mean the year of adoption from 2014 to 2026.
Source: BOK (2024a)

Against this backdrop, the BOK has carried out a gap analysis in 2019 with the support of external experts and conducted a survey of BOK-Wire participants in 2021 on the adoption of ISO 20022 in BOK-Wire. An analysis and a survey were followed by the final decision to migrate to ISO 20022[21]. Consequently,

21) In "Enhancing Cross-Border Payments: Building Blocks of a Global Roadmap" (October 2020), a report prepared upon a request from the G20 Finance Ministers and Central Bank Governors' Meeting, the BIS and the FSB selected, "adopt a harmonised version of ISO 20022

the BOK has got down to the implementation project of ISO 20022 in 2022. The development of message formats for core funds transfers have been completed in 2023 since then. As for the process now in progress, new message formats compliant with ISO 20022 standards are to be developed and the IT systems need to be updated along with them. After testing the application of new messaging formats in collaboration with BOK-Wire participants, ISO 20022 is expected to be deployed in 2026[22].

3. Large Value Payment System in Nepal

NRB-RTGS is a large value payment system owned and operated by Nepal Rastra Bank (NRB). The foundational arrangement for NRB-RTGS was laid-down in National Payment Systems Development Strategy (NPSDS), 2014[23], based on which the Payments and Settlement System (P&S) Act, 2019, and the P&S Bylaw, 2020 mandated the establishment and operation of the RTGS system in Nepal.

The RTGS system was implemented on 12 September 2019, with 28 commercial banks as direct participants. However, due to technical challenges, the system was halted and re-implemented on November 22, 2019. The NRB organized a dedicated RTGS Operation Unit within the Payment Systems Department to operate, manage the RTGS system. Gradually, additional participants have been added in the system, As of mid-July, 2024, 44 direct participants, including 20 commercial banks, 11 development banks, 12 finance companies, and 1 infrastructure development bank are actively using the RTGS System. The banks and financial institutions that are members of the retail payment system for electronic cheque clearing are indirect members of the RTGS system.

NRB-RTGS is an interbank fund transfer system that allows real-time or instantaneous settlement of funds and/or securities, thereby discharging the

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for message formats," as one of the priority tasks. The BIS advised member countries of the CPMI to announce their decision whether or not they will adopt ISO 20022 by June 2022. The tasks outlined in the report including the adoption of ISO 20022, will be jointly carried out by the BIS CPMI and its member countries. (BOK 2021)

22) BOK (2024a)

23) Large Value Payment System has been considered as the second pillar of the NPSDS, 2014.

participants of their payment obligations as soon as the transaction is settled in RTGS system. The system is based on ISO 20022 messaging standards. The transactions are settled on an individual order basis without netting debits with credits, on the books of NRB's General Ledger (GL) system. Transactions settled through the RTGS system are irreversible and irrevocable; thus, the system ensures finality of settlement. The RTGS system fulfills the criteria of a Systemically Important Payment System (SIPS) as specified in Section 1.5.1 of the Payment Systems Oversight Manual, 2021[24].

A. Features of NRB-RTGS

NRB-RTGS has the following features.

i. Real-time or instantaneous settlement of high-value and critical payments.
ii. Transaction settlement on a gross basis, without netting debits with credits.
iii. Transactions settlement in the books of NRB's GL system
iv. Continuous transaction process throughout the active business periods in a day.
v. Irrevocable and irreversible transactions once they are settled.

B. Participants in NRB-RTGS

The banks and financial institutions (BFIs) are known as Participants of NRB-RTGS. NRB-RTGS allows the following three types of participants in the system.

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24) Section 1.5.1 of Payment Systems Oversight Manual, 2021 classifies SIPS as a system satisfying any or all of the criteria set out below:
   a. Principal payment systems in the country
   b. Owned/operated by central bank
   c. Holds the largest share of market
   d. The only existing market system of this nature
   e. Participants/ members are of high importance to the national economy/payment system
   f. Involvement in cross-border activity
   g. Involved in settlement of transactions of other financial institutions
   h. Has the potential to trigger or transit systemic disruptions.

NRB-RTGS fulfills all the specified criteria except (f).

(1) Direct Participant

Direct Participant has a settlement account (SA) in NRB-RTGS and has an appropriate communication platform monitor and manage their transactions and account position. A direct participant, thus, has the technical ability to send and receive payment orders and other messages to/ from NRB-RTGS system.

(2) Indirect Participant

Indirect Participant has a settlement account in NRB-RTGS system and NRB's GL System but may or may not have an appropriate communication platform to monitor and manage their transactions and account position directly from NRB-RTGS. An indirect participant shall appoint another direct participant to send and/or receive payment orders and other messages to/from NRB-RTGS on their behalf.

(3) Special Member

NRB-RTGS accommodates special members like a clearing house, securities settlement system, or any organization recognized by NRB under this category that may directly be connected to NRB-RTGS System for submission of Deferred Net Settlement (DNS) files. At present, Nepal Clearing House Limited (NCHL), the only clearing house in the country, is on-boarded as a special member in NRB-RTGS. NCHL has been granted limited access to send and/or receive payment orders and other messages to/from NRB-RTGS on their behalf. Besides, NRB has approved Public Debt Management Department (PDMO) as a participant for RTGS in Nepal. PDMO plans to settle the cash leg of securities exchanged through the Debt Operation Management Software (DOMS) via the RTGS System. PDMO has been granted limited access in the test environment of the RTGS system, and post the successful completion of all test scenarios, PDMO shall be implemented as a special member in the RTGS System.

C. Current Number of Participants

As of Mid-July, 2024, there are a total of 44 Direct Participants in NRB-RTGS system. The list of Direct Participants is presented in Table 2-10.

<Table 2-10>

Participants of NRB-RTGS System (As of Mid-July, 2024)

Institutions	Institution Class	Count
Commercial Banks	A	20
Development Banks	B	11
Finance Companies	C	12
Nepal Infrastructure Bank Limited	Infrastructure Development Bank	1
Total		44

Source: NRB

D. Types of Allowed Transactions

NRB-RTGS allows participants to process the following types of transactions (receive and pay) through the system[25].

(1) Credit Transfer (Single Customer Payment Transfer)

Credit transfer payments are customer-to-customer payments processed by a participant of NRB-RTGS system by providing instruction to debit the account of a customer maintained at their bank and credit the account of another customer maintained at another bank. For instance, Bank A sends the payment instruction to NRB-RTGS to debit the account of Mr. X maintained at Bank A and credit the account of Mr. Y maintained at Bank B. For such transactions, NRB-RTGS generates pacs.008 message and processes them as per the payment instruction.

25) Section 9.0: Types of Messages of RTGS System Rules, 2019 specifies various types of ISO 20022 messages (information as well as payment messages) accepted by NRB-RTGS system. Participants must submit the messages according to the specification of NRB-RTGS. Else, the transactions fail before entering into NRB-RTGS system for settlement.

(2) Return Payments

Any credit transfer (pacs.008) payment with incorrect details (such as wrong account number, wrong account length, etc.) or with a dormant/ inactive beneficiary account is returned by NRB-RTGS. Returned payments are the reverse entries of the original pacs.008 payments. The system generates pacs.004 message for return payments, carrying the original transactions' message identification (ID) or reference ID.

(3) General Financial Institution Transfer

General financial institution transfer payments are the payments initiated by one participant by debiting their SA and crediting another participant's SA. For instance, Bank A debits its SA and credits Bank B's SA using the RTGS communication platform. For such settlements, the RTGS system generates pacs.009 message from the system.

(4) Interbank Direct Debit Payments

Interbank direct debit payments are the transactions initiated by NRB's departments by debiting the SAs of the participants. Such transactions are done to collect fees, interest, fines, penalties, etc. from the BFIs. For direct debit payments, NRB-RTGS generates pacs.010 message.

(5) Net Balance Position from External System

Nepal Clearing House Limited (NCHL), the only clearing house of the nation, is a special member of NRB-RTGS in operation. NCHL sends net settlement file (NSF) for the final settlement of Electronic Cheque Clearing (ECC), Interbank Payment System (IPS), and connectIPS systems to NRB-RTGS in different batches. For such settlements, the RTGS system generates pacs.009 message from the system.

E. Allowed Currencies for Transactions

NRB-RTGS allows the transactions to be settled in five currencies, viz Nepalese Rupees (NPR), United States Dollar (USD), Euro (EUR), Great Britain Pound Sterling (GBP), and Japanese Yen (JPY). The transactions are allowed between the same currency accounts, and the system does not allow inter-currency transfers at present. For instance, a transaction debiting the JPY account and crediting the USD of another participant is not allowed in the system.

F. Transaction Limits for Allowed Currencies

The following transaction limits have been specified for allowed currencies in NRB-RTGS[26].

<Table 2-11>
Transaction Thresholds for Allowed Currencies in NRB-RTGS

Currency	Mandatory Threshold	Minimum Threshold
NPR	NPR. 2 Million or above	NPR. 200,000 or above
USD	USD 20 Thousand or above	USD 2 Thousand or above
EUR	EUR 20 Thousand or above	EUR 2 Thousand or above
GBP	GBP 20 Thousand or above	GBP 2 Thousand or above
JPY	JPY 2 Million or above	JPY 200,000 or above

Note: Maximum number of days in advance of value date that a transaction can be submitted is 10 days.
Source: NRB

G. Transaction Trend of NRB-RTGS

NRB-RTGS replaced the manual process to clear large value and critical payments in NRB's OBS with an automated, real-time payment process. NRB-RTGS can reduce the settlement risk in the payment mechanism as it

26) Appendix 7 of RTGS System Rules, 2019 specifies the Parameters and Limits for each currency. NRB may update the appendix as and when needed. The Participants shall comply with the limits specified in the appendix from time-to-time.

requires real-time liquidity to settle the transactions. By processing high-value and critical payments, the system can further help in increasing the velocity of money and boosting economic activities. Table 2-12 shows the volume and value of transactions processed through NRB-RTGS since its inception.

<Table 2-12>

Volume and Value[1)] of Transactions Processed through NRB-RTGS

Currency	FY 2019/20		FY 2020/21		FY 2021/22		FY 2022/23		FY 2022/23	
	Count	Amount	Count	Amount	Count	Amount	Count	Amount	Count	Value
NPR	189,554	9,714,581	522,174	20,445,704	733,795	41,561,970	794,427	34,135,418	677,977	39,272,37
USD	8,928	637	10,364	688	14,774	828.12	17,384	936	13,496	984
EUR	1,186	511	702	161	1,098	222	2,034	172	1,610	101
GBP	698	8	426	3.23	582	5	964	8	592	9
JPY	-	-	-	-	348	75,634	371	8,307	459	12,684

Note: 1) Value in Rs Million.
Source: NRB

H. Liquidity Management

The RTGS system has also been used for liquidity management through the provisions of ILF and OLF. RTGS participants pledge highly liquid securities (government securities and NRB Bonds) with NRB. The securities are valued as per their market prices and the collateral limit (after 10 percent haircut) is provided to the participants. At any point in a day, if the RTGS participants fall short of liquidity to fulfill their settlement obligations, intraday liquidity facility can be availed by debiting collateral management account and crediting the settlement account. If the participants fail to pay back the utilized intraday liquidity by the end of the RTGS business day, the intraday facility is recorded as the overnight liquidity facility, on which the participants are subject to pay an interest at policy rate.

The ILF and OLF facilities were started from 16 December, 2022. BFIs are charged interest on OLF at policy rate as per the Intraday Liquidity Procedure (Third Amendment, 2023), 2019. In 2022/23, the direct participants of the RTGS system have availed ILF of NPR. 3025 billion, of which the total liquidity

provided in the form of OLF has stood at NPR. 2379 billion. The usage of ILF and OLF was the highest during mid- February, 2023 to mid-June, 2023 because of the liquidity crunch in the Nepal's financial market. BFIs have extensively relied on OLF to fulfill their settlement as well as CRR obligations during the said period. As the liquidity position of BFIs improved in 2023/24, the usage of OLF has gradually decreased, with Rs. 803.56 billion usage of the OLF facility.

4. Retail Payment Systems in Korea

A. Features of Retail Payments

Payment systems are generally categorized as either retail payment systems or large value payment systems. Retail payment systems are generally dealing with large volume but low value payments such as credit transfers, direct debits, checks, card payments, and e-money transactions. Retail payments, inclusive of relevant systems and instruments, play a pivotal role for the effective and stable operation of financial system, the assurance of consumer confidence, and the functioning of commerce. In addition, the efficient and safe use of cash in retail payments is of critical importance in circulating the money as the primary means of payment. These features of retail payments draw central banks' attention to the safety and efficiency of retail payments.

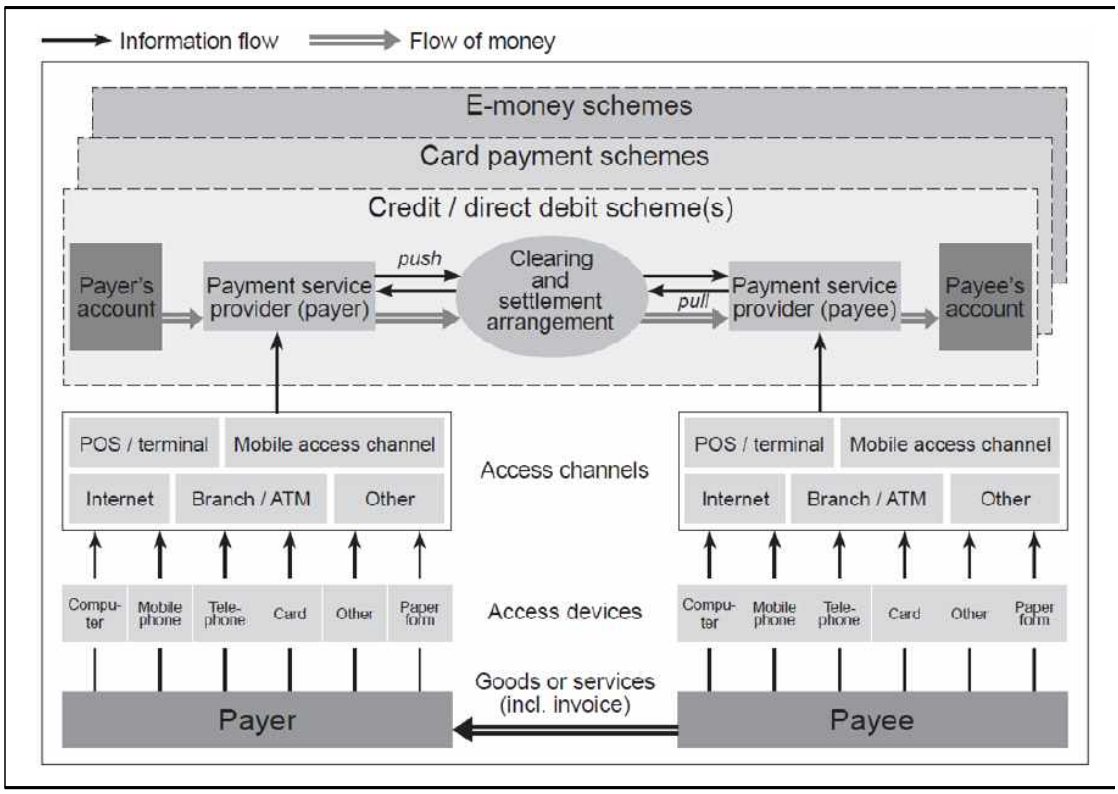
A simplified form of payment process in retail payments is shown in Figure 2-12. First, end-users of payment service initiate transactions. A payer buys goods or services and the payee sells them by using a payment instrument. The transaction then goes through a relevant access device and channel. Later on a payment service provider for the payer and payee collects the information respectively to proceed the following clearing and settlement process. Finally, the account of payer is debited and of payee is credited after the settlement[27]. However, issues arise from this simple form of payment process. Many players in the market and payment instruments or channels vary depending on their

27) In practice, especially for funds transfer transactions, a debit transaction for the payer or sender and a credit transaction for the payee or receiver are performed on a real-time basis in many retail payment systems.

preferences and circumstances. Any part of the payment process can also have a breakdown due to various reasons. Otherwise, the payment process functions anyhow but it may be proven to be either expensive or slow. These issues bring central banks to intervene so as to ensure efficient as well as safe retail payments.

<Figure 2-12>

A Simplified Payment Process in Retail Payments



Source: CPMI (2012)

As for the characteristics of retail payments market, a report of the BIS has it that the concepts of economies of both scale and scope in microeconomics are also applied to retail payments. Furthermore, the concept of two-sided markets and the theory of network effects are found in retail payments market[28].

As a result, central banks find themselves in a position to intervene not only for the efficiency and safety in retail payments but for the public welfare as a whole.

28) CPMI (2012)

<Box 2-1>

Features of Deferred Net Settlement Systems

Retail payment systems can be operated based on a multilateral deferred net settlement (DNS) or a real-time gross settlement (RTGS) mechanism. Features of DNS systems are as follow[29].

- In DNS systems, payments are accumulated and netted throughout the day (or possibly once a day), and settlement of the net amount takes place at the end of the day, if not more frequently intraday.
- By netting payment values among participants, DNS systems require significantly less liquidity for settlement, as compared to RTGS systems.
- However, DNS systems may expose participants to credit and liquidity risks for the period during which settlement is deferred.
- Settlement finality is only achieved at the end of the day or at designated times during the day in DNS systems and thus if there is no settlement guarantee, either by the system or its participants, there is no certainty that the payments will be settled until that point in time.
- If a participant fails to meet its payment obligation when due, some or all processed payments could be unwound, thereby exposing participants to liquidity risk and possibly credit risk depending on the design, rules, and legal framework of the payment system.

In recent years, distinctions between RTGS and DNS systems have become less clear. Some DNS systems have increased the frequency of intraday final settlement to reduce risks associated with delayed settlement. Many RTGS systems have incorporated liquidity-saving features akin to netting in DNS systems in order to economize on participants' use of liquidity. A range of system designs with liquidity-saving mechanisms and settlement priority options are sometimes classified as hybrid systems[30].

As pointed out above, DNS systems are inevitably exposed to systemic risk because of a potential of default by any participant before final settlement[31].

When it comes to Korea, funds transfers via most of retail payment systems are credited to the account of a recipient in real time. However, net obligations between financial institutions are settled at a designated time (11:00 am) on the following business day. Consequently, credit exposure is becoming relatively high in retail payment systems, and it is expected to increase as electronic payments become more prevalent. The awareness of systemic impact embedded in the DNS systems caused the BOK to introduce a net settlement risk management framework which mainly focuses on systemic risk as previously discussed.

B. Regulatory Framework for Korean Retail Payments

With respect to Korean retail payment systems, there are a range of laws and regulations governing the transactions concerned, their settlement details, the issuance and circulation of payment instruments, oversight of the relevant systems, and settlement finality.

The BOK Act, Financial Investment Services and Capital Markets (FISCM) Act, Electronic Financial Transactions (EFT) Act, and Specialized Credit Finance Business Act, among others, constitute fundamental legislation on retail payments in Korea.

Debtor Rehabilitation and Bankruptcy Act prescribes the guarantee of settlement finality for systemically important payment systems among payment and settlement systems. Major laws regulating activities of retail payments such as transactions, settlement processes, oversight, and settlement finality guarantee are explained in Table 2-13.

29) CPMI (2012).
30) CPSS (1997).
31) The CPSS discusses six key risks in payment and settlement systems: systemic risk, legal risk, credit risk, liquidity risk, general business risk, custody, investment risk, and operation risk. It also explains necessary measures against credit risk, collateral, margin and liquidity risk in principle 4 to 7 (CPSS, 2012).

<Table 2-13>

Laws Related to Retail Payments in Korea

Subject		Governing laws
Transactions	Commercial transactions	Civil Act Commercial Act Act on the Regulation of Terms and Conditions
	Securities transactions	Financial Investment Services and Capital Markets Act
	FX transactions	Foreign Exchange Transactions Act
Payment instruments	Bills and checks	Bill of Exchange and Promissary Notes Act Check Act
	Electronic funds transfers Electronic payment instruments	Electronic Financial Transactions Act Framework Act on Electronic Documentation and Transactions Digital Signature Act
	Electronic bills	Issuance and Distribution of Electronic Bills Act
	Credit, debit and prepaid cards	Specialized Credit Finance Business Act
Oversight	Payment and settlement systems	Bank of Korea Act Electronic Financial Transactions Act Financial Investment Services and Capital Markets Act
Settlement finality		Debtor Rehabilitation and Bankruptcy Act

Source: BOK (2016)

C. Payment Instruments

Payment instruments are divided into cash and non-cash. Cash has long been used as a fundamental payment instrument for small-value transactions, but its share of usage is continuously in decline as variety of non-cash payment methods have become prevalent. All the non-cash payment instruments fall under three categories according to their characteristics: i) checks and bills, ii) account transfers, and iii) payment cards. Checks, bills, and slip Giros are paper-based payment instruments whereas payment cards, CD/ATM transactions, and account

transfers through payment networks are electronic payment instruments.

- Checks and bills are certificates by which issuers promise payment of a certain amount. They used to be the representative payment methods for business activities of companies for a long time. But, the use of checks and bills has sharply declined due to the wide acceptance of electronic payment methods such as internet banking, mobile banking, credit cards, etc.
- Account transfers refer to payments through money transfers between deposit accounts instead of the direct exchange of payment instruments between payers and payees. Payment channels for account transfers include bank windows, CD/ATMs, internet banking, mobile banking, and QR codes.
- Payment cards include pre-paid cards, debit cards, and credit cards. E-money, a popular payment instrument, is also a kind of pre-paid cards. Debit card payment is a payment method where the purchase amount is withdrawn from the card holder's deposit account at the card issuing bank and simultaneously transferred to the seller's deposit account upon the purchase of goods or services. Check card is a type of debit cards as well, but it differs from debit cards in that it is issued by credit card companies, and it goes through credit card network when used.

In the meanwhile, non-cash payment instruments can be again grouped into paper-based or electronic ones depending on physical forms. On the other hand, transactions can be defined as face-to-face transactions or un-tact ones from a perspective of the way of transaction.

From a global point of view, the retail payment trend has been evolved both from paper-based to electronic-based and from face-to-face to un-tact. With regard to individual country, there is no exception regardless of the level of economic development or the size of the economy. A recent trend has also witnessed a wide adoption of payment cards in most countries, even though different kind of payment cards are issued in terms of different features, such as function and structure. As illustrated in Table 2-11, there are several distinctive characteristics of payment cards in Korea. Among others, debit cards and check cards have a common feature in that the card holder’s account is debited in real

time. Nevertheless, the difference lies in the issuer of cards, meaning that check cards are issued by credit card companies whereas debit cards are issued by banks. Thus, the subscription and management of merchants are separated from each other. However, in reality, card merchants have overlapping affiliations to accept debit, check, and credit cards. Table 2-14 summarizes the comparison of payment cards currently used.

<Table 2-14>

Comparison of Payment Cards in Korea

	Prepaid Card	Debit Type			Credit Card
		Check Card	Debit Card	IC Cash Card	
Debit of Card holder Account	Ex-ante	Real-time	Real-time	Real-time	Ex-post
Limit of Usage Amount	Pre-charge limit	Account balance	Account balance	Account balance	Credit limit
Annual Fee	-	-	-	-	Yes
Network	Credit card	Credit card	EFT/POS	CD/ATM	Credit card
Issuer	Credit card company	Credit card company, etc.[1)]	Bank	Bank	Credit card company
Daily Average Usage[2)]	9.7	666.0	0.0	4.5	2,780
Operating Hour	24 hours	24 hours	08:00~23:30	24 hours	24 hours
Pay-out to Merchant	T+3~5 days	T+3~5 days	T+1 days	T+1 days	T+3~5 days
Merchant fee[3)]	1.45%	1.45% (0.25%)	-	-	2.08% (0.5%)
Authorization[4)]	Signature	Signature	Pin	Pin	Signature
Credit Offering	-	Yes	-	-	Yes
Add-on Benefit	-	Yes	Yes	Yes	Yes

Note: 1) Including financial investment company and savings bank
2) Billions of KRW during 2023
3) Average rate of credit card companies for 2023. ( ) are the minimum special discount rate applied to petty merchants with annual sales of not more than KRW 300 million.
4) Signature- or pin-free for transactions not more than KRW 50,000
Source: BOK (2015).

D. Payment System Operators

There are four crucial institutions that have systemic importance for the sound operation of payment and settlement systems in Korea: BOK, KFTC, KRX, and Korea Securities Depository (KSD)[32].

With regard to retail payment systems, KFTC is the sole operator of retail payment systems. As a not-for-profit incorporated association, KFTC was established in 1986 by merging National Clearing House and Korea Bank Giro Centre to promote the development of financial industry. KFTC has been playing a critical role in modernizing retail payment systems in Korea since its inception. KFTC is currently operating 12 different types of retail payment systems.

As of the end of 2023, KFTC has 10 general members, 13 associate members, and 122 special participants. Being general or associate members, banks, including the central bank, may participate in all the retail payment systems of KFTC. Other institutions are subject to the approval of KFTC's general meeting to be special participants in any individual system. Special participants are Korea Post, federations of non-bank credit institutions, branches of foreign banks, and financial investment companies, and so on.

Besides, Federations of non-bank credit institutions operate individual funds transfer systems for their respective member institutions. These institutions include Korea Federation of Savings Banks, Korean Federation of Community Credit Cooperatives, and National Credit Union Federation of Korea. Transactions among members are conducted through a federation's system, while transactions between a member and a non-member are conducted through retail payment systems operated by KFTC.

BC Card, a domestic credit card company established through joint investments

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32) Korea Exchange performs a role as the central counterparty for the exchange-traded securities, derivatives, and OTC derivatives markets. KRX has been established to promote the safety and efficiency of securities transactions through fair pricing and trading of securities and listed derivatives. Korea Securities Depository, as the central securities depository of Korea, supports the development of the capital market by providing services in relation to securities transactions such as the issuance and distribution of securities.

In addition, CLS Bank provides foreign exchange payment versus payment (PVP) settlement service through interconnection to BOK-Wire. Also, commercial banks such as Hana Bank, Kookmin Bank, Shinhan Bank, and Woori Bank operate their own domestic foreign currency funds transfer systems.

by banks, operates BC Card settlement scheme. When BC card holders purchase goods or services, the company processes and settles the amounts receivable and payable arising between card issuing banks and banks for merchant stores on a multilateral netting basis. The settlement among member banks is then carried out via Check Clearing System of KFTC.

E. Payment Service Providers

As for payment service providers, most payment service providers have close relations with KFTC. Banks and non-banks provide payment services based on the participation in the KFTC platform. The most striking feature of recent retail payments landscape can be the rapid increase of fintech companies' entry into the payment service market[33].

(1) Banks

As the key providers of payment service to end-users, banks offer a wide range of payment services including funds transfers based upon their customers' demand deposits. Banks issue checks and bills and provide cash deposit and withdrawal services and funds transfers through retail payment systems operated by KFTC. Banks have proved themselves as the spearhead of internet banking and mobile banking services for a recent couple of decades.

(2) Financial Investment Companies

Financial investment companies, licensed to engage in trading or brokerage businesses, have been allowed to directly carry out funds transfer services for customers who are not legal entities[34]. However, to prevent any increase in settlement risks caused by financial investment companies' participation in retail payment systems, it is required that their net settlements be processed through

33) Most of this part referred to "Payment Systems in Korea (BOK, 2014)".

34) Before 2009, financial investment companies provided their customers with funds transfer services via partnership with individual banks and this indirect way of funds transfer was evaluated as causing inefficiencies and social cost.

settlement agent banks in the same way as those of federations of non-bank credit institutions are processed.

(3) Federations of Non-bank Credit Institutions

Federations of non-bank credit institutions, such as community credit cooperatives, credit unions, and mutual savings banks, are permitted to perform funds transfer services and offer several payment services that are offered by banks. These federations have been accepted as special participants in KFTC and have been offering diverse funds transfer, cash deposit, or withdrawal services since early 2000s. To this end, head offices of each federation participate in KFTC systems as special participant status. Meanwhile, net settlements obligations between federations and other financial institutions through KFTC's retail payment systems must be processed by their respective settlement agent banks. The measure is to control settlement risks that might arise from the participation of these institutions which are generally in a weak position to manage risks. They include National Agricultural Cooperative Federation, National Federation of Fisheries Cooperatives, National Forestry Cooperative Federation, Korea Federation of Savings Banks, Korea Federation of Community Credit Cooperatives, and National Credit Union Federation of Korea. These institutions are also classified as non-bank depository institutions, which include post offices.

(4) Credit Card Companies

Credit card companies provide credit by issuing credit cards on the basis of card holders' credit ratings or incomes. Then credit card holders purchase goods and services or get a card loan using credit cards. The services offered by credit card companies are classified as general purchases, installment purchases, cash advances, and card loans. Credit card companies also issue debit and pre-paid cards. When a credit card is used at an affiliated merchant store, which has its account at a bank different from card issuing bank, the settlement of transaction goes through the retail payment systems of KFTC.

Besides commercial banks, eight credit card companies issue credit and check

cards[35].

(5) Electronic Financial Business Companies

Electronic financial business companies perform various payment services such as:

- Electronic funds transfer service,
- Issuance and management of electronic pre-payment instruments,
- Issuance and management of electronic debit payment instruments,
- Electronic payment settlement agency service called as payment gateway (PG),
- Deposit service of payment funds called escrow service, and
- Electronic bill presentment and payment (EBPP) service.

Each electronic financial business is required to be registered respectively at the Financial Services Commission but banks and most financial institutions, which already have relevant licenses, may conduct these businesses without registration. A lot of companies have joined electronic financial businesses, especially into PG service, electronic pre-payment service, and payment funds deposit service since 2007.

<Table 2-15>

Classification of Electronic Financial Business

Service	Content of service	Service providers[1)]
Electronic pre-payment	Issuing and managing prepayment means in order for customers to use charged money for transportation or transactions	82 companies -Transportation card -Online marketplace accounts -General purpose reward points -Airline mileages -Charge money onto mobile pay apps

35) BC Card, Lotte Card, Samsung Card, Shinhan Card, Woori Card, Hana Card, Hyundae Card, and KB Kookmin Card.

Electronic debit payment	Relaying funds transfers from buyer's account to seller's account with smart phone based authentication	24 companies
Payment Gateway (PG)	Collecting funds from buyers in e-commerce transactions and obtaining payment information to ensure the funds get paid to sellers or agent /intermediary services for settlements	159 companies -Credit card PG -Account transfer PG -Virtual account PG -Gift certificate PG -Online marketplace agent settlement
Escrow	Holding funds received from buyers until the receipt of the e-commerce transaction items before transfer funds to sellers	44 companies
Electronic bill presentment and payment (EBPP)	Agent settlement through electronic billing via emails or apps and collection of payments	16 companies

Note: 1) As of 28 August 2024
Source: KFTC (2022) and FSS (https://fine.fss.or.kr/fine/bbs)

(6) Other Payment Service Providers

Korea Post, an agency of government, offers most of services offered by banks. Korea Post has been participating in the various retail payment systems operated by KFTC from the very beginning of development of payment systems. Korea Post is a special participant of KFTC system as well.

In addition to above-mentioned payment service providers, there are also subsidiary electronic financial business companies, which assist electronic financial transactions, perform a part of transactions on behalf of financial service providers, or operate a PG system. Typical examples are credit card VAN companies and banking VAN companies. Credit card VAN services include the operation of networks, installation of terminals, transmission of transactions, collection of sales slip and billing, etc. Banking VAN service is based on the operation of off-premises CD/ATMs on behalf of banks.

On the other hand, mobile telecommunication service providers such as KT, SK Telecom, and LG Telecom are offering mobile banking services by providing banks with wireless payment platforms. Other payment service providers such as fintech companies, makers of mobile phones, social networking service providers,

retail companies, etc. are aggressively penetrating into the electronic payments industry as well. These services bear names of pays or wallets represented by easy payments[36].

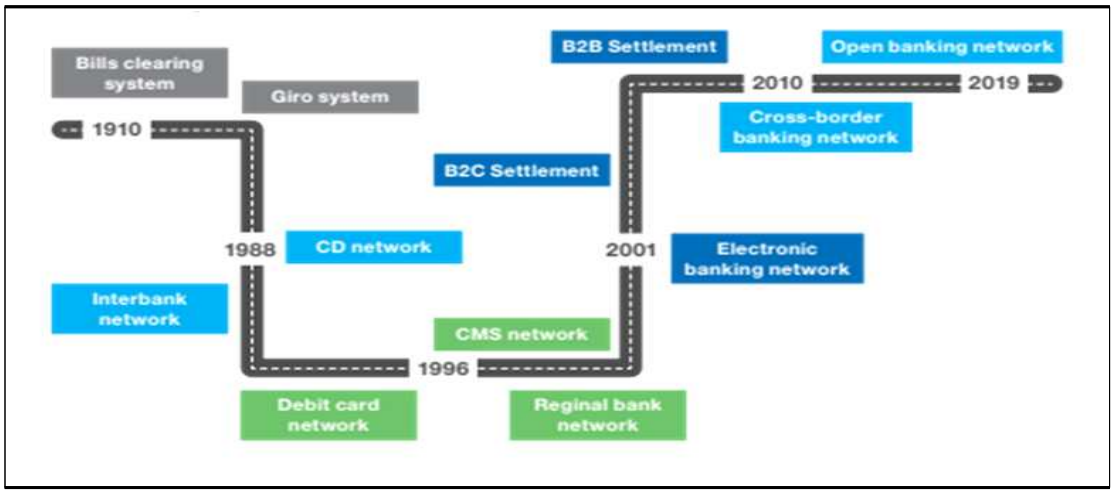
F. Retail Payment Systems

(1) Retail Payment Systems of KFTC

Retail payment systems in Korea have mostly been developed by KFTC. Except for Check Clearing System and Giro System which had been developed before the 1980s, KFTC started to launch CD/ATM System, the first interbank shared network, in 1988. Since then, KFTC has introduced various retail payment systems, diverse payment channels, and numerous payment services up until today. Figure 2-13 is showing a revolution of retail payment systems in Korea.

<Figure 2-13>

Evolution of Retail Payment Systems of KFTC



Source: KFTC (2022)

From a broad perspective, Korean retail payments can be classified into five

36) For example, online and mobile easy payment services have gained popularity in recent years. Major market leaders include bigtechs such as Samsung Pay, Naver Pay(Naver Financial), Kakao Pay, Payco(NHN Payco), toss Pay(Viva Republica), Smile Pay(Gmarket), SK Pay(11st), SSG Pay(SSG.COM), L Pay(LOTTE Members) and so on.

categories: Check Clearing System, Giro System, Interbank Shared Networks, E-commerce Payment and Settlement Systems, and credit card payment networks. As of September 2024, there are 12 retail payment systems in service, operated by one single operator, KFTC. Transactions through these 12 retail payment systems are finalized on the basis of multilateral deferred net settlement (DNS) on the BOK-Wire. The final settlements are carried out at a designated time (11:00 am) of the following business day (T+1).

Table 2-16 summarized 12 retail payment systems KFTC is currently operating.

<Table 2-16>

Retail Payment Systems of KFTC

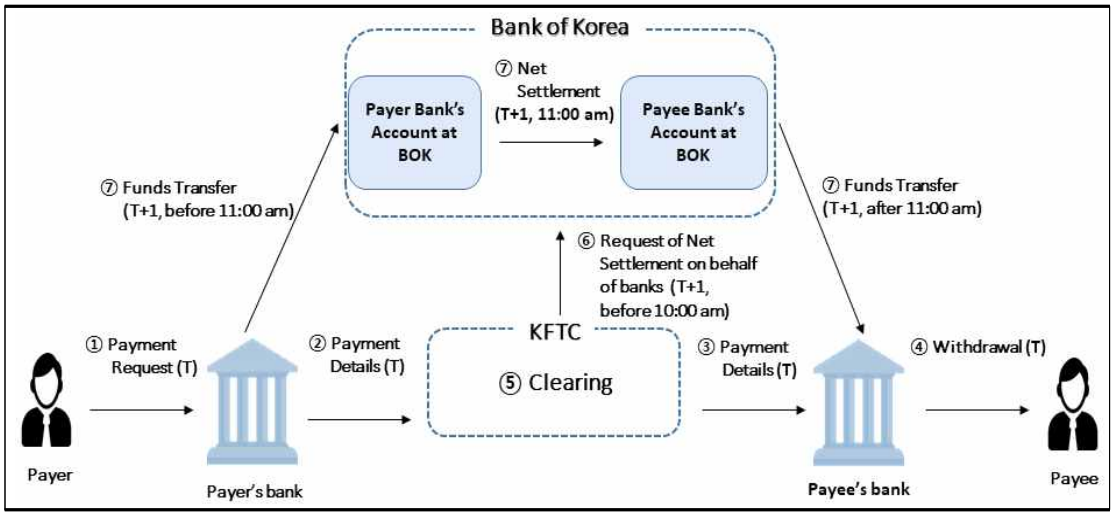
Name of system	Launch	Transactions	No. of participants
Check Clearing	1910	Checks, bills, promissory notes, etc. (including electronic)	69
Giro	1977	Large volume payments (salaries, pensions) & collections (utility bills)	48
Interbank Shared Networks			
CD/ATM	1988	Cash deposit & withdrawal, tunds transfers via CD/ATMs	41
Interbank Funds Transfer	1989	Funds transfers via bank branches	56
EFT/POS	1996	Purchase of goods & services via debit cards	14
Cash Management Service	1996	Pre-arranged withdrawal & deposit of insurance premia, credit card charges, tuition fees, salaries, pensions, etc.	55
Regional Bank Shared	1997	Cash withdrawal & deposit between regional bank customers	6
Electronic Banking	2001	Internet/tele/firm/mobile-banking service	64
Cross-border Payment	2010	Overseas CD/ATM local currency withdrawals	14
Open Banking	2016	Open API & mobile app based easy payments, etc. for Fintech	56
E-commerce			
B2C	2000	E-commerce for online shopping Malls (PG services)	42
B2B	2002	Electronic payment receivables from E-commerce sales (PG services)	19

Note: As of the end of March 2023
Source: BOK

Meanwhile, credit card companies operate their individual clearing and settlement schemes. Payments to affiliated merchant stores and charges to credit card holders are done through Check Clearing System and other retail payment systems such as Giro System or Cash Management Service System, etc. Check card transactions, however, go through credit card network even though they are used in the same way as debit cards issued by banks.

A typical payment-clearing-settlement process in retail payment systems in Korea is illustrated in Figure 2-14.

<Figure 2-14>
Typical Payment-Clearing-Settlement Process in Retail Payment Systems



Source: BOK

Among 12 retail payment systems, six systems have been designated for settlement finality according to the Debtor Rehabilitation and Bankruptcy Act[37]. Besides, Check Clearing System, Interbank Funds Transfer System and Electronic Banking System have been designated as systemically important payment and settlement systems (SIPS) from the perspective of oversight.

(2) Credit Card Payment Schemes

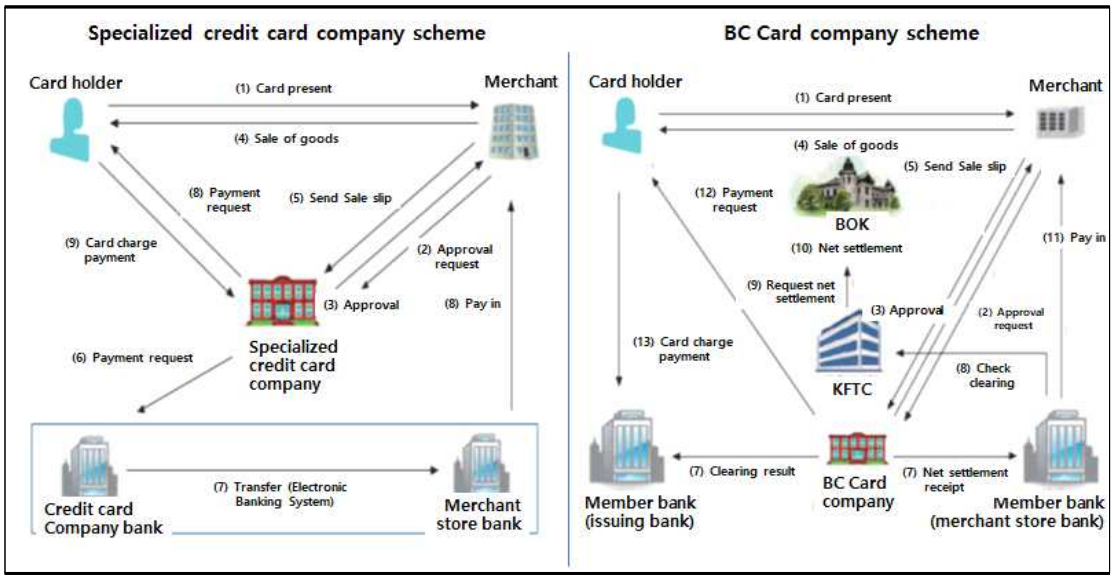
Credit card payment schemes conduct payments relating to transactions made

37) Six systems are Electronic Banking System, Interbank Funds Transfer System, CD/ATM System, Check Clearing System, Giro System and Cash Management System.

by credit cards. Available services of the scheme are credit purchase of goods and services with a lump-sum purchase or an installment purchase. Credit card holders may use loan services such as cash advance, card loans, and revolving loans. Except for international credit card networks such as VISA or MasterCard, domestic credit card schemes are divided by specialized credit card and BC Card in terms of payment processes[38]. They differ from each other in several ways as shown in Figure 2-15.

<Figure 2-15>

Payment Process of Credit Card Schemes



Source: BOK (2014)

A credit card payment scheme may not be defined as one kind of payment system from a strict perspective because of the absence of specified multilateral clearing and settlement arrangement among participating companies. Rather, it relies on other retail payment systems for the payment to merchant stores as well as for the charges to card holders. It might, therefore, be labeled as a

38) As per the Specialized Credit Finance Business Act, credit card companies are categorized into two groups: specialized credit card companies (licensed as solely engaged in credit card business) and banks (concurrently engaged in credit card business). As of September 2024, eight specialized credit card companies and 11 banks are doing credit card business. Eight specialized card companies are LOTTE, BC, Samsung, Shinhan, Woori, Hana, Hyundai, and KB Kookmin Card. 11 Banks are NH Nonghyup, Kyongnam, Kwangju, Busan, Suhyup, Citi, Jeonbuk, Jeju, DGB iM, IBK, and SC Korea.

quasi-system of payment. Furthermore, the credit card payment scheme does not pose any significant risks to other payment systems due to its process although there have been continuously raised issues of consumer protection and fair competition and so on.

G. Risk Management in Retail Payment Systems

(1) Settlement Risk Management

Credit exposure is high in Korean retail payment systems since most of systems are providing customers with real-time funds transfers before final settlement among participating institutions. It is expected to be on the increase as fast or instant payments become industry norms.

This nature of deferred net settlement mechanism brought about net settlement risk management as discussed before[39]. The pivotal arrangements are represented by Net Debit Caps, Collateral Requirements and Loss-sharing.

(2) Operating Risk Management[40]

KFTC maintains a comprehensive risk management framework such as Regulation on Risk Management (RRM) and Crisis Response Action Plan (CRAP). The RRM defines types of risk, risk management organizations, risk management process, risk management system and the CRAP describes crisis management system, response and procedures depending on the level of alert and type of crisis, IT business continuity plan (BCP), etc[41]. IT BCP secures a robust operational resilience for the full scale of IT services. In this regard, KFTC has been granted the ISO 22301 certification and has been maintaining BCP performance through annual post-certification review and tri-annual renewal process.

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39) The Principles for financial market infrastructures (PFMI) has four principles focusing on credit and liquidity risk management in Principle 4~7 regarding credit risk, collateral, margin, and liquidity. (CPMI, 2012)

40) KFTC (2022)

41) Risks are categorized into ⑴ concerned, ⑵ caution, ⑶ alert and ⑷ serious by alert level. While, categorized into ⑴ technical disaster, ⑵ electronic violation, ⑶ natural disaster, ⑷ social disaster and ⑸ management emergency by type.

KFTC also performs systematic monitoring for risk management by conducting Risk Control Self Assessment, operating early warning indicators, managing data loss, reviewing risks and assessing signs of crisis according to the type. In order to guarantee safety and reliability of crucial payment systems in the event of abnormality of the systems and disaster, crisis response capacity has been reconfirmed through the implementation of training plans, disaster recovery drills, and scenario-based crisis response training.

In addition, KFTC conducts cyber threat response exercise on a regular basis to maintain cyber resilience and performs relevant test in case of major changes in participants' IT systems as well.

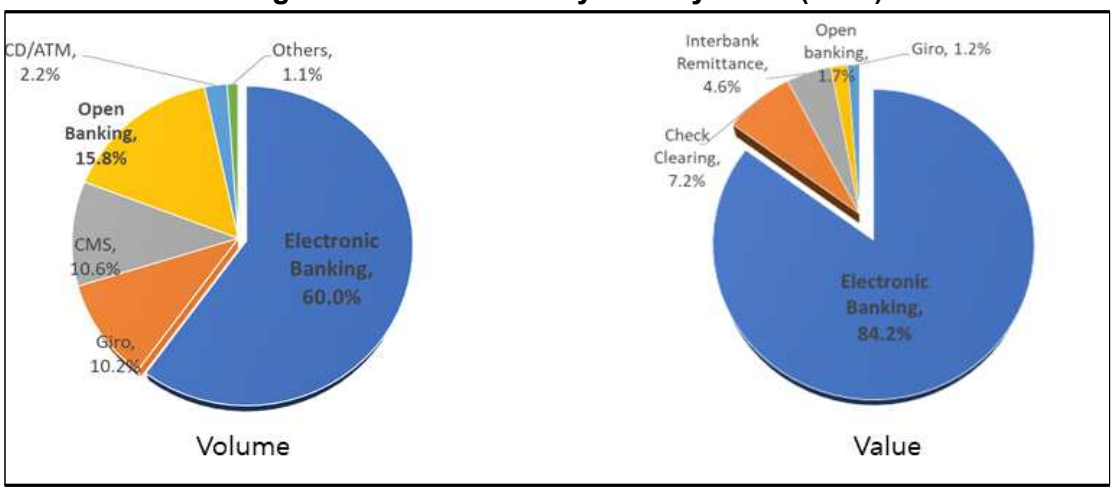
H. Recent Payment Trend in Retail Payments

A notable trend in the changing Korean retail payments could be defined as digitalization and easy payments. While credit cards are dominating in non-cash payment market, payment trend is moving toward easy, instant, and mobile payments. Besides, non-finance companies such as bigtechs and fintechs are actively accelerating the digitalization of retail payments.

In terms of usage of retail payment systems during 2023, Electronic Banking System holds a dominant share of 60.0% and 84.2% by volume and value, respectively. (Figure 2-16).

<Figure 2-16>

Usage Share of Retail Payment Systems (2023)

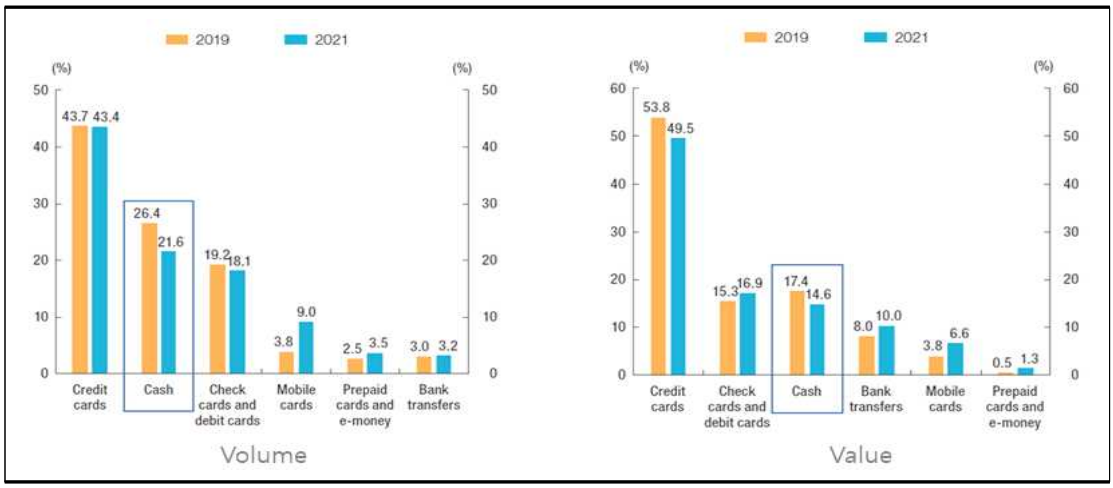


Source: BOK (2024a)

As to usage share of payment instruments, biennial survey reveals that credit card is the most popular payment instrument[42]. (Figure 2-17).

<Figure 2-17>

Usage Share of Payment Instruments

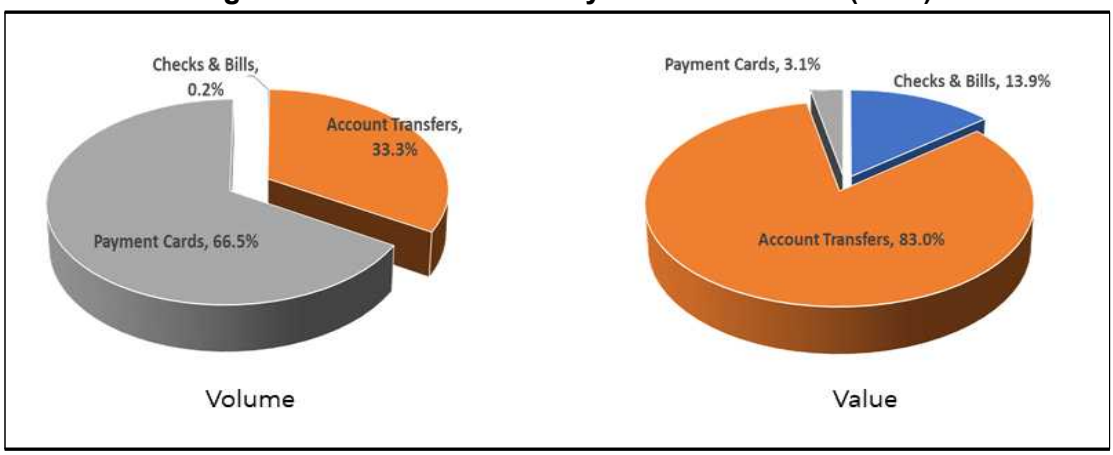


Source: BOK (2022)

Meanwhile, payment cards take up 66.5% of transaction volume but account transfers occupy 83.0% by value term in 2023, from the viewpoint of usage share of non-cash payment instruments. (Figure 2-18).

<Figure 2-18>

Usage Share of Non-Cash Payment Instruments (2023)



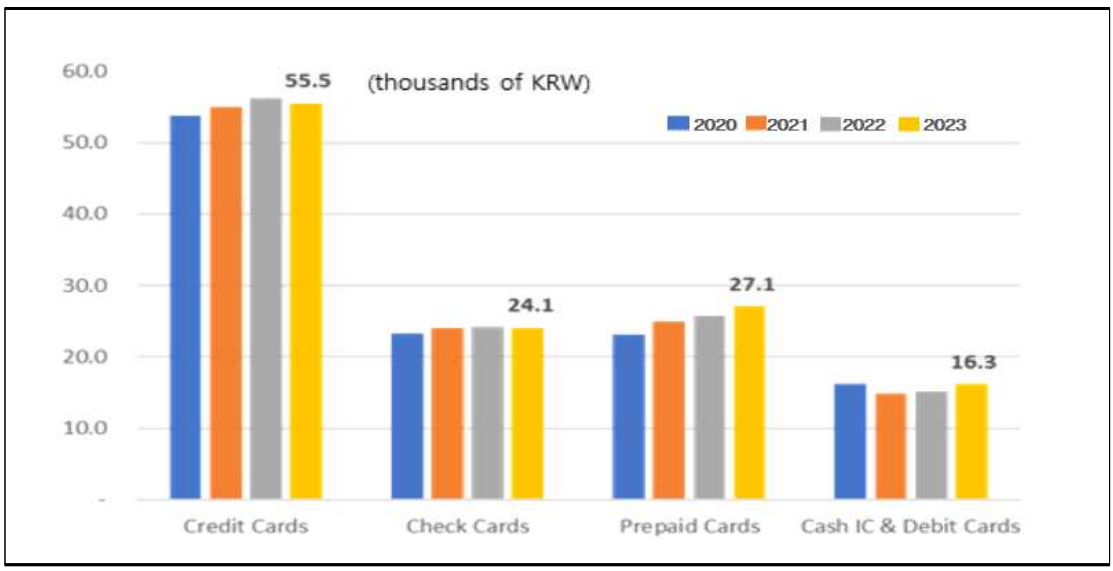
Source: BOK (2024a)

42) Bank of Korea carries out a survey on end-users' behavior in retail payments every other year.

Furthermore, credit cards take 80.3% share of total value among payment cards and followed by check cards with 19.2% in 2023. The average transaction value per card estimated as KRW 55,500 for credit cards, KRW 24,100 for check cards and KRW 27,100 for prepaid cards. (Figure 2-19).

<Figure 2-19>

Average Transaction Value Per Card (2020~2023)



Source: BOK (2024a)

Regarding payment card transactions by method, both the use of device-present payments and device-not-present payments fairly increased each year, maintaining the respective share of around 60% and 40% by transaction value. Of the device-present payment method, the daily average value of payments using mobile devices by contact payment terminals is showing a steep upward trend[43].

Besides, easy payment and easy funds transfer service based on mobile phones or personal computers has been gaining popularity because of its convenience[44].

Figure 2-20 is showing a usage recent of easy payment service by service providers and the usage share of payment method by electronic financial service providers.

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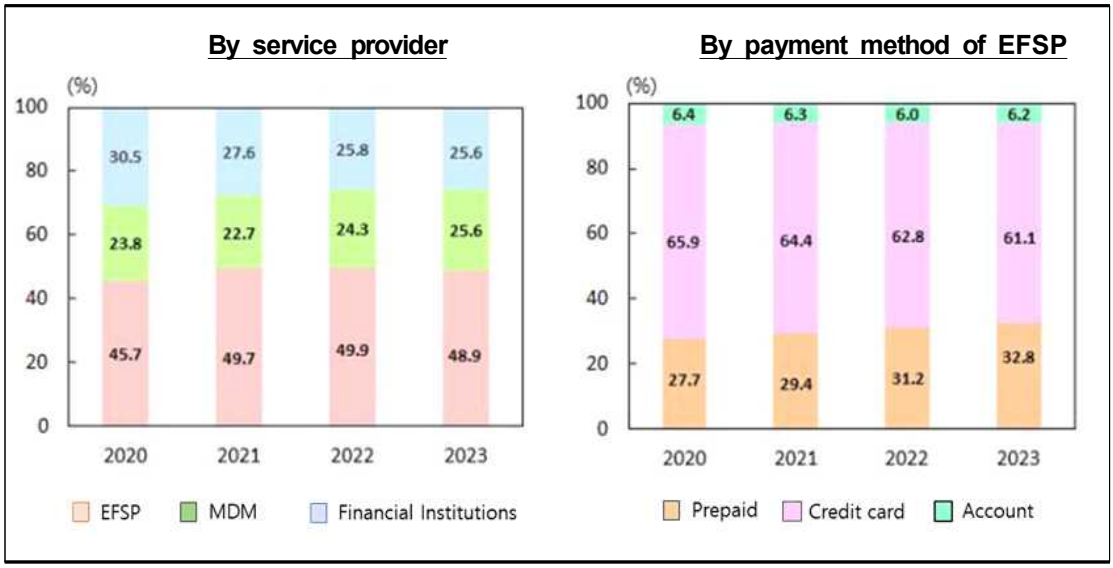
43) BOK (2024a)

44) A digital wallet service in which users' card information is stored with the service provider and payments are authorized by an easy authentication process such as a password or biometric data, including fingerprints or facial images. (BOK, 2024).

<Figure 2-20>

Usage Share of Easy Payment Service



Note: 1) EFSP: electronic financial service providers, MDM: mobile device manufactures
Source: BOK (2024)

5. Retail Payment Systems in Nepal

The retail payment systems include instruments and systems facilitating the general public to make payments for availing various services. Nepal's retail payment systems include electronic cheque clearing, electronic fund transfer, card-based payment systems, QR code-based payment system, and e-Wallets.

Payment related institutions are issued either a PSO or a PSP license. PSOs facilitate the switching and settlement tasks and PSPs provide payment solutions to their customers. Any institution willing to carry out payment related transactions or operate payment system must seek an approval from the NRB before commercially operating such instruments/systems. Some of the existing solutions for retail transactions offered by licensed PSPs in Nepal are as follows.

A. Cheque

Cheque is one of the oldest and widely used mediums of payments in Nepal. Interbank cheques are cleared through the ECC system, owned and operated by NCHL. Owing to the Covid 19 pandemic, the use of cheque reduced, with just

a 1.2 percent increase in the number of presented cheques in 2019/20 compared to 2018/19. However, the number of presented cheque increased by 21.1 percent in 2020/21. Due to wide use of retail payment systems, the use of cheque as a medium of payment is slowly decreasing. In 2022/23, the number of presented cheque dipped by 9 percent, compared to 2021/22[45]. The number of cheques presented for payment has further decreased by 3 percent in 2023/24, compared to 2022/23.

B. Cards

Card is one of the oldest electronic payment instruments in Nepal. Currently, debit, credit and prepaid cards offered by the international scheme providers-Visa, MasterCard, and UnionPay are in operation in Nepal. Cards are used in Point-of-Sale (POS) terminals as well as in payment gateway for e-commerce. In the fiscal year (FY) 2023/24, the number of card users increased by 5 percent, compared to that of FY 2022/23. Similarly, there has been a 7 percent and a 9 percent increase in the number and value of card-based transactions respectively in 2023/24, compared to 2022/23. The use of prepaid card is on increasing trend, compared to debit and credit cards in last few years. Credit card, however, is yet to take the desired momentum in Nepalese payment system. The NRB has allowed banks and financial institutions (BFIs) to enable NFC-based payments up to a maximum of NPR. 5,000 per day. In this line, BFIs have issued NFC-enabled tap cards, providing convenience and efficient payment mechanism to their customers. Card virtualization has started, with a PSO implementing virtual prepaid card. Similarly, one of the licensed PSPs allows virtualization of Visa cards, enabling customers to use card balance to avail e-Wallets services. Other licensed PSOs have also secured approval from the NRB to implement domestic virtual card scheme in Nepal. The NRB, through NCHL, is implementing the National Payment Switch (NPS) and a domestic card scheme with an overarching objective of reducing cost of card transactions and increasing efficiency of card payments and settlement.

45) Payment System Oversight Report, 2022/23

C. Mobile Banking

Mobile banking application started from 2012 and is one of the most widely used retail payment channels in Nepal. Through mobile banking, customers can carry out several financial services such as interbank fund transfer (IBFT), utility bill (electricity, drinking water, internet, school, airlines, etc.) payments, mobile top-ups, online fixed deposit account opening, and e-Wallets transfers/payments. Customers can also avail ancillary services such as applying for cards, opening demat accounts, sending remittance, making stash payments, etc.

As of Mid-July, 2024, there are around 24.65 million (almost 85 percent of total population) mobile banking customers in Nepal. Nonetheless, the said outreach does not account for unique customers. Customers can own mobile banking applications of multiple banks and hence an 84 percent outreach does not necessarily mean an 80.52 percent of the population having access to mobile banking. Compared to 2022/23, the transaction count and value through mobile banking has increased by 50 percent and 59 percent respectively in 2023/24[46].

D. Internet Banking

The users of internet baking are increasing, although at a decreasing rate, primarily because of the wide impact of mobile banking and fast payment systems in Nepal. In 2022/23, the number of internet baking customers increased by 10.21 percent compared to 2020/21. Similarly, in 2023/24, the number increased by just 3 percent compared to 2022/23. In terms of transaction count, internet banking transactions have increased by 9 percent in 2023/24 compared to 2022/23. There has been a marginal increment in the value of transactions accomplished through internet banking, with an 8 percent increase in the value of transaction in 2023/24 compared to 2022/23.

E. QR Codes

Merchant QRs are the most widely used modes of retail payment in Nepal.

46) Payment System Indicators, 2023/24, PSD, NRB

QR codes have primarily played a crucial role in promoting digital payments and reducing the use of cash. To further support QR payments and bring small merchants in the digital banking channel, PSD, NRB has issued simplified KYC requirements for small merchants. With a simplified onboarding of small merchants in the banking channel, the avenues to issue merchant QRs to them is also simplified. Compared to 2022/23, in 2023/24, there has been a 117 percent increase in total number of QR transactions. Similarly, in terms of transaction value, there has been a 104 percent increase in 2022/23 compared to 2021/22.

Since February 28, 2024, Fonepay Payment Service Limited has started acquiring UPI transactions, allowing Indian customers to scan Nepalese merchant QR codes using their own mobile banking applications. As of mid-July, 2024, Nepalese merchants have acquired Rs. 321.67 million from 134,701 transactions.

F. e-Wallets

Although e-Wallets was started by eSewa in 2010, e-Wallets took pace from 2016 after PSD, NRB started issuing PSP license to e-Wallets service providers. The use of e-Wallets surged especially after the Covid 19 pandemic. As of Mid-July, 2024, there are 23.46 million e-Wallets users. e-Wallets transactions are generally of small-ticket size. In 2023/24, e-Wallets transactions increased by 38 percent compared to 2022/23. The value of e-Wallets transactions increased by 35 percent in 2023/24 compared to 2022/23.

G. Faster Payment Systems

Three retail fast payment systems, viz: connectIPS, Fonepay IBFT, and Insta-fund, are operational in Nepal. connectIPS is offered by the licensed PSO-NCHL, Fonepay IBFT is offered by another licensed PSO-Fonepay Payment Service Limited, and Insta-fund is offered by the licensed PSO-Nepal Payment Solution (NPS). Fonepay IBFT can be availed through mobile banking applications of BFIs using either account number or registered mobile number (Fonepay Direct). NCHL, on the other hand, offers connectIPS through the mobile banking application of BFIs, NCHL's connectIPS web portal, and

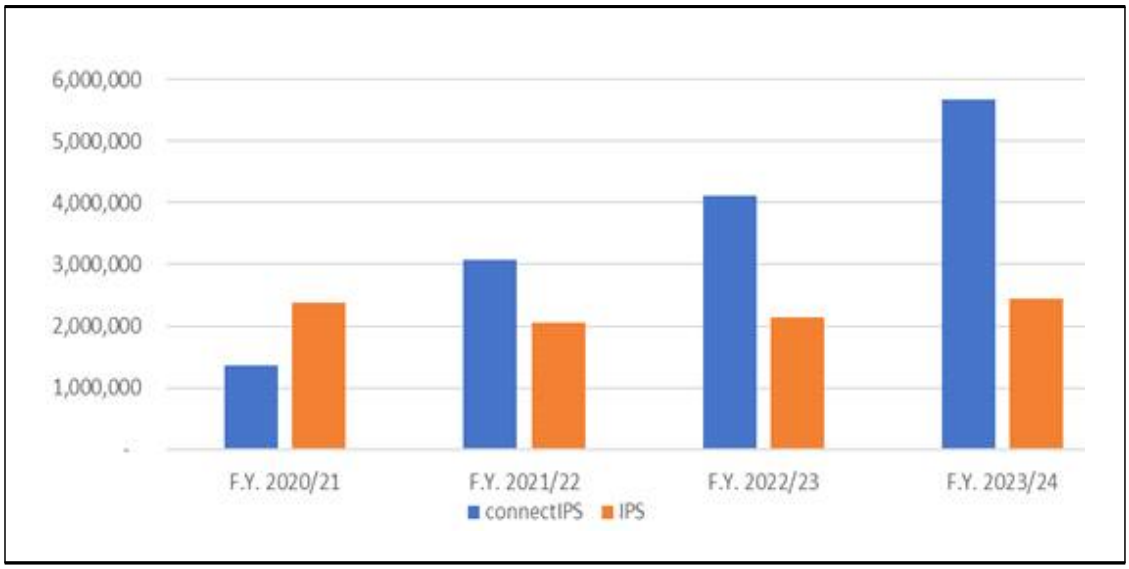
connectIPS mobile application. It is an interbank fund transfer service, allowing customers to transfer funds to A, B, and C class banks as well as e-Wallets using mobile number or account number.

H. Interbank Payment System (IPS)

The IPS is a non-real time payment system offered by NCHL. It is a deferred net settlement (DNS)-based system that settles transactions in different batches. The sender's account is debited immediately, while the beneficiary receives the payment only after the batch consisting a particular transaction is settled. As shown in Figure 2-21, connectIPS has been replacing IPS gradually due to its real time processing capabilities.

Consequently, while the value of transactions processed through connectIPS has increased by 38 percent, the value of transactions has increased just by 14 percent in 2023/24, compared to 2022/23. It is evident from the statistics that customers prefer connectIPS to IPS for retail transactions, primarily due to convenience, agility, and mobile functionalities.

<Figure 2-21>
Value of Transactions Processed Through IPS and ConnectIPS Systems



Source: Nepal Rastra Bank

I. Tap and Pay

Fonepay Payment Service Limited and NCHL have respectively implemented FoneTag and NepalPayTag tap and pay solutions. Tap and pay solution enables customers to make merchant payments by presenting NFC tag or a CP QR code (customer presented QR code) from their mobile app even in areas with limited or no internet connectivity. Thus, Tap and Pay provides offline merchant payment capabilities to customers without using mobile data and unsecured public Wi-Fi for making payments.

J. Digital Loan and Buy-Now-Pay-Later (BNPL)

Fonepay Payment Service Limited has collaborated with BFIs to offer pre-approved digital loan (Foneloan) through mobile banking application and use the loan amount to make merchant payments using Fonepay QR. The service was started from the fiscal year 2020/21. It is available to salaried customers, who pass the eligibility criteria. The loan is collateral-free, paperless, and fully automated based on the decision analytics. Customers can choose to pay back the loan in a month or in equal monthly installments (EMI) in a period of 3 months, 6 months, 9 months, or 12 months for the purchase. The merchant gets the full payment when the transaction is completed, but the repayment to the bank happens later as per the selected pay back option. Outstanding amount of digital loan (Foneloan) availed by BFIs in Nepal through mobile banking application are shown in table 2-17 below.

<Table 2-17>

Digital loan (Foneloan) availed by BFIs

S.N.	Name of the Institution	Type of Digital Loan	Sanctioned Loan Amount (NPR)	Outstanding Amount (NPR) till FY 2023/24
1	Agriculture Development Bank Limited	Instance Fone Loan	1,297,500	922,095
2	Citizens Bank International Limited	Pay Day Loan	1,060,500	1,037,147
3	Everest Bank Limited	Epaicho Foneloan	49,496,000	27,978,000

4	Global IME Bank Limited	Foreign Employent Support Loan	22,150,000	18,167,803
5	Himalayan Bank Limited	NA	-	-
6	Kumari Bank Limited	Fone Pay loan	209,337,500	163,428,158
7	Laxmi Sunrise Bank Limited	Smart Phone Loan	1,894,014,146	284,961,204
8	Machhapuchchhre Bank Limited	Digital Lending via Mobile banking	5,717,500	736,438
9	Nabil Bank Limited	Fone Loan	323,282,000	234,966,796
10	Nepal Bank Limited	NA	-	-
11	Nepal Investment Mega Bank Limited	NIMB Smart Loan	6,921,500	231,521
12	Nepal SBI Bank Limited	NA	-	-
13	NIC Asia Bank Limited	Fone Lone	68,175,500	50,748,144
		Credit Card Insta Buy	196,334,300	67,657,404
14	NMB Bank Limited	Daraz NMB Sajilo Karja	8,248,920	3,433,153
		NMB Kheti Karja	76,180,959	67,461,234
		NMB Sajilo QR Loan Fixed	1,400,000	1,145,338
		NMB Sajilo QR Loan Floating	9,974,000	6,103,487
		NMB Sapati Fixed	2,959,544	603,339
		NMB Sapati Floating	15,792,231	3,527,286
		NMB Sapati Existing Loan Customer Fixed	11,400,000	2,732,774
		Nmb Sapati Existing Loan Customer Floating	8,775,000	1,921,392
15	Prabhu Bank Limited	Fone Loan	47,144,000	28,060,044
16	Prime Commercial Bank Limited	NA	-	-
17	Rastriya Banijya Bank Limited	NA	-	-
18	Sanima Bank Limited	NA	-	-
19	Siddhartha Bank Limited	QR loan	19,337,532	12,532,547
20	Standard Chartered Bank Limited	NA	-	-
Total			2,978,998,632	978,355,305

Source: NRB

K. Cross-Border Payments

Cross-border payments were enabled by international card networks like Visa Worldwide Pte. Ltd, MasterCard Asia/Pacific Pvt. Ltd., and Union Pay International Company Limited. BFIs accept these international card schemes, ensuring interoperability of their card switches.

Several initiatives for cross-border integration of faster payment systems have started in Nepal. Himalayan Bank and Focusone Payment Solutions Pt. Ltd. have been acquiring Alipay transactions since 2019. In 2023, a total of NPR 4.03 crores of Alipay transactions were acquired through 24,000 plus merchant points. Similarly, Nepal SBI Bank Limited has been acquiring UPI's Rupay cards through their ATM and POS terminals. NMB Bank Limited has been acquiring WeChat pay transactions, with other banks expressing their interest to undertake acquiring of several other international payment service providers.

The key milestone in cross-border payment integration has been the Memorandum of Understanding (MOU) between NRB and Reserve Bank of India (RBI) for the integration of India's UPI and Nepal's NPI. With such integration, customers are expected to enjoy seamless cross-border person-to-person payments. The project is expected to go live by September-end, 2024.

Moreover, Since 28 February 2024, one of Nepal's fast payment systems (Fonepay) has been integrated with India's UPI for acquiring P2M based UPI transactions through Nepalese QR codes. Till mid-July, 2024, Fonepay has acquired a total of 134,701 number of UPI transactions valued NPR 321.67 million. The current approval covers the acquiring side, and soon the issuing side will also be implemented, after which Nepalese customers will also be able to scan Indian QR codes.

Similarly, another fast payment system (connectIPS) is in the final phase of acquiring UPI-based P2P payments. Such integrations are benchmarking developments as Nepal and India share frequent movement of people between the countries.

Nonetheless, cross-border integrations require a robust payment infrastructure, including real time processing capabilities, secured networks, and interoperability.

Cross-border integrations also raise exchange rate risk and risk of capital flight

if such risks are not addressed and managed adequately. The involvement of multiple intermediaries in cross-border transactions can also result in high processing fees and longer processing time; thus, streamlining payment process and reducing intermediary costs are crucial for enhancing the interoperability. Similarly, differences in data protection laws and regulations between countries may complicate compliance and increase the risk of data breaches. Thus, the regulatory and oversight role of the NRB is crucial in managing these risks and challenges as Nepal opens up its retail payment for cross-border transactions.

L. Other Developments

As global economies explore Central Bank Digital Currencies (CDBCs), the NRB has also envisioned to launch the CDBC pilot by 2026. In this light, a CBDC Division has been established within PSD to implement and operate CBDC pilot in Nepal. Apart from CBDC, the NRB has declared all other forms of crypto assets as illegal through multiple public notices[47].

Observing the access and usage trend of modern payment instruments, the movement from cash to non-cash payment systems is clearly visible in Nepal. The use of cash is gradually declining, which can be observed from the decreasing rate of growth of ECC transactions. Following the events of crises like the earthquake and Covid 19 pandemic, people had developed the behavior of holding cash. However, the Covid 19 pandemic has further spurred the use of digital payments. In days to come, such holding is expected to decrease. This is also evident from the reduced currency in circulation-to-GDP ratio in last two fiscal years (10.3 percent in 2021/22 and 9.6 percent in 2022/23), compared to 13.1 percent in 2020/21.

47) https://www.nrb.org.np/contents/uploads/2021/09/FXMD-Notice-03-207879-Cryptocurrency.pdf; https://www.nrb.org.np/contents/uploads/2022/01/FXMD_Notice_Crypto.pdf; https://www.nrb.org.np/contents/uploads/2022/08/FXMD-Notice-2_207980_Cryptocurrecy.pdf; https://www.nrb.org.np/contents/uploads/2023/04/FXMD-Notice-Cryptocurrency_2079.12.20.pdf; https://www.nrb.org.np/contents/uploads/2023/04/Cryptocurrency-Related-Risks-Assessment_2079.12.20.pdf

6. Policy Implications

A. Overview

The Nepal Rastra Bank, with the vision of "Unlocking the potential and moving towards safe and efficient payment systems in Nepal", has been continuously pushing ahead with plans facilitating non-cash payments as well as digital payments in Nepal[48]. Advances in digital payments have transformed Nepali end-users' lives in recent decades. Owing to these efforts, innovative payment instruments have brought a sea change to the payment ecosystem: QR codes, connect IPS, card-less withdrawal, smart POS, contact-less cards based on NFC technology, virtual cards, etc.

With all the recent achievements, there still remain rooms for NRB to further improvement with respect to the safety and efficiency of payments. While the stability of payment and settlement systems rests on the firm foundations set by central banks, end-users seek everything to be faster, simpler and cheaper in terms of cross-border as well as domestic payments. Central banks need to address these demands. Improving the functioning of the payment and settlement system might be thus an important public policy objective if NRB wishes to pursue a sustainable advancement[49]. Delivering this issue, to be sure, will require proactive collaboration between public authorities and private sector institutions.

Against this backdrop, past experiences of Korea would not be meaningless to Nepal.

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48) Examples of such initiatives can be represented by "Payment System Development Strategy" (2014), "Nepal Financial Inclusion Roadmap 2017-2030" (2016), "Nepal Financial Inclusion Roadmap Action Plan" (2016), "Payment System Oversight Framework" (2018), "Digital Nepal Framework" (2019), "Nepal Payments System Development Strategy" (2019), "Retail Payments Strategy" (2019), and so forth.

49) A CPSS report explains what must be taken into account when a development plan of a national payment system is implemented. It points out that "there is no single recipe for effective development of a national payment system, but the questions countries undergoing a reform process ask themselves are largely similar. For instance, who should be involved and who should initiate the process? What are the priorities in which to invest? And are they based on a solid understanding of the payment system? What are the different infrastructures needed and what are their supporting institutional arrangements?" (CPSS, 2006).

B. Lessons and challenges

(1) Lessons Learned in Korea

Then, what can be learned from past experience of Korea? In retrospect, there have been several key success factors. From an institutional perspective, BOK and other relevant authorities have tried to maintain following aspects:

- Try to comply with international principles, practices and recommendations. The CPSS/CPMI is one of the main international standard setters in payment and settlement systems. In this regard, BOK has explicitly incorporated the PFMIs in its regulation.
- Establish a firm legal and regulatory framework. Powers, responsibilities, and procedures of the central bank should be clearly defined. Likewise, BOK has made every effort to clarify central bank's role and responsibility in relevant legislation as well as the BOK Act.
- Set up a governing body for coordination and cooperation. It could be a national payment commission, committee, or council. In this connection, BOK tried to make the most of the function of Committee on Financial Informatization Promotion in order to coordinate different participants and stakeholders.
- Maximize the benefits of a central clearing center/switch mainly for the efficiency reasons. In Korea, the KFTC has been playing a crucial role in retail payments as the sole clearing center and payment switch.

In addition, several aspects from an operational perspective can be also raised:

- Strike a fine balance between private sector innovation and public sector initiative.
- Too tight rules might thwart creativity. Private sector, by its nature, tends to be more focused on efficiency, whereas public sector is more on the safety issue. Sometimes private sector takes the lead, then public sector follows, vice versa the other times.
- Gain industry-wide consensus for each project to gather momentum.

- Follow up technological advances and market trends to embrace innovation.
- Determine country-specific characteristics of payments because payment landscape, such as financial consumers'preference, is of importance.
- Regularly communicate with stakeholders and the general public through various channels. It can be a form of public consultation, research paper, annual report, seminar or disclosure of relevant information. In this context, BOK regularly publishes annual report on payment and settlement systems, press release on quarterly payments trend, occasional research papers, statistics on payment and settlement and holds annual conference, frequent seminars, etc.

(2) Challenges for central bank

A dominant and persisting challenge of a central bank in payment systems is the issue of maintenance of balance between safety and efficiency of the system for the public interest. Both safety and efficiency are the ultimate goals of oversight activity of a central bank. As the convergence of finance and ever-evolving IT changes the payment landscape, central banks are confronted with risks that have not been experienced before. Specifically in Korea, the growing presence of non-financial players in payment systems has posed unconventional risks deriving from innovative payment services and channels, and it has enhanced the convenience of end-users, while reducing the cost of payments with improved options.

Risks arise mainly from the complex inter-linkage between banks and non-financial companies, such as bigtech and fintech companies. Therefore, central banks are required to cope with these emerging issues lest any shock to retail payments should be materialized at all.

Nonetheless, measures against newly emerging risks have to be carefully taken to facilitate innovations that non-financial companies bring[50]. BOK is not

50) Main issues in relation to non-bank activities in retail payments can be summarized as follows: concentration issues, outsourcing issues, operational complexity issues, consumer protection issues, level playing field issues, and stakeholder involvement (CPMI, 2014).

exceptional in this regard and expected to produce a preemptive oversight framework.

In addition, financial inclusion has received increasing policy attention over the past decade[51]. The benefits stemming from innovations in the financial sector differ between geographical regions, financial asset levels, and generations. Aspects vary from country to country. For example, innovative payment services provided by fintech companies are known to have caused digital divide between young and old generation and raised an issue of financial inclusion. On the contrary, the digital way of easy or instant payment services are instrumental in promoting financial inclusion. BOK, responding to a call for improvement, has been required to pay more attention to economically vulnerable classes who are excluded from the recent evolvement in retail payments.

C. Recommendations for NRB based on Korean experience

Although limited resources in English translation constraints the analysis, issues that might draw our attention can be derived from observations so far. The following are policy recommendations for NRB to further review[52].

(1) Secure a Robust Legal Framework

Payment and settlement systems that have been defined as systemically important payment and settlement systems (SIPS) by NRB should secure guarantee of settlement finality. This legal underpinning has to be prescribed in a law rather than a regulation or rule book. The guarantee of settlement finality comprises RTGS system, securities settlement system, retail payment system and cross-border payment system. To that end, NRB will need to establish a

51) A report by CPMI and World Bank explains the relationship between financial and payments as follows: “Financial inclusion starts with payments. They serve as a gateway to other financial services, such as savings, credit, and insurance. Transaction accounts operated by a regulated payment service provider are at the heart of retail payment services. To improve financial inclusion, these transaction accounts need to enable end users to meet most, if not all, of their payment needs and to safely store some value.” (CPMI and World Bank Group, 2020).

52) In fact, a number of important recommendations have been already suggested by Technical Assistance Report (FSSR) of IMF in 2023.

framework for the designation of SIPS beforehand.

(2) Reinforce NRB-RTGS System

The RTGS system of NRB seems to be successfully positioned as the settlement system of crucial importance since its inception in 2019. The system is being operated on a firm legal basis from many aspects. Its overall operational structure appears to be also well organized to ensure somewhat compliance with international principles and standards. However, it might be important to note that not only payments ecosystem but also the wider financial environment varies from country to country when the design and operation of an RTGS system are reviewed. For instance, the RTGS system may have to interact with other systems such as securities settlement systems or cross-border interconnections and its operation may have substantial monetary policy implications.

With this in mind, further improvements can be made in the following issues to enhance the safety and efficiency of the NRB-RTGS system[53]:

- Clarification of legal underpinning of settlement finality
- Sophistication of queuing mechanism
- Introduction of hybrid mechanism
- Improving intraday liquidity facility
- Reinforcing risk-based monitoring and analysis of settlement data
- Realignment of net settlement times for NCHL's DNS systems[54]
- Other improvements[55]

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53) As for the above issues, applicable principles of the PFMIs can be found in Principle 3 (Framework for the comprehensive management of risks), Principle 4 (Credit risk), Principle 7 (Liquidity risk), Principle 17 (Operational risk), and Principle 23 (Disclosure of rules, key procedures, and market data). (CPSS-IOSCO, 2012).

54) For example, the settlement time for ECC seems to be stipulated around 1:30~1:40 and 3:00~3:40. And the time for IPS is set around 3:00~3:15 and 3:15~3:30, according to NCH rule.

55) For instance, offering incentives to encourage early settlements, expansion of direct participant base, and expanding provision of information on the RTGS settlement.

Of course, a result of the assessment of the RTGS based on the "PFMIs: Disclosure Framework and Assessment Methodology" may raise a series of issues to be further addressed[56].

(3) Strengthen Management of Settlement Risk in Retail Payments

A core pillar of settlement risk management for NCHL's DNS systems can be understood as the pre-funding of settlement liquidities (i.e. Interlocked Debit Cap) for final net settlement. While this approach fully guarantees settlement of net obligations, participants of retail payment system may experience inefficient management of settlement liquidities due to dispersed settlement times during operating hours of NRB-RTGS system.

Therefore, NRB might need to consider a simple net settlement processing rule to improve the efficiency of liquidity management. In this case it would be necessary for NRB to investigate a possibility of single integrated net settlement time which comprises NCHL's retail payment systems altogether.

Meanwhile, it has been reported that there are 10 PSOs and 89 PSPs licensed by NRB[57]. Except NCHL, most of settlements among participating institutions of individual PSOs are likely carried out on settlement accounts held at commercial banks. This process will raise issues such as guarantee of final settlement with central bank money and protection of customer's money whatever the customer is a sender or a recipient[58]. Safeguarding customer funds is of crucial importance in building end-user confidence in retail payments.

In addition, it has been known that there were reported cases of IT system failures in retail payments. It might be worthwhile for NRB to monitor down times of IT system in order to analyse root causes of system failures both in payment system operators and payment service providers.

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56) It also relates to the principle that "central banks should apply the same standards to their FMIs as those that are applicable to similar private-sector FMIs." (CPMI-IOSCO, 2015).

57) Domestic PSOs are Nepal Clearing House Ltd. (NCHL), SmartChoice Technology Ltd., Nepal Electronic Payment Systems Ltd. (NEPS), Nepal Payment Solution Pvt. Ltd., Fonepay Payment Services Ltd., First Pay Technology Pvt. Ltd., and Gateway Payment Service Pvt. Ltd. International PSOs are Union Pay International Company Ltd. (Shanghai), Visa Worldwide Private Ltd. (Singapore) and Master Card Asia/Pacific Pte Ltd.(Singapore).

58) It would be especially important for Fonepay since NCHL and Fonepay are taking a greater part of retail transactions in Nepal.

These policy recommendations would pave the way for a user-centric, unified and universal payment ecosystem brought into the digital era that is inclusive, innovative, participatory, accessible and affordable, and leaves no one behind. In this sense, a proactive role of NRB is a promising vehicle to deliver on digital payments in Nepal.

D. Detailed Policy Tasks from perspective of NRB

Apart from the above-mentioned issues, following policy implications and pending tasks can be come up with to improve payment systems from the perspective of NRB, based on the current situation in Nepal.

(1) Improve Legal and Regulatory Framework

(a) Need for a provision to provide the Payment and Settlement Act preceding over the Insolvency Law

The Payment and Settlement Act (2019) has provision for settlement finality, wherein any transaction is considered to be final as soon as the real amount is transferred. Once a settlement is deemed final, it is considered irrevocable to maintain confidence and stability in the financial system. However, a final settlement can be reversed following a court's order given sufficient grounds for ordering the reversal.

However, the Act does not have clear provision to protect the netted transactions from potentially disruptive insolvency law. Even if a system participant fails during the day, a liquidator cannot generally unwind settlement occurring net at end-of-day. The current law, however, does not explicitly protect the transfer orders and netting from insolvency law provisions from the moment they enter a designated system. Thus, transfer orders and netting shall be legally enforceable and, even in the event of insolvency proceedings against a participant, shall be binding on third parties, provided that transfer orders were entered into a system before the moment of opening of such insolvency proceedings.

(b) Prohibition of Retroactive Effects of Zero Hour Rule

The Payment and Settlement Act (2019) does not have provisions to prevent or prohibit the retroactive effects of the zero-hour rule. The zero-hour rule can backdate the effect of a bankruptcy or insolvency order to the start of the day (i.e. zero hour) on which the order is made. Thus, any transactions carried out after midnight of the day of the insolvency order can be invalidated. In the RTGS system, the effect could be to reverse payments that have apparently already been settled and were thought to be final. In a system with deferred net settlement, such a rule could cause the netting of all transactions to be unwound. This would entail a recalculation of all net positions and could cause significant changes to participants' balance, posing systemic risk in the ecosystem. Hence, a clear provision related to prohibiting the retroactive effects of zero-hour rule should be included in the Payment and Settlement Act.

(c) Continuous Improvement of Regulatory Framework

As digital risks are evolving, the regulator should rapidly invest on research and development activities to identify emerging risks and innovation facilitators. To address emerging risks and facilitate responsible innovations, the regulatory framework should be improved/updated from time-to-time.

(2) Upgrade Interoperability and Scalability of Systems

(a) Upgrading Messaging Standards

Many financial institutions rely on legacy systems that were built around ISO 8583 or local messaging standards. However, considering the progression of payments ecosystem and cross-border integrations, there is a need for upgrading to ISO 20022 or similar messaging standards. For this, enforceability may be needed from the policy level.

(b) Interoperability of Payment Systems

To ensure efficiency, convenience, security, and inclusivity in financial transactions, policy arrangement related to interoperability of payment systems should be strictly enforced as specified in NRB unified directive issued to PSO and PSP.

(c) Promotion of Cross-border integrations

Cross-border integrations of payment systems can foster trade and investment. Thus, cross-border integrations for payment system can be promoted by policy formulation and harmonization with international standards.

(d) Automation Interest Charging for OLF

To avoid the missing and duplication of interest charging and its calculation, NRB GL system should be made robust to reflect the transactions timely in the system.

(3) Promote Digital Payments

(a) Investment in Digital Public Infrastructure (DPI)

To foster digital payment and promote responsible innovation, the state should make investment in relevant digital public infrastructure like digital ID system, regulatory sandbox, data exchange platforms, among others. The ambitious National Payment Switch (NPS) is partly functional, with Retail Payment Switch (RPS) in operation since November 2021. The card component of the NPS is planed to go-live by September-end, 2024. Once the NPS is fully functional, policy considerations should be made to direct all domestic transactions through the NPS.

(b) Digital Financial Literacy

The policies should mandate investment in promoting digital financial literacy to ensure that customers and stakeholders are aware of emerging risks and threats from digital platforms. Such investment may also encourage and ensure higher adoption of digital services.

(c) Focus on Financial Inclusion

Digital systems can reach areas where physical branches cannot. Hence, the primary policy goal for any innovation should be to foster financial inclusion of the unbanked, marginalized and underserved segments of the population.

(d) Incentivize Digital Payments

By promoting efficiency, convenience, speed, and transparency, digital payments can greatly contribute in digitalization of the overall economy and the economic growth thereof. Hence, to promote digital payments, incentives such as tax refunds/benefits and subsidies for merchants/customers can further foster digital payments in the economy.

(e) Digitalization of Person-to-Government Payments

As digital transaction can be traced with detailed logs, such transactions ensure transparency of payments flow. Hence, with the digitalization of P2G payments, corruption and shadow trades can be significantly reduced.

(4) Protect End-users and Prevent Criminal Activities

(a) AML/CFT Considerations

The digital payment systems, as FATF calls them new payment methods, are extensively used for money laundering (ML), terrorism financing (TF), and proliferation financing (PF). Thus, to prevent these systems from being used for ML/TF/PF activities, the following considerations should be made:

- Implement a risk-based approach
- Mandate stringent customer identification, verification, and acceptance measures
- Mandate and promote continuous monitoring of transactions, behavior, and activities
- Specify value limits (per transaction, per day, per month, per geography, etc.)
- Set restrictions on risky funding methods like third party funding and cash funding
- Mandate periodic KYC updating rules
- Specify risk assessment and reporting requirements
- Specify regulation for monitoring and managing the obligations of outsourced activities
- Specify clear provisions for prosecution and sanctions
- Specify programs for increasing awareness of stakeholders, etc.

(b) Digital Consumer Protection

Digital transactions usually constitute non-face-to-face interactions with the service providers. In such case, issues related to transaction errors, frauds, misuse of sensitive customer data, non-hearing of issues and complaints, etc. may occur. To protect customers from such issues, there should be clear provision related to digital consumer protection in relevant policies.

(c) National ID and Centralized KYC System

The increasing use of retail payments, targeted at general public, raises several risks and challenges. Identity risk is one of the severe risks associated with digital onboarding in Nepal. In this light, national ID and centralized KYC system can play pivotal role in managing such risk.

III. Risk-based Supervision and Oversight

1. Overview

This chapter examines the supervision and oversight activities of the Bank of Korea and the Nepal Rastra Bank in detail. The purpose of this chapter is not to compare the supervision and oversight activities of the two central banks. The first objective is to provide knowledge and information on the supervision and oversight activities of the Bank of Korea to the Nepal Rastra Bank in line with the purpose of the BOK-KPP project. The second objective is to understand the supervision and oversight activities of the Nepal Rastra Bank, identify areas (needs) for improvement, and then provide policy recommendations to the Nepal Rastra Bank to improve its risk-based supervision and oversight activities. It is for this second objective that this chapter includes the supervision and oversight activities of the Nepal Rastra Bank.

The following section introduces in detail the legal basis for the supervision and oversight of the Bank of Korea, the oversight framework, and monitoring and system evaluation as oversight tools. In particular, we discuss the what the Bank of Korea recommended to payment system operators for improvement in the evaluation activities based on the PFMI. Also, the following section explains the payment information system used for real-time monitoring, 11 monitoring indicators, and the net debit cap caution level (70% rule). In particular, we discuss the Timon & WeMakePrice incident and the MergePoint incident that occurred in Korea in relation to settlement risk management. Nepal still has a large proportion of cash usage, but it is moving towards digital finance. Therefore, it is necessary to appropriately manage settlement risks related to prepaid electronic payment methods and customer funds handling on e-commerce platforms in Nepal as well. Considering that there have been issues with the fund management of e-commerce platforms in India, it is worthwhile for the Central Bank of Nepal to refer to these two cases in Korea.

Meanwhile, the supervision and oversight of Nepal is introduced in Section 3 and the challenges and policy issues that Nepal Rastra Bank faces are presented in Section 4.

2. Risk-based Supervision and Oversight of the Bank of Korea

A. Oversight Framework of the Bank of Korea

The Bank of Korea lost its supervisory power when the Financial Supervisory System was reorganized in the wake of the financial crisis in 1997. In 2001, the Monetary Policy Committee of the Bank of Korea established regulations on the operation and management of the payment and settlement system and required the Bank of Korea to report its surveillance activities to the Monetary Policy Committee annually. In 2003, the IMF's Financial System Stability Assessment (FSAP) pointed out that the Bank of Korea's oversight capabilities needed to be significantly improved. In other words, the IMF determined that the Bank of Korea did not have the responsibility and power to apply the core principles of the BIS to the payment and settlement systems, and that this was an obstacle to securing the stability of the payment and settlement systems in Korea. The IMF recommended that i) the Bank of Korea's role and goals related to the payment and settlement system be stipulated in law, ii) the Bank of Korea's role in the supervision role be included in the responsibility for ensuring the smooth operation of the payment and settlement system, and iii) the Bank of Korea be granted legal authority to request data from participating institutions, set technical standards, etc., and issue instructions to participating institutions that do not meet the standards.

Based on the IMF's assessment and recommendations, the Bank of Korea's oversight responsibility was specified in Article 81 of the 「Bank of Korea Act」. Comparing Table 3-1, it can be seen that before the revision in September 2003, the Bank of Korea's legal functions and responsibilities regarding the payment and settlement system were marginal, but the 2003 revision laid the foundation for the current supervisory system. The current oversight system consists of i) designation of payment and settlement systems subject to oversight, ii) monitoring, iii) assessment, iv) improvement recommendations, and v) emergency measures.

<Table 3-1>

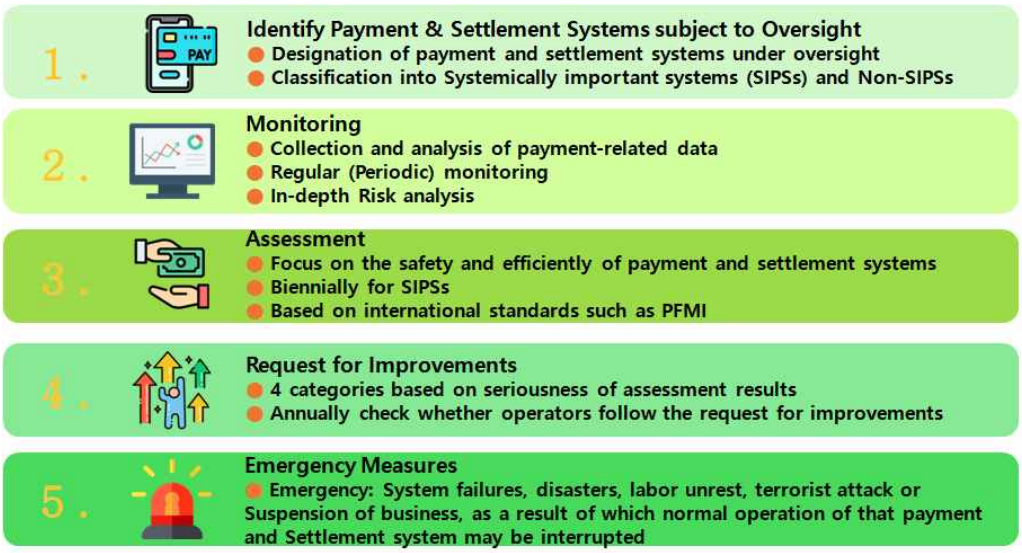
Article 81 of the 「Bank of Korea Act」

Before the Revision	Revision made in September 2003
The Bank of Korea operates and manages the payment and settlement system that is directly related to monetary policy	① The Bank of Korea may establish necessary measures regarding the payment and settlement system operated by the Bank of Korea in order to promote the safety and efficiency of the payment and settlement system.
	② The Bank of Korea may, if necessary, request improvement of operating standards, etc., payment and settlement systems operated by entities other than the Bank of Korea to the relevant operator or supervisory authorities
	③ In order to ensure smooth operation of the payment and settlement system, the Bank of Korea may request payment and settlement-related data from the payment and settlement system operator pursuant to the Paragraph 2. In this case, the institution receiving the request shall comply.
	④ The Bank of Korea may request the submission of necessary data from participating institutions in the payment and settlement system pursuant to the Paragraph 1.

Source : Bank of Korea

<Figure 3-1>

Oversight Framework of the Bank of Korea



Source : Bank of Korea (2020)

(1) Legal Bankgrounds of Oversight and Supervision

(a) 「Bank of Korea Act」

The Bank of Korea's power or authority to oversee the payment and settlement system is based on Article 81 of the 「Bank of Korea Act」. Although the Article does not directly mention the term “oversight”, it means that the Bank of Korea can exercise oversight power over the payment and settlement system, so the Article is considered to be a provision granting the Bank of Korea the authority to oversee.

Article 81 is as follows. First, the Bank of Korea may establish necessary measures regarding the payment and settlement system operated by the Bank of Korea in order to promote the safety and efficiency of the payment and settlement system. The payment system corresponding to this is BOK-Wire+, and it is natural to interpret that the system includes the net settlement process of retail payment systems.

Second, the Bank of Korea can request improvement of operating standards for private payment and settlement system operators or supervisory agencies. Also, the Bank can request submission of related data from the operators. Unlike the first one, it provides the basis for the Bank of Korea to exercise its oversight power over payment & settlement systems except BOK-Wire+. The payment and settlement systems subject to it include retail payment systems, securities settlement systems, and credit card systems. Supervisory agencies include the Financial Services Commission and the Financial Supervisory Service.

Third, the Bank of Korea may request data submission from BOK-Wire+ participating institutions. All commercial banks and foreign bank branches, major securities firms (financial investment companies) and insurance companies in Korea participate in BOK-Wire+, so the scope of participating institutions is wide and the number of participating institutions is large.

Article 81 of the 「Bank of Korea Act」 on the oversight power has two characteristics. First, the Bank of Korea directly oversees payment and settlement system operators. Although the Bank of Korea can request submission of data from participating institutions of BOK-Wire+, this is a right exercised in its

capacity as a system operator. This is because the Bank of Korea can only request payment and settlement information related to BOK-Wire+ from commercial banks, and cannot request payment and settlement information related to other systems from them.

(b) 「Regulation on the Operation and Management of Payment and Settlement Systems」

As part of its monitoring activities on financial market infrastructure pursuant to Article 81 of the 「Bank of Korea Act」, the Bank of Korea prescribes assessment criteria, assessment cycles, and assessment methods in the 「Regulation on the Operation and Management of Payment and Settlement Systems」 and the 「Working Regulation on the Operation and Management of Payment and Settlement Systems」.

The 「Regulation on the Operation and Management of Payment and Settlement Systems」 consists of 5 chapters and 46 articles. Chapter 4 deals with the oversight of payment and settlement systems and consists of a total of 11 Articles.

Article 33 contains the contents of supervision work, including i) selection and classification of payment and settlement systems subject to oversight, ii) collection and analysis of payment and settlement-related data, iii) assessment of the safety and efficiency of payment and settlement systems subject to oversight, iv) request for improvement of payment and settlement systems subject to oversight, and v) measures in case of emergency.

Article 35 deals with the classification of payment and settlement systems subject to oversight. Specifically, the Bank of Korea designates systemically important payment and settlement systems (SIPSs) based on the size of settlement, nature of settlement, etc., and lists systems that occupy an important position in the financial system.

Article 36 specifically states the data that the Bank of Korea may request from payment and settlement system operators other than BOK-Wire+, including: i) regulations and business processing procedures related to payment and settlement system operation, ii) data for payment and settlement system assessment and compilation of payment statistics, and iii) other payment and

settlement-related data that the Governor deems necessary.

Article 37 states that the BIS-IOSCO 『Principles on Financial Market Infrastructures』 be used as the criteria for evaluating payment and settlement systems. It also states that the Governor of the Bank of Korea may add other monitoring criteria.

Article 38 stipulates that systemically important payment and settlement systems (SIPSs) will be regularly assessed every three years, and that assessments of other systems will be conducted only when there are significant changes affecting their safety and efficiency.

Article 39 deals with requests for improvement to system operators. That is, if the Bank of Korea finds that the results of the payment and settlement system assessment do not meet a certain standard, it may request the operator or supervisory agency to improve the operating standards.

(c) Additional Supervisory Power

The Bank of Korea may conduct on-site examinations of some non-bank payment service providers and financial investment companies participating in the small payment system in accordance with the 「Electronic Financial Transaction Act」 and the Financial Investment Services and Capital Markets Act」. However, only joint examinations with the Financial Supervisory Service are permitted. In addition, the Bank of Korea holds the right to request information from the relevant institutions.

<Table 3-2>

Articles relevant to Oversight in 「Regulation on the Operation and Management of Payment and Settlement Systems」

Article	Main Contents
33	**(Activities of oversight)** The oversight duties of the Bank as referred to in Article 3 Paragraph ② are as follows: 1. Designation and Classification of payment and settlement systems under its oversight authority, 2. Collection and analysis of payment-related information, 3. Assessment of the safety and efficiency of payment and settlement systems under its oversight authority, 4. Requests for improvements in payment and settlement systems under its oversight authority, 5. Emergency measures, etc.
34	**(Payment and settlement systems under oversight)** Scope of payment systems subject to oversight
35	**(Classification of payment and settlement systems under oversight)** Important System Selection Criteria, List of important systems
36	**(Request for submission of materials)** Regulations and business processing procedures related to the operation of payment and settlement systems, and data for payment and settlement system evaluation and compilation of statistics
37	**(Standard for assessment)** PFMI established by BIS-IOSCO, other criteria designated by the Governor
38	**(Assessment period)** Regular evaluation of important payment systems, and evaluation of other systems when reasons arise
39	**(Request for improvement)** Request for improvement of operating standards for operating agencies or supervisory agencies
40	**(Notification by payment and settlement system operators)** The system operator shall report to the Bank of Korea any changes to regulations, business processing procedures, participating organizations, or computer systems related to operation and in the event that the system cannot operate normally due to computer system failure, disaster, strike, terrorism, or business interruption,
41	**(Measures for emergency)** In the event of an emergency such as a system failure, work processing procedures and operating hours may be temporarily changed and participation of some participating organizations may be restricted.
42	**(Detailed oversight methods)** Detailed matters concerning oversight, such as assessment of payment and settlement systems under the Bank's oversight authority, shall be decided by the Governor.

Source: Bank of Korea

<Table 3-3>

Oversight Power of the Bank of Korea

Background	Oversight Tool	BOK-Wire+	Other System		Non-bank PSP1)
		Participant	Operator	Participant	
Bank of Korea Act	Information Request	O	O	-	O
	Assessment and Recommendation	-	O	-	-
	Joint On-site Examination	O (bank, financial investment company)	-	-	△2)
MPC Regulation	On-site Check as a Post-action	O	O	O	-

Note: 1) PSPs provide electronic funds transfer service, electronic pre-paid means, or payment gateway
2) PSPs providing electronic funds transfer service are subject to joint on-site examination, but there are no such PSPs as of 2024

Source: Bank of Korea

(2) Oversight Target

In order to focus its monitoring capabilities on payment systems that are considered important at the financial system level, the Bank of Korea classifies payment and settlement systems into i) systemically important systems (SIPSs) and ii) other systems based on the size of settlement, nature of settlement, and impact on the financial system.

A systemically important payment and settlement system (SIPS) is a system where, if the system fails to operate normally, the impact of a system failure could spread throughout the financial system, potentially putting the entire financial system at risk.

(3) Oversight Activities of Bank of Korea

The oversight activity of the Bank of Korea is divided into five categories.

The first stage is to choose the payment and settlement system to be overseen and designate the systemically important payment and settlement system (SIPSs).

The second stage is monitoring. Monitoring is the task of collecting and

analyzing information on system operation, liquidity of participating institutions, and payment transactions from the payment and settlement system. The Bank of Korea creates settlement risk indicators in real time and observes the movement of the indicators. In addition to this real-time monitoring, the Bank of Korea conducts a survey on system failures, regulatory changes, etc. to payment and settlement system operators every quarter to identify risk factors. Risk indicators related to BOK-Wire+ include the settlement concentration rate during closing time zone and the net debit cap utilization rate for net settlement. In addition, the Bank of Korea holds the Payment and Settlement System Operators' Council twice a year. At this meeting, the Bank of Korea obtains information on the payment and settlement system operators' main business plans and risk management procedures.

The third step is the assessment of safety and efficiency. The purpose of monitoring is to collect information, and identify and measure settlement risks based on the information. In other words, it is to identify vulnerabilities in terms of safety and efficiency based on payment data and dynamic payment behaviors of participants. And it is assessed whether the payment system satisfies the core principles of PFMI from the perspective of safety and efficiency. Systemically important payment systems (SIPSs) are regularly assessed every three years. In general, it takes a long time to change the operating standards or payment procedures of the payment system, such as going through a process of collecting opinions, so the assessment cycle of three years is not long. And since real-time monitoring and quarterly monitoring are conducted, it is possible to identify settlement risks that occur over a three-year period. If a settlement risk is discovered less than three years after the assessment, irregular assessment can be conducted on an occasional basis.

The fourth step is that if the Bank of Korea determines that the settlement system needs improvement in terms of safety and efficiency based on the monitoring and assessment results, it may request the relevant system operating organization to improve the system. The assessment results for the Korea Exchange (KRX) and the Korea Securities Depository (KSD) are reported to the Financial Services Commission, and if any areas requiring improvement are found in the securities settlement system, it may request the Financial Services

Commission to make improvements. Meanwhile, in the event of an emergency, the Bank of Korea may request the relevant operator to change its business processing procedures. In addition, if the Bank of Korea does not consider it desirable for a participant to participate in the system from the perspective of settlement risk, it may temporarily restrict the participation of the participant. In addition, if necessary, the closing time or net settlement time of BOK-Wire+ may be delayed.

The final step is cooperation between relevant organizations. Relevant organizations include payment system operators and financial supervisory authorities (FSC and FSS). The Bank of Korea can hold meetings with payment system operators, cooperate with or exchange opinions on related tasks with supervisory authorities, and participate in the international standard-setting work of international financial institutions such as the IMF and BIS. In particular, it can establish a cooperative oversight system with other countries' central banks for the CLS system and SWIFT related to cross-border payments and foreign exchange settlements. The Bank of Korea participates in the CLS Oversight Committee and the SWIFT Oversight Forum to participate in cross-border cooperative oversight.

(4) Features of the Bank of Korea's Oversight Activity

(a) Directly adopting PFMI as an evaluation criterion

Article 37 of the 「Regulation on the Operation and Management of Payment and Settlement Systems」 stipulates PFMI as an evaluation criterion. In addition, the 「Working Regulation」 lists 23 of the 24 principles of PFMI (excluding the principle on transaction information repositories) as assessment criteria.

However, there is no guideline that specifies the principles. For example, the report on PFMI published by BIS-IOSCO provides a rather extensive explanation of each principle. However, the Bank of Korea does not specify how to apply the 23 principles to the assessment. A guideline that explains detailed criteria applied to the assessment is necessary for consistent and transparent assessment.

(b) Specify oversight targets by system (not operator)

The Bank of Korea designates oversight targets not by operating agency but by individual system. In other words, not all retail payment systems operated by the KFTC are designated as SIPSs. This has the advantage of allowing monitoring capabilities to be focused on systemically important payment systems (SIPSs). However, the importance of each system must be evaluated each time, and a designation procedure must be followed each time if a new system is designated as a systemically important payment system.

(c) Insufficient oversight tools

The Bank of Korea can request the system operator to submit data and request improvement of operating standards. In order to effectively use this authority, it regularly evaluates the payment system. Nevertheless, the Bank of Korea does not have the right to directly investigate or request corrective action against the operator.

The Bank of Korea does not have financial supervision authority, so the enforcement of oversight measures (including recommendations for improvement) is weak, but the Nepal Rastra Bank has financial supervision authority, so it will not have this problem.

(d) Need to strengthen cooperation between relevant authorities

The Bank of Korea mainly exercises strong supervisory (or oversight) power over the funds transfer system, and the Financial Services Commission has strong supervisory authority over the securities settlement system and credit card system. Therefore, a cooperative system for supervision between the Bank of Korea and the Financial Services Commission can be established from the perspective of the entire payment & settlement system in Korea. However, there is no official platform and channel to communicate with each other for cooperative supervision and oversight. However, the Bank of Korea and the Financial Services Commission cooperate in relation to financial standardization.

<Table 3-4>

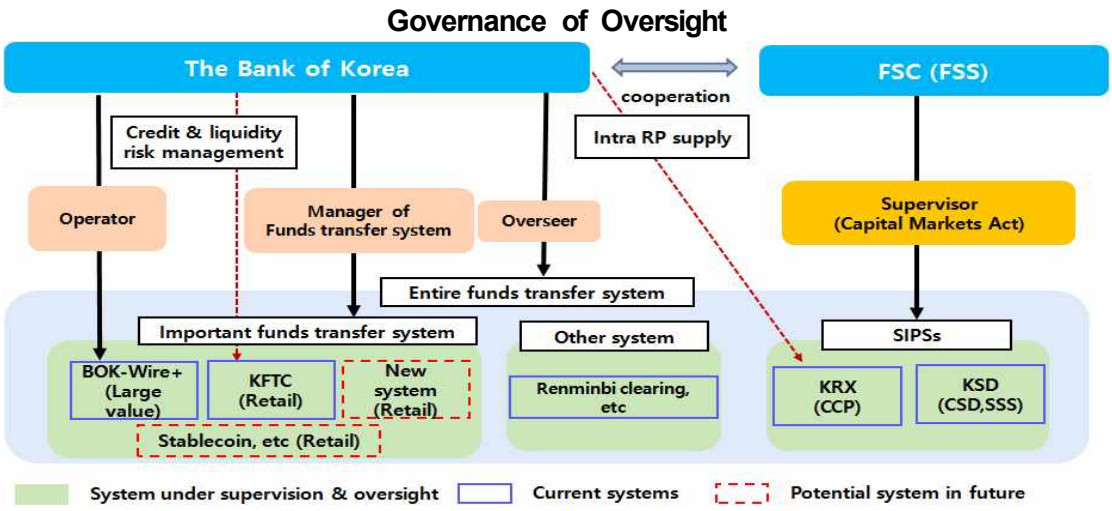
FSAP Evaluation of IMF

Year	Recommendation by IMF	Action
2003	- The Bank of Korea's role in oversight the payment and settlement system is specified in the law - Strengthening the Bank of Korea's authority to oversee FMI and related agencies	No action
2013	- Strengthening the Bank of Korea's authority to oversee FMI and related agencies - Establishment of a formal cooperation system between the Bank of Korea and the FSC on FMI supervision and oversight	No action

Source: Bank of Korea

As BIS-IOSCO's PFMI emphasizes cooperative oversight, it would be helpful for the Nepal Rastra Bank (NRB) to establish a cooperative relationship with the Ministry of Finance to achieve the safety and efficiency of the payment and settlement system. This is because, in the case of securities settlement, funds settlement must ultimately be made from the central bank's current account. In addition, if problems occur in the securities settlement system and the foreign exchange settlement system, there may be financial institutions that suffer from liquidity shortages due to settlement delays, and such problems may develop into systemic risks.

<Figure 3-2>



Source: Bank of Korea

(5) Oversight of Financial Services Commission

The Financial Services Commission authorizes or permits financial market infrastructure in accordance with the 「Electronic Financial Transaction Act」 the 「Financial Investment Services and Capital Markets Act」, etc., and supervises business activities as the primary supervisory authority for securities settlement system operators. The Financial Services Commission manages the system operation regulations of the Korea Exchange and the Korea Securities Depository and conducts soundness supervision. In addition, in 2015, the Financial Services Commission announced the 「Financial Market Infrastructure Business Standards」 and required financial market infrastructure operators to adopt them as the standards for internal operation regulations.

One unique aspect is the supervision of the KFTC. There is no license for the retail payment system operator in Korea. The KFTC is a non-profit corporation established under the 「Civil Act」. The Financial Services Commission is the agency that licenses the KFTC, a non-profit corporation, under the Civil Act. The Financial Services Commission audits the business of the KFTC and compliance with internal regulations in accordance with the 「Financial Services Commission Audit Regulation」. The Bank of Korea sends the results of the regular assessment of the KFTC to the Financial Services Commission.

The Financial Services Commission has financial supervision authority, so it conducts financial supervision on all payment service providers (financial institutions, fintech, and big tech companies). The Financial Services Commission has the authority to request information and conduct on-site inspections on all payment service providers.

B. Assessment Based on PFMI

(1) Overview

The Bank of Korea has been regularly assessing the safety and efficiency of systemically important payment systems since 2004. From 2004 to 2019, a total of 32 assessments of systemically important payment systems were conducted,

and a total of 287 improvement recommendations were made. Since 2012, the Bank of Korea has made 217 improvement recommendations, most of which were related to operational risk, financial risk, and organizational management. Most of the improvement recommendations for BOK-Wire+ and the Korea Financial Telecommunications and Clearings Institute (KFTC) were related to cyber resilience and operational risk. Most of the improvement recommendations for the Korea Securities Depository (KSD) were related to credit risk management, collateral requirements, and operational risk.

<Table 3-5>

Recommendations for Improvement by Operator

(unit: time)

Operator	Recommendation	Operator	Recommendation
Bank of Korea	42	KSD	76
KFTC	59	KRX	106

Source: Bank of Korea

The system assessment cycle was initially one year, and was extended to two years in August 2006, and then to three years in April 2024. The reason for the change in the assessment cycle is that regular system assessment has been conducted so far, and a lot of improvements have been made in many areas, so that routine settlement risks are appropriately controlled. Meanwhile, the Bank of Korea recognizes that it is important to improve cyber resilience as IT risks become more important and operational risks become more important.

Meanwhile, assessment of other payment systems have also been conducted intermittently. In 2005 and 2024, assessment were conducted for the Giro system operated by the Korea Financial Telecommunications and Clearings Institute (KFTC), and in 2015, assessment were conducted on the Stock Institutional Settlement System operated by the Korea Securities Depository (KSD). The Bank of Korea announces the assessment results in the Annual Report of Payment and Settlement Systems, and also posts the assessment results report on the Bank of Korea website.

(2) Assessment and Recommendations for Improvement

(a) BOK-Wire+

The assessment of BOK-Wire+ conducted in 2021 identified several things to be improved, the main contents of which are as follows: First, the business continuity plan of BOK-Wire+ has a principle that in the event of a failure in the IT center, recovery must be made within 2 hours. However, for large-scale failures that inevitably require a transfer of work to a secondary computer center, a recovery time of 3 hours is recognized. Since the international standard for cyber resilience (BIS principle) states that a recovery time of 2 hours must be observed even in the case of a large-scale failure, the Bank of Korea planed to normalize work within 2 hours in response to all operational risks occurring in BOK-Wire+. To this end, it has begun strengthening mock training and reinforcing IT professionals.

Second, the guidance on cyber resilience for financial market infrastructures stipulate that disaster recovery training should be conducted to reflect risks arising from major external service providers such as power facilities (eg. power plant) and communications infrastructure. Accordingly, the Bank of Korea decided to reflect the requirements of these international standards in the BOK-Wire+ business continuity plan.

In 2023, the Bank of Korea conducted a regular assessment of BOK-Wire+. The assessment employed 18 of the 24 principles of the PFMI applicable to large-value payment systems and the “Guidance on Cyber Resilience for Financial Market Infrastructures.” This assessment focused on whether BOK-Wire+ operates normally and achieves settlement finality in the event of a computer failure in an overseas payment system or financial institution. Since this assessment emphasized the IT aspect, external experts in IT security also participated.

The assessment results showed that BOK-Wire+ met almost all of the PFMI principles, but some improvements were needed in operational risk management. First, the Bank of Korea established and operates a contingency plan for BOK-Wire+ and conducts mock training to respond to situations where physical

and human disasters occur. However, this mock training was evaluated as being somewhat simple or formal. In order to ensure the effectiveness of the mock training, it was evaluated that it is necessary to set various scenarios of human disasters and to specify the method of selecting employees who participate in the training for replacement workers.

Second, the Bank of Korea operates a disaster recovery center separate from the main computer center of BOK-Wire+. In order to minimize the time required for disaster recovery, it was found necessary to hire more IT professionals working at the disaster recovery center and to dualize the power supply system.

(b) KFTC

In 2020, the Bank of Korea assessed the check clearing system, interbank remittance system, electronic banking system, and open banking system. The Bank of Korea recommended strengthening the risk management governance structure and internal regulations related to cyber risk for the four systems. It recommended clarifying the risk governance structure so that the board of directors can assume the ultimate management responsibility for settlement risk. It also recommended that the board of directors' risk management roles and responsibilities be transparently and clearly stated and that board members be able to prevent conflicts of interest in risk management.

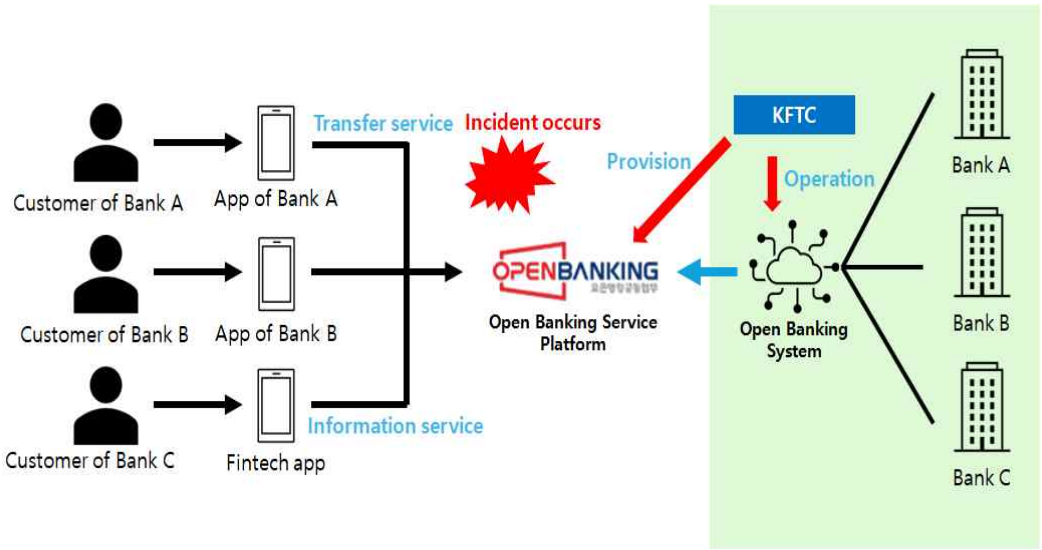
The open banking system is a newly established system, so several areas for improvement have been discovered. First, since the number of users and usage amounts of the open banking system is rapidly increasing, the Bank of Korea recommended that the open banking system be designated as a payment system guaranteeing settlement finality. Payment finality means that even if a payment system participant goes bankrupt, payment instructions and settlements processed in the payment system remain valid. The open banking system performs the same function as the electronic banking system, and the electronic banking system is a system in which settlement finality is guaranteed. Therefore, settlement finality for the open banking network is necessary.

Second, it was recommended that institutional arrangements for participation procedures be established. Fintech companies can participate in open banking

system without the approval of the KFTC's general meeting of shareholders. Therefore, it was necessary to establish participation criteria based on the principle of "same action-same regulation."

<Figure 3-3>

Structure of Open Banking System



Source: Bank of Korea (2021)

Third, the open banking system is exposed to the risk of a "single point of failure". In the case of the electronic banking system, customers receive payment services via a platform developed by each financial institution. On the other hand, in the case of the open banking system, customers access the common platform of the KFTC through the mobile app provided by the fintech company or bank to receive services. Therefore, if a security incident occurs on the platform operated by the KFTC, the open banking service is interrupted.

In 2023, the KFTC conducted an assessment of the check clearing system, interbank remittance system, electronic banking system, and open banking system. The open banking system was designated as a systemically important payment system because its usage scale has been rapidly increasing recently. The assessment results of the SIPSs operated by the KFTC showed that most of them were compliant with the PFMI. However, it was confirmed that improvements were needed in some areas, such as strengthening operational risk management and increasing transparency. In terms of cyber security, it was

recommended to build and utilize a cyber resilience maturity assessment model to strengthen the cyber resilience response system.

<Table 3-6>

Open Banking System Levels of Access and Eligibility

Levels of Access	Eligible Institutions
Funds Transfers and Data Access	- Open Banking System participants - Electronic financial service providers pursuant to the Electronic Financial Transactions Act - Cross-border retail payment service providers pursuant to the Foreign Exchange Transactions Act - Organizations designated by the KFTC with a business model highly unlikely to cause losses to financial consumers
Data Access only	- Companies engaged in businesses classified as fintech business under the Korean Standard Industrial Classification system - Other institutions whose access to the system is deemed necessary for benefit of the public interest goals

Source: Bank of Korea (2024)

Finally, the Bank of Korea, together with the Korea Financial Telecommunications and Clearings Institute, revised the regulations and rules related to open banking operations in November 2023. Through this revision, the qualification criteria for institutions using the open banking system were newly established, and several measures were introduced to mandate regular re-examination of these institutions. The most important measure was to systematize the qualification criteria for using the transfer and inquiry services of the open banking system.

(3) Joint Examination

The Bank of Korea conducts joint inspections with the Financial Supervisory Service. The subjects of joint inspections are banks and financial investment companies. The number of joint inspections is approximately 3 to 5 times per year.

<Table 3-7>

Number of Joint Examinations Conducted by the Bank of Korea

(unit: number)

	2018	2019	2020	2021	2022	2023
Bank	2	2	2	3	2	3
Financial Investment Company	3	3	1	1	1	1
Total	5	5	3	4	3	4

Source : Bank of Korea

For banks, joint examination focuses on intraday liquidity management, settlement risk (foreign exchange, securities, and net settlement), establishment and operation of a business contingency plan, compliance with payment and settlement-related regulations, IT operational risk management, and information security management. The following are recommended areas for improvement as a result of the inspection of banks since 2019.

- Shortening the target recovery time for critical payment systems in the business continuity plan
- Compliance with guidelines established to save settlement liquidity of BOK-Wire+ participating institutions
- Supplementing measures to respond to liquidity risks, such as early warning indicators and stress tests

<Table 3-8>

Joint Examinations

Institution	Items of Examination
Bank	- Intraday liquidity management - Net settlement risk management - Payment and settlement-related regulations compliance - IT operational risk management - Information security management - Incident and emergency response procedures
Financial Investment Company	- Funds transfer procedures - Settlement liquidity management

Source: Bank of Korea

For financial investment companies, the Bank of Korea focuses on examining the status of fund transfer operations and the status of liquidity management related to fund transfers. The following are recommended improvements based on the inspection results for financial investment companies since 2019.

- Improve fund transfer procedures and settlement liquidity management system
- Include operational risk identification items to self-control assessment and key indicator items
- Supplement the reporting system to external organizations in the event of a computer failure (add reporting obligations to the Bank of Korea into financial investment companies'internal regulations)
- Strengthen liquidity management to prepare for massive withdrawals by customers (setting a limit on holding identical bonds in RP-type CMA)
- Include a daily check of the basic cash asset holding ratio of RP-type CMA in financial investment companies' internal regulations
- Manage liquidity risk by setting limits on short-term borrowings such as inter-institutional RPs

(4) International Cooperative Oversight

The Bank of Korea is a member of the CPMI and, as a member of the BIS Board of Directors, actively participates in international discussions related to payment and settlement oversight.

(a) Oversight of CLS Bank

The Bank of Korea participates in the CLS system and uses SWIFT for international payments and remittances. Therefore, it participates in international oversight of the CLS system and SWIFT. The CLS system provides a service for simultaneous settlement of two currencies, and the main oversight agency is the Federal Reserve Bank of New York. The Bank of Korea, together with the

Federal Reserve Bank of New York and the central banks of settlement currencies, such as the Bank of England, forms an oversight committee for the CLS system (central banks issuing 18 settlement currencies + 5 central banks of the euro area) and conducts joint supervision of the CLS system.

In 2019, the CLS Oversight Committee decided to supplement the defense system and separate internal and external audits to strengthen operational risk control. The defense system for CLS operational risk consists of three stages. Stage 1 is handled by the business department (front-end), Stage 2 is handled by the risk management department, and Stage 3 is handled by the internal oversight department. In 2021, the CLS Committee inspected the status of CLS Bank's payment risk management and recommended CLS Bank to strengthen IT security by reinforcing IT personnel and building additional data centers.

Meanwhile, the Bank of Korea also participates in international oversight of SWIFT. In 2019, the SWIFT oversight forum, which consists of central banks of advanced countries, established a security enhancement strategy for SWIFT customers. In 2021, the SWIFT oversight forum reviewed the settlement risks inherent in all business activities, including SWIFT's organization, policies, business processing procedures, and internal controls.

(b) Participating in improvement of cross-border payment services

BIS's CPMI held a working-level consultation on improving cross-border payment services in 2023. The main focus are on the extension of the operating hours of major payment systems such as large-value settlement systems and fast payment systems, the adoption of international financial professional standards (ISO 20022), and establishment of cross-border payment systems. The Bank of Korea is assessing the status of cross-border payment services in Korea and preparing improvement in this area. In June 2023, a 'cross-border payment service improvement task force' was created with the participation of domestic commercial banks, retail overseas remittance companies, card companies, etc., and discussed how to implement the cross-border payment roadmap.

(c) Participation in global stablecoin regulation

The Financial Stability Board (FSB) is in the process of establishing a regulatory framework for global stablecoins. The FSB announced the “High-level Recommendations for the Regulation, Supervision and Oversight of Global Stablecoin Arrangements” in 2023. This recommendation consists of a total of 10 items. The main items are cooperation in oversight between countries, establishment of a risk management system, soundness requirements, and governance. The FSB plans to review the implementation status of the recommendation by the end of 2025. Accordingly, the Bank of Korea inspected the operational status and risk situation of global stablecoins that are currently operating or plan to operate in Korea and studied oversight measures for global stablecoins.

<Table 3-9>

Final Recommendations for the Regulation, Supervision and Oversight of Global Stablecoin Arrangements

	Recommendation
①	Authorities’ readiness to regulate and supervise global stablecoin arrangements
②	Comprehensive oversight of GSC activities and functions
③	Cross-border cooperation, coordination and information sharing
④	Governance structures and decentralized operations
⑤	Risk management
⑥	Data storage and access to data
⑦	Recovery and resolution of the GSC
⑧	Disclosures
⑨	Redemption rights, stablization, and prudential requirements
⑩	Conformance with regulatory, supervisory and oversight requirements before commencing opeations

Source: Financial Stability Board

(d) Strengthening cooperation on cyber response

As digital finance deepens and the dependence on IT for payment services increases, cyber risks are increasing, and global cooperation on cyber incident prevention and recovery is being strengthened. Examples of international cooperation in the field of cyber response are as follows.

- Hong Kong and Singapore share information on cyber incidents within 24 hours
- EU has enacted the 「Network and Information Security Directive (NIS)」 and agreed to share cyber incident response technologies among member states.
- ASEAN central banks jointly conduct mock drills on cyber hacking in 2019

In May 2019, BIS established the Cyber Resilience Coordination Center (CRCC) to create a platform for central bank cooperation to strengthen cyber resilience[59]. The Bank of Korea participated in the CRCC and discussed key issues and trends related to cyber security.

In particular, the Bank of Korea participated in the Cyber Range Exercise organized by BIS in October 2019. The scenarios of this exercise included hacking of payment systems, withdrawal of funds, distribution of malware, and internal infiltration attacks.

In 2023, the Bank of Korea also participated in a cyber range exercise planned and conducted by the BIS. Nine central banks participated in this simulation exercise, and the purpose of the exercise was to share knowledge about cyber attacks and establish a cooperative system. The simulation exercise consists of an attack team (red team) composed of BIS staff and a defense team (blue team) of the Bank of Korea. When the attack team attempted a mock

59) The CRCC provides member central banks with the following services: i) a cyber resilience self-assessment system, ii) a cyber attack defense simulation exercise, iii) a cyber security seminar, iv) a security platform for collaboration, v) research cooperation related to cyber security, vi) mutual dispatch of staff, and vi) cooperation with the Financial Stability Institute (FSI).

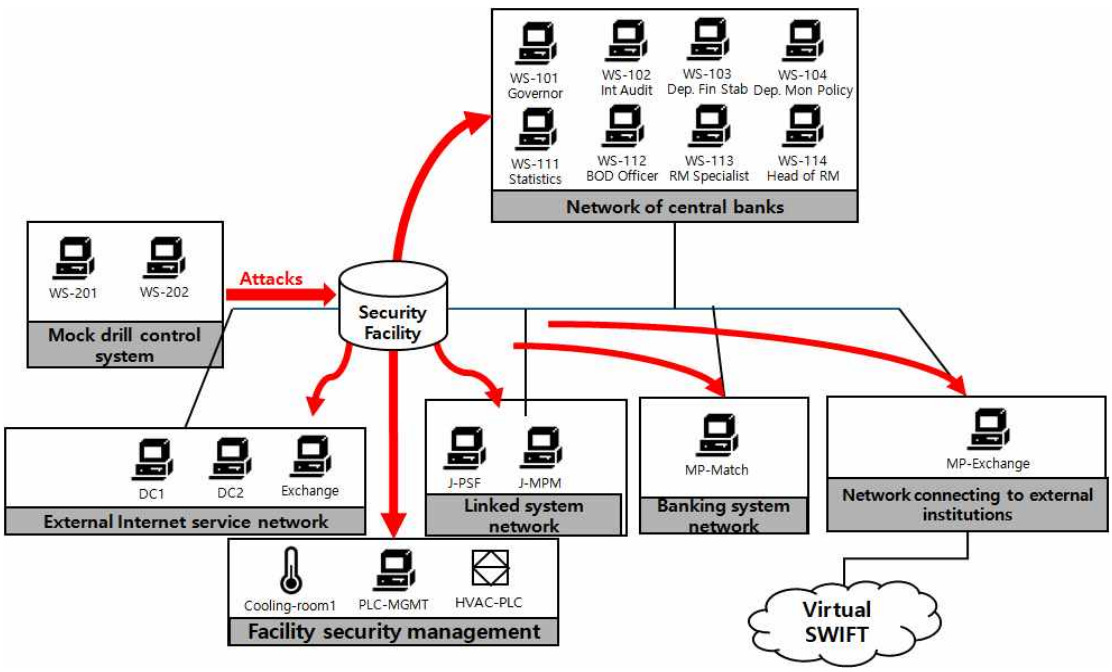
hacking, the defense team blocked the hacking and recovered the damage caused by the hacking.

The training scenarios included: i) forgery and alteration of payment data, ii) distribution of ransom ware, and iii) attacks on security vulnerabilities in IT systems. After the training, BIS and the nine central banks shared their countermeasures against attacks, such as how they prevented attacks, and shared new IT security technologies, such as detection technologies that detect data forgery and alteration.

In addition, the Bank of Korea participated in the Working Group on Payments and Market Infrastructure (WGPMI) of the Organization of Central Banks in East Asia and the Pacific (EMEAP). The working group discusses member countries' payment infrastructure improvement activities and the development and regulation of stablecoins. EMEAP member countries agreed that the regulatory framework for stablecoins should hold consistency and uniformity and that international cooperation in oversight activities is necessary to prevent regulatory evasion (regulatory arbitrage).

<Figure 3-4>

Outline of BIS Cyber Simulation Training



Source: Bank of Korea (2024)

<Box 3-1>

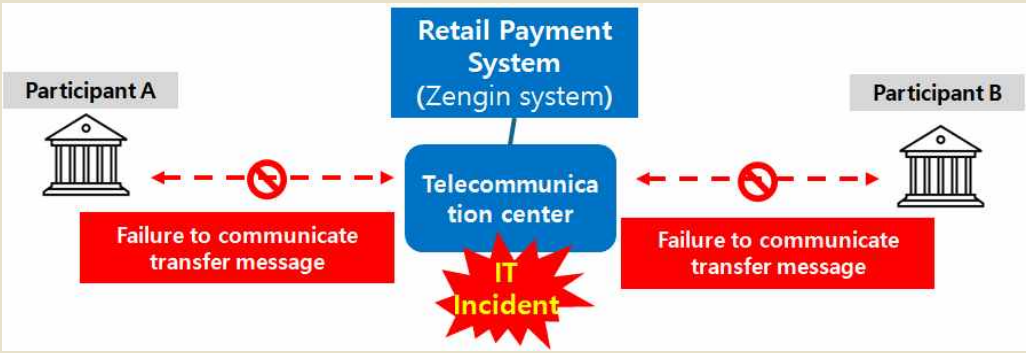
IT Failure in Major Countries' Payment Systems

As digital finance becomes widespread, the dependence on IT for payment systems is increasing, and the complexity of IT is also increasing. Accordingly, if a system failure occurs, it can cause serious and huge settlement risks and, in some cases, hinder the smooth operation of the entire financial system. The following is a summary of recent computer failures.

- Japan's retail payment system (Jen-Kin System) experienced a failure in October 2023. Interbank fund transfer across financial institutions were not available for two days. This was due to an IT problem in the central telecommunication system, which prevented the transmission and reception of payment messages between participating institutions and the central system.

<Figure 3-5>

Conceptual Diagram of IT Failure in Japan



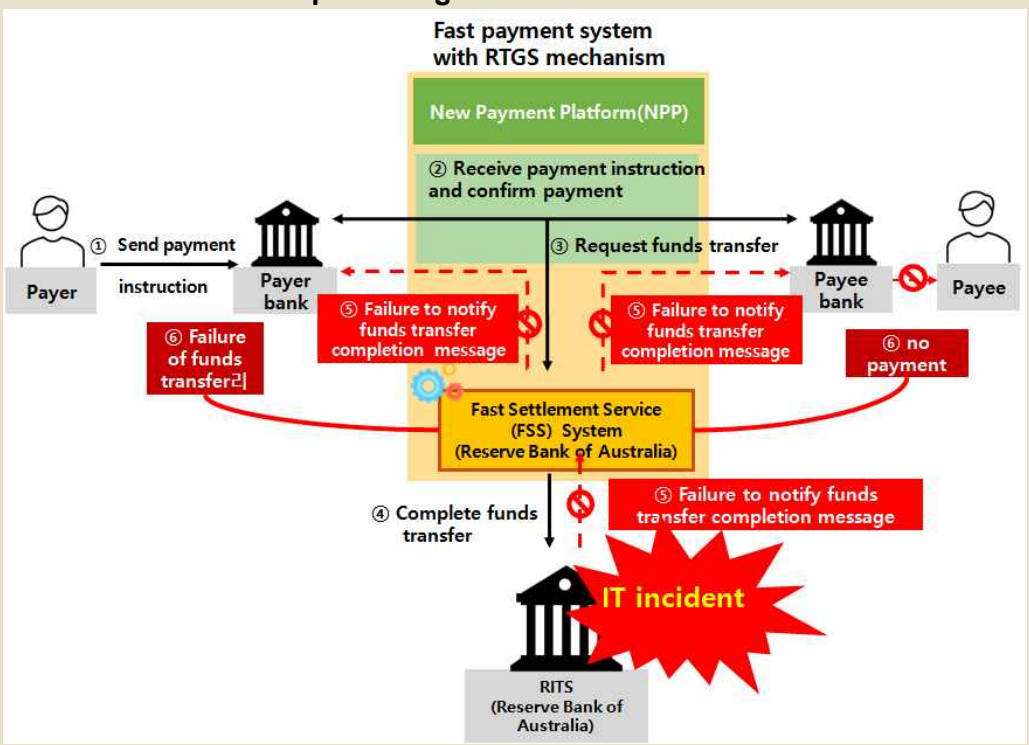
Source: Bank of Korea(2024)

- In October 2022, the Large-Value Payment System (RITS) operated by the Reserve Bank of Australia experienced a system failure. The problem occurred during server maintenance. As a result, the operation of the NPP, a fast payment system linked to RITS, was suspended for about 4 hours. Australia's NPP is a system with very high cyber resilience

because it operates through a dualization method. However, actual payments are made through the Fast Settlement Service (FSS) operated by the Reserve Bank of Australia, and this FSS is linked to RITS to perform payments. Thus if a cyber problem occurred in RITS, neither the FSS nor the NPP would be able to provide services smoothly.

<Figure 3-6>

Conceptual Diagram of IT Failure in RITS



Source: Bank of Korea(2024)

- In August 2023, the Bank of England's CHAPS large-value payment system experienced a technical issue, causing the system to be shut down for six hours. The cause of the problem was a software error, and the Bank of England extended the closing time by one hour to ensure intraday settlement completion.

Source: Bank of Korea(2024), Bank of England(2023)

(5) Cooperation with IMSG of BIS

The BIS CPMI has been monitoring the implementation of the PFMI in 26 countries since 2013. The monitoring is conducted by the “Implementation Monitoring Standing Group (IMSG)”, which was established to check on the implementation status of member central banks. And the Bank of Korea also participates in the IMSG.

IMSG conducted an assessment of 37 payment systems, including BOK-Wire+, in 2023, and the focus of the assessment was on cyber resilience in the IT sector. The assessment revealed that some systems did not comply with PFMI Principle 17 on operational risk. Namely, some systems did not resume operations within two hours after an IT failure. In the case of a serious cyber attack, it took more than two hours to resume operations, and there were cases where cyber resilience testing was not conducted when payment systems underwent important changes.

In addition, there were cases where the roles and responsibilities of response units were not specified in the cyber resilience test scenarios. There were also cases where external organizations involved in system restoration (e.g., telecommunications companies, power companies) did not participate in the cyber resilience test. The Bank of Korea plans to analyze these findings and utilize them in the evaluation of systemically important payment systems (SIPSs) in Korea. Since the establishment of the IMSG, the Bank of Korea has been emphasizing the importance of cyber resilience in the evaluation of payment systems.

IMSG conducts an evaluation based on the PFMI for two countries every year to check whether the payment system complies with the PFMI. The implementation evaluation for the EU and Turkey was scheduled to be completed in 2020 and the inspection for Russia and Japan was scheduled to be conducted in 2021, but these evaluations were temporarily suspended due to the outbreak of COVID-19. The evaluation for Korea was also scheduled to be conducted in 2025 but was postponed. However, the Bank of Korea is steadily continuing work to further improve the consistency of the system with the PFMI and strengthen the cyber resilience of the payment system.

<Table 3-10>

CPMI-IOSCO Cyber Resilience Guideline

Type	Category	Main Contents
Risk Management	Governance	- Establish a documented response system - Operation of the expert committee
	Identification	- Identify key information assets and external dependencies
	Protection	- Establishing safeguards for assets and services
	Detection	- Rapid detection of internal and external incidents and potential risks
	Response & recovery	- Recovery of major operations within 2 hours - Providing intraday settlement finality
Support	Testing	- Vulnerability check for risk management system
	Situational awareness	- Developing strategic response measures appropriate to the characteristics of each cyber attack
	Learning and evolving	- Improving preventive capabilities through continuous introduction of new technologies

Source: CPMI-IOSCO, Bank of Korea(2021)

<Box 3-2>

Regulation on Digital Wallet

(Regulatory framework for payment instruments in Korea)

The Specialized Credit Finance Business Act (hereinafter SCFBA) and the Electronic Financial Transactions Act (hereinafter EFTA) are the two representative laws regulating retail payments and related issues in Korea. Besides them, there are the Act on Promotion of Information and Communications Network Utilization and Information Protection, the Act on Consumer Protection in Electronic Commerce, and the Foreign Exchange Transactions Act.

The licensing of banks, card companies, securities companies and insurance companies are regulated in accordance with the individual acts for these sectors. The EFTA was enacted in January 2007, to arrange for the

authorization, registration and supervision of entities engaging in the functions of the electronic financial business.

The EFTA stipulates 1) The seven types of electronic financial business licenses[60], the obligations to be observed by merchants, and the supervision of electronic financial business entities (hereinafter EFBEs)[61] and subsidiary electronic financial business entities[62]; 2) consents to withdrawal of deposits by transfers, the times when payments take effect, and legal issues such as transfers and refunds of electronic prepayment (or prepaid) means, and 3) the procedures for revision of terms and conditions for electronic financial transactions, and user protection-related measures including the responsibilities of the users and the financial institutions when electronic financial failures occur.

Except as otherwise provided in other statutes, this Act applies to all electronic financial transactions. But it does not apply to the electronic financial transactions prescribed by Presidential Decree, among those conducted under separate contracts between financial companies and electronic financial business entities.

While the EFTA deals with electronic prepaid (or prepayment) and debit-based payment means (or instruments) in a broad manner, it does not address credit cards[63]. As credit cards are issued by credit card companies, the SCFBA (Specialized Credit Finance Business Act) is applied to them first, rather than the EFTA. According to the SCFBA, a credit card company may issue prepayment (prepaid)/debit cards as incidental businesses of the company. A credit card company, as a fully dedicated credit card company, may be incorporated by obtaining a license from the FSC (Financial Services Commission), in compliance with the SCFBA. Commercial banks and other deposit-taking financial institutions may also run credit card businesses as their concurrent businesses.

Merchants operating large physical shops and distributors may issue credit cards by simply registering with the FSC, rather than applying for permission to do so, when the nature of the business performed makes it appropriate to combine a credit card business with others. However, this type of credit card

can only be used at the shop which the card issuer runs. And in this case, financing to the credit card holder is not allowed. Department stores, for example, issue this kind of card.

Payment via a debit card is authorized as the amount paid is deducted from the user's bank account, while payment with a prepaid card is done through deduction from the prepaid amount. In the case of a debit payment, the payment request leads to a real-time transfer from the user's account, and so the user is required to hold a real name account with his or her financial institution.

In the case of a check card, the credit card company requests the debit transfer from the card holder's bank account in real time, and makes a credit transfer of the amount purchased to the merchant's account. Under the EFTA, electronic prepayment means cover a rather wide spectrum of cases of value stored in advance and then used. Thus, they can include such items as "points," "mileage" and "game money." In Korea, the prepayment means can also be recharged (by the depositing or loading of value into them) using bank account transfers, credit cards, check cards and other points.

Therefore, a prepayment card can be charged (or have value deposited for it) by the user even without that user holding a bank account, and so linkage to a bank account, legally, is not required. However, in reality, charging from a bank account is most common.

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60) For Electronic funds transfers, Electronic cash, Electronic prepayment means, Electronic debit payment means, Payment gateways, Escrow, and Electronic bill presentments and payments

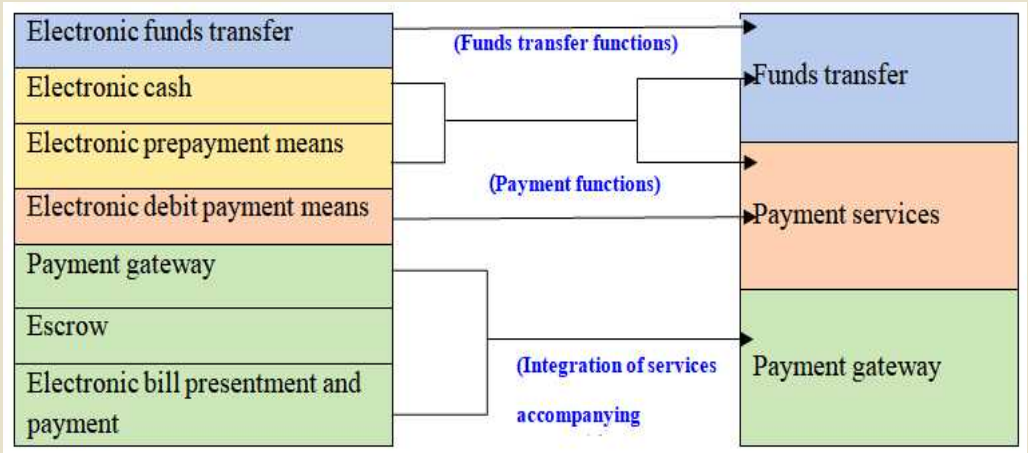
61) The term "electronic financial business entity" means any legal person who has obtained permission or whose business has been registered to operate as such (excluding financial companies)

62) The term "subsidiary electronic financial business entity" means any legal person who assists in electronic financial transactions; or vicariously performs apart in such transactions for a financial company or an electronic financial business entity; or who operates a payment gateway system.

63) The SCFBA stipulates prohibition of discrimination in merchant fee rates(Article 18-3), stating that 'each credit card company shall reach a mutually fair and reasonable agreement with credit card merchants on merchant fee rates, and shall not unfairly discriminate against any credit card merchant when setting merchant fee rates.' The Act also regulates matters to be observed by credit card merchants (Article 19), stating that 'no credit card merchant shall refuse any payment by a credit card or treat card holders unfavorably due to a transaction by credit card.'

<Figure 3-7>

Plan to Change the PSP License Framework in Korea



Source: Financial Services Commission

The government is pushing policy initiatives to promote growth of the innovative digital finance industry. Large-scale revision[64] to the EFTA is currently being discussed in the National Assembly. In the below figure, on the righthand side (the new scheme under the EFTA) there are three functional categories which will replace the current seven categories. The new Act will streamline the framework for regulating electronic financial businesses – by reorganizing the seven sub-sectors into five functional categories, setting up the foundations for digital financial transactions, and establishing the legal bases for the open banking and digital clearing businesses. There will be two new categories which are not depicted in the figure. They are 1) "Comprehensive Payment Business Operator," which is equivalent to narrow banking, and 2) the Payment Instrument Service Provider (PISP) category.

Under the current Act the prepayment means is not required to be linked to an account at a financial institution. This convenience is regarded as the biggest advantage of "Easy Payment Services" for non financial companies, the DW service providers.

(Regulation on Digital Wallet)

A Digital Wallet (hereinafter DW) is also called a Mobile Wallet[65], as wallet services are provided via mobile devices. A Mobile Wallet is a mobile payment device or system that, in essence, allows its users to store their credit cards, debit cards, gift cards, etc. on their cellphones or smartphones. In Korea, "Easy Payment Service Providers" provide services as payment gateways[66], and provide payment services like so-called "00-pay", having close similarities to DWs, with payment instruments like bank accounts, and prepaid, debit and credit cards that are linked or stored. These services are widely used in Korea, particularly among the younger generations.

DWs are widely used for 1) mobile commerce with membership (loyalty) points, coupon and product advertisements, 2) mobile identities with employee ID cards and passes, 3) mobile payments, for offline payments with credit/debit/prepaid cards and for online payments in P2B, P2P, B2B and G2B, and 4) mobile banking via CD/ATM, account inquiries and asset management. In Korea, a DW is not legally defined and is not regulated. It seems to be more like a financial platform[67].

The consumer stores several payment instruments in his/her DW, setting passwords for them. For using KakaoPay[68], for example, the consumer first shops in an online shopping mall like Market Kurly or Coupang[69]. KakaoPay then transmits the consumer's payment information to the credit card company, and mediates settlements with the merchant. In this case, KakaoPay is called a "representative merchant." As KakaoPay, an electronic financial business entity, mediates the settlement of price, it is registered as a payment gateway in compliance with the EFTA.

A bank account can be linked to, in a DW, but it is not obligatory. In the case where a bank account is linked to, at Kookmin Bank[70] for example, that account is connected to and the payment amount debited. In terms of the license[71] type, an "Easy Payment" service provider is registered as an entity providing services of ① a Payment Gateway, and ② electronic prepayment means. When a business entity withdraws funds from the customer's account

and transfers them to the merchant's account, we can say that a payment means has been issued.

Typical types of payment means include prepaid, debit and credit payment means. When a check card issued by Kookmin Bank is used, it is Kookmin Bank which withdraws funds from the consumer's account. Thus, Kookmin Bank comes to provide an electronic debit payment means according to the EFTA. DW services that KakaoPay and Naver provide can be used with money deposited into prepayment means, and they deduct funds from the deposited amounts to make payments. Prepaid, debit and credit type payment instruments themselves are not money. Money is what is in an account.

Is the issuer of the payment means in my DW linked to my bank account? When a credit card or a check card is used, the paid amount is settled by way of banks. Credit card company (e.g, Shinhan Bank which issues credit card) $\neq$ DW business entity (KakaoPay). In this case, the DW business entity is required to hold a PG (payment gateway) status.

In Korea, check cards are issued by card companies. The card company may hold a PG status, but, under the EFTA, it is exempted from the requirement of licensing as a PG. When the funds are withdrawn from the bank account, the card company may also be the holder of status as a supplier of electronic debit and prepayment means. However, under the EFTA, a card company is also not required to have that status.

Unlike card companies, KakaoPay, which is an EFBE, needs both a license (or status) of a PG and a license for supplying electronic prepayment means. Why is a license for supplying prepayment means required? Legally, the amount being deposited for a debit payment instrument should be exactly the same as the amount for settlement, but in practice this is usually not the case. In the case of an instant deposit into debit means, an excessive amount is often transferred, larger than the exact amount necessary for settlement. Thus, the debit instrument which is being settled by instantaneous transfer becomes more like a prepaid instrument in character. Ultimately, the EFBE ends up holding licenses (statuses) for provision of electronic debit payment means and prepayment means at the same time.

Meanwhile, as a prepayment means can be deposited with “points” or by credit cards, it does not necessarily need to be connected with a bank account. Thus, depending upon the type of payment instruments stored in the DW, whether they are cards or accounts, the type of license required can differ. As the issuer of a prepayment means conducts mediation of funds settlement, it generally holds licenses for both the PG business and for supplying prepayment means.

There are also cases where an EFBE does not hold a license required by the EFTA. For example, “Samsung Pay,” provided by Samsung Electronics, is regarded as being close to a DW service. Legally, however, Samsung Pay is interpreted as an entity which just intermediates information among users, merchants, card companies and other financial institutions. Thus, it does not hold any licenses stipulated by the EFTA.

In conclusion, in Korea, regulatory actions are executed depending upon the types of payment instruments that are stored in the DW. DWs per se are not regulated in a holistic manner.

(Conclusion)

In Korea, the DW itself is not regulated holistically. What is regulated are the payment instruments that are stored in the DW. Naver Pay and Kakao Pay, which are registered, in terms of the EFTA, as EFBEs (electronic financial business entities) serving as PGs and prepayment means providers, carry out payment and funds transfer services, which are casually called “Easy Payments”.

Funds transfers, or as they are called “Easy Payments”, are realized, in practice, by the means of transfers and refunds of prepayment instruments. This practical transfer process, which is conducted by the electronic financial business entity, is not interpreted as being a funds transfer across accounts as specified in the EFTA. Currently, only deposit-taking institutions conduct the funds transfer business. The Easy Payment service is provided with a prepayment means license held by the electronic financial business entity involved.

The case of Samsung Pay differs from that of Kakao Pay. Samsung Pay is a sort of electronic wallet service provider, but it is not interpreted legally as a provider of electronic payment services but as an intermediary of payment services provided by the affiliated companies[72] whose payment instruments are stored in Samsung Pay.

According to the new EFTA draft revision now in process, an EFBE is expected to obtain licenses for funds transfer and payment services. In the case of the funds transfer license, the accounts of both the payers and the payees using the EFBE's services should be linked to financial institutions.

Under the new law, the current practice of accomplishing the same effect as that of an electronic funds transfer, through combining the issuance, transfer and refunds of prepayment(prepaid) means, is prohibited.

Entities engaging in funds transfers should carry out KYC and consumer protection. For this, the customers' accounts should be linked to financial institutions which are covered by "the Act on Real Name Financial Transactions and Confidentiality (RNFTC)". On the other hand, entities engaging in payment services for purchased products have no obligations to link with financial institutions. When these entities go real name, their ceilings on issuance of payment instruments can be set higher. This general legal intention is maintained in both the current law and the upcoming revised version of it.

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64) The major issues to be highlighted in the revised EFTA are as follows. Lower entry requirements will be set, to promote the growth of innovative firms by expanding the scope of work allowed to electronic financial business entities. The revision of the actis also establishing a strong user protection system for digital finance, and measures for the protection of consumer funds held by electronic financial business entities.

It has set up rules and principles for platform business models, which strengthen the standards of accountability of electronic financial business entities and financial companies for financial accidents, and require more caution by digital finance consumers. It has also established the foundations for digital financial transactions, and the legal bases for the open banking and digital clearing businesses. The coverage of user protection and financial data security has been expanded as well. The revised act is encouraging big tech companies' entrance to the financial industry, while serving to minimize any negative side effects such as regulatory arbitrage.

65) In this paper, the terms digital wallet and mobile wallet are used interchangeably.

66) Payment gateway system means any financial data processing system that deals with business affairs relating to the settlement of accounts and payments by transmitting electronic financial

C. Monitoring Activity of the Bank of Korea

(1) Key Features of Monitoring

The Bank of Korea's monitoring frequency is divided into real-time, daily, weekly, monthly, and quarterly, and the characteristics of the Bank of Korea's monitoring are as follows: First, monitoring capabilities are focused on BOK-Wire+, which has the largest settlement volume and is located at the top of the entire payment and settlement system in Korea, and ultimately processes all fund settlements (net settlement, foreign exchange settlement, securities settlement, etc.).

Second, with the development of IT, real-time information collection has become possible and information processing has become automated and fast, making monitoring on a real-time basis, which is now the most important monitoring. Naturally, the importance of daily, weekly, monthly, and quarterly monitoring has decreased significantly. In particular, with the upgrade of BOK-Wire+ in 2019, information collection and analysis capabilities have been greatly strengthened, and real-time monitoring has become the most important role in detecting and responding to settlement risks (including operational risks and liquidity risks).

Third, monitoring is important for achieving intraday settlement finality, but the information collected through monitoring is used as reference, evidence or basic data for establishing payment and settlement policies or improving the system.

Fourth, the Bank of Korea develops risk indicators and uses them for monitoring. If a risk indicator suddenly increases or is structurally increasing, it

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transaction information between a financial company and an electronic financial business entity.

67) In the EFTA revision now being carried out, the concept of financial platform is defined, but it is not clear whether it is to be applied to a DW.

68) Kakao is, together with its competitor Naver, a representative SNS company in Korea. It provides the Kakao Pay service and also runs an internet-only bank, Kakao Bank.

69) Both are online food distributors in Korea.

70) This is a Korean commercial bank.

71) In strict legal terms the word “license,” is not appropriate, as an EFBE providing services as a payment gateway or prepayment means is only required to register, rather than receive authorization and permission from the FSC.

72) Credit card companies and commercial banks.

implies that a risk factor has occurred. Some of these risk indicators were developed independently, while others were developed with reference to data from BIS, such as BCBS (2013).

Finally, the Bank of Korea conducts a simulation on settlement risk using the data collected through monitoring. Through simulation, the Bank can analyze whether BOK-Wire+ participating institutions can complete settlement by the end of the business operating hours when the financial institution with the largest net debt position defaults on settlement.

(2) Daily Monitoring

(a) Monitoring Routine during a business day

Real-time monitoring can detect risk factors immediately and enable rapid response measures. This reduces the possibility of risk occurrence, and even if actual risk occurs, minimizes the impact and prevents the spread of the crisis throughout the system. Therefore, it is the most important of various risk monitoring methods.

Real-time monitoring is jointly managed by the Payment Stability Team of the Payment & Settlement Department and the Settlement Operations Team of the Financial Operation Office. The Payment Stability Team of the Payment & Settlement Department is a team whose main task is oversight, and it performs monitoring using the latest Payment and Settlement Information System that was recently established. Key management indicators include the size and number of payments queue processing, the status of daily settlement liquidity utilization by participating institution, payment delays, and whether the closing time is adjusted due to payment failure.

The Settlement Operation Team is responsible for directly operating BOK-Wire+. The Team continuously monitors during work hours whether there are any problems, failures, or errors in the overall payment process, and continuously communicates with BOK-Wire+ participating organizations through messengers and other media to ensure smooth payment on BOK-Wire+.

<Table 3-11>

Daily Routine of BOK-Wire+ Operation Team

Time	Monitoring Activity
9:00～11:00	To guarantee that net settlement is conducted successfully at 11:00 without any delay or failure, the Team keeps monitoring current account balances for each participant.
9:00～17:30	All business day it continuously monitors net debit cap utilization rates of all net settlement participants.
Once a Business Day	Everyday it prices value of collateral securities provided to meet net settlement obligations. Then, it puts a documented pricing result on the official online document archive system of BOK.
Every Hour	It checks once an hour whether automated processing of funds transfer requests is working normally without any error.
16:00～17:30	It monitors whether any securities settlement is not made yet and whether BOK-Wire+ participants who need not maintain reserves have sufficient account balances. If it determines an illiquid participant with remaining security settlement obligations, it immediately notifies the participant of unsettled amounts. Moreover, the Team determines the causes of unsettlement and takes adequate measures.
Whenever Necessary	If a participant faces technical errors or operational malfunction, usually temporary and minor, and cannot complete any outgoing payments and fund transfer, the Team determines the cause of errors and takes adequate measures.

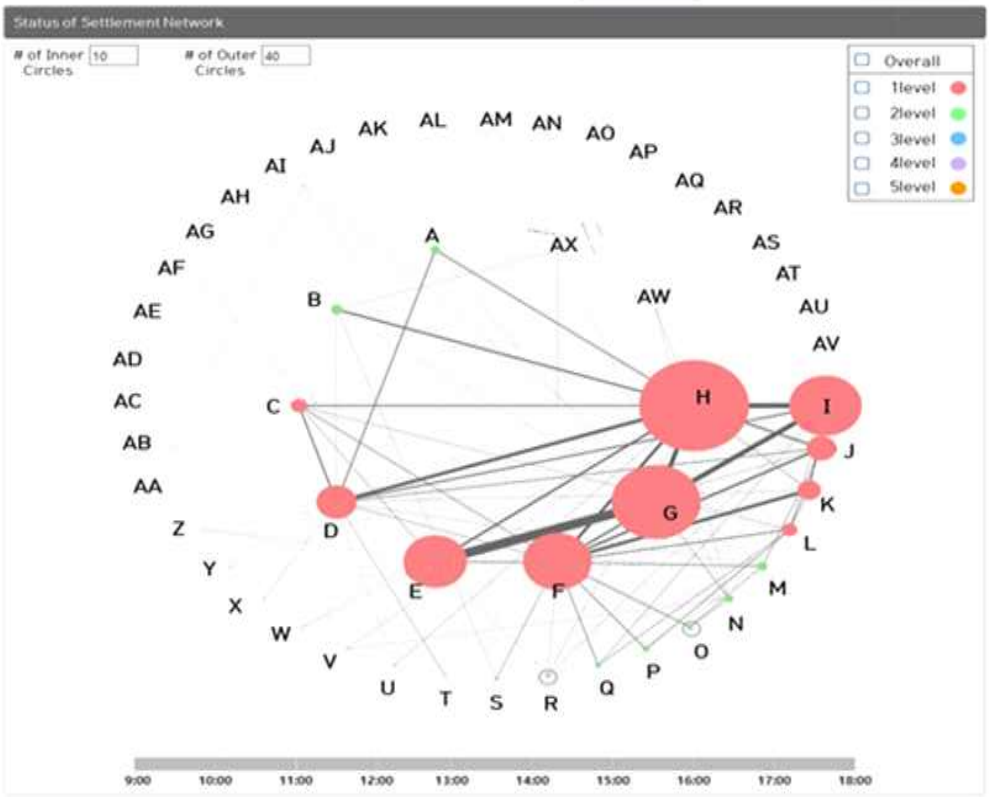
Source: Bank of Korea.

(b) Real-time Monitoring System

In 2020, the Bank of Korea fully introduced the Payment and Settlement Information System, which has dramatically improved its real-time monitoring capabilities. This system stores data such as all payment instructions made through BOK-Wire+, and the Bank of Korea conducts real-time monitoring using this large amount of data. In addition to real-time monitoring, the system also has functions for data and analysis and statistical processing. The main features of the real-time monitoring system are as follows. First, it visualizes the real-time payment status as a network between participating institutions, as shown in Figure 3-8.

<Figure 3-8>

Monitoring Screen of Real Time Settlement Network

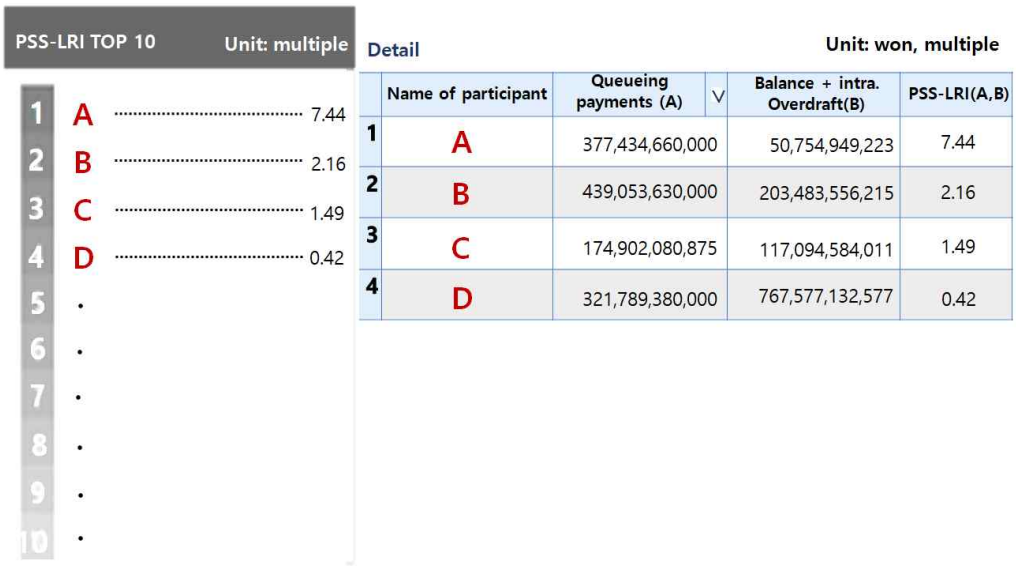


Source: Bank of Korea

Figure 3-8 shows the actual screen of the payment information system. This network is created as follows. ① The TOP 50 participating institutions are selected based on the total transaction amount for the past five business days. ② The participants with large transaction amounts and participants who play important roles in the network are placed in the inner circle, and the other participants are placed in the outer circle. The number of participants placed in the inner circle can also be set by the staff in charge. A node represents a participant. By moving the bar at the bottom of the screen, you can observe the changes in the payment network over time. The lines, or links, connecting nodes represent the entire payment flow between participants. The size of each node is set in proportion to the total payment amount exchanged by the participant. In addition, participants are classified into five levels based on the total transaction amount, and level 1 includes participants whose transaction volume is in the top 20%.

<Figure 3-9>

Screen-shot of PSS-LRI



PSS-LRI TOP 10 Unit: multiple

1	A	7.44
2	B	2.16
3	C	1.49
4	D	0.42
5	.	
6	.	
7	.	
8	.	
9	.	
10	.	

Detail Unit: won, multiple

	Name of participant	Queueing payments (A)	Balance + intra. Overdraft(B)	PSS-LRI(A,B)
1	A	377,434,660,000	50,754,949,223	7.44
2	B	439,053,630,000	203,483,556,215	2.16
3	C	174,902,080,875	117,094,584,011	1.49
4	D	321,789,380,000	767,577,132,577	0.42

Source: Bank of Korea

Second, the Bank of Korea introduced the PS-LI liquidity risk indicator as the Payment System Liquidity Index in 2013. PS-LI is an indicator that shows the ratio between liquidity demand and liquidity supply at a certain time point. Liquidity demand means the total amount that participating institutions have to pay to other financial institutions on that day. Liquidity supply, on the other hand, consists of three elements. One is the balance of reserves held by participants at the Bank of Korea (namely, outstanding balances of current accounts), the other is the intraday credit limit provided by the Bank of Korea, and the last is the amount expected to be received from other financial institutions. When this indicator exceeds 1, it is interpreted as a red signal that the possibility of liquidity risk occurring among participating institutions has increased (Baek et al., 2014).

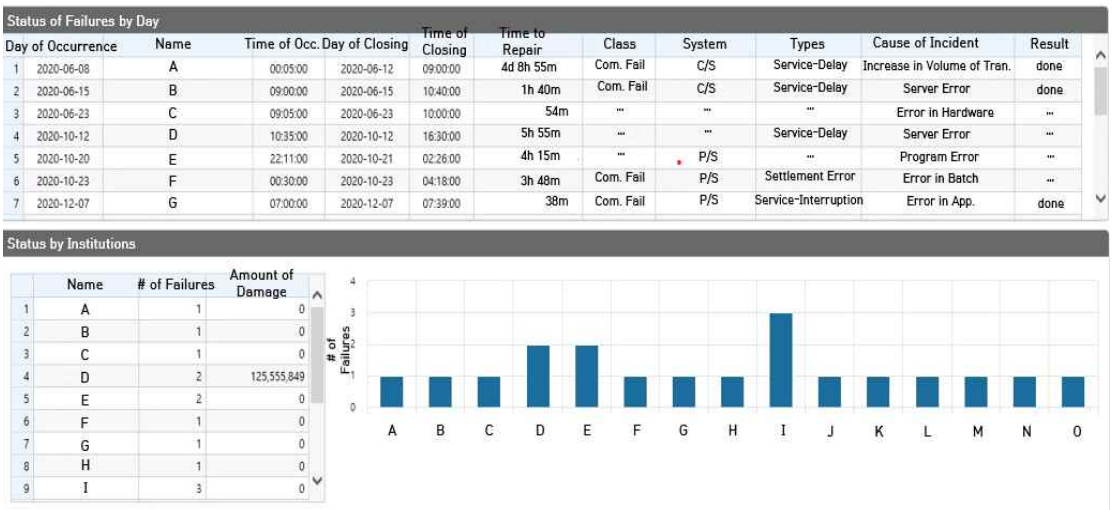
Since then, PSS-LRI (Payment System-Liquidity Risk Index) was created to improve PS-LI. The Payment and Settlement Information System shows the list of participants with the highest PSS-LRI. The numerator of PSS-LRI is the payment amount in a queuing status, and the denominator is the available liquidity (account balance + remaining daily overdraft limit). Therefore, the

higher the PSS-LRI, the greater the liquidity risk. In particular, if the PSS-LRI of a participant is greater than 1, this participant will face significant constraints in solvency if he or she does not receive funds from other participating institutions.

Third, the system has a unique feature of operational risk identification and detection. Operational risk detection and management are carried out in real time. Figure 3-10 shows in detail the system failure cases that occurred for each participating organization. This includes the date when the operational risk occurred, the name of the participating organization, the time the failure started and ended, the cause of the failure (such as server errors), and the results of the failure (such as service delays). Most of these system failures are displayed as errors in the payment process, service delays, or system interruptions.

<Figure 3-10>

Screen-shot of Operation Risk Management



Status of Failures by Day

	Day of Occurrence	Name	Time of Occ.	Day of Closing	Time of Closing	Time to Repair	Class	System	Types	Cause of Incident	Result
1	2020-06-08	A	00:05:00	2020-06-12	09:00:00	4d 8h 55m	Com. Fail	C/S	Service-Delay	Increase in Volume of Tran.	done
2	2020-06-15	B	09:00:00	2020-06-15	10:40:00	1h 40m	Com. Fail	C/S	Service-Delay	Server Error	done
3	2020-06-23	C	09:05:00	2020-06-23	10:00:00	54m	···	···	···	Error in Hardware	···
4	2020-10-12	D	10:35:00	2020-10-12	16:30:00	5h 55m	···	···	Service-Delay	Server Error	···
5	2020-10-20	E	22:11:00	2020-10-21	02:26:00	4h 15m	···	P/S	···	Program Error	···
6	2020-10-23	F	00:30:00	2020-10-23	04:18:00	3h 48m	Com. Fail	P/S	Settlement Error	Error in Batch	···
7	2020-12-07	G	07:00:00	2020-12-07	07:39:00	38m	Com. Fail	P/S	Service-Interruption	Error in App.	done

Status by Institutions

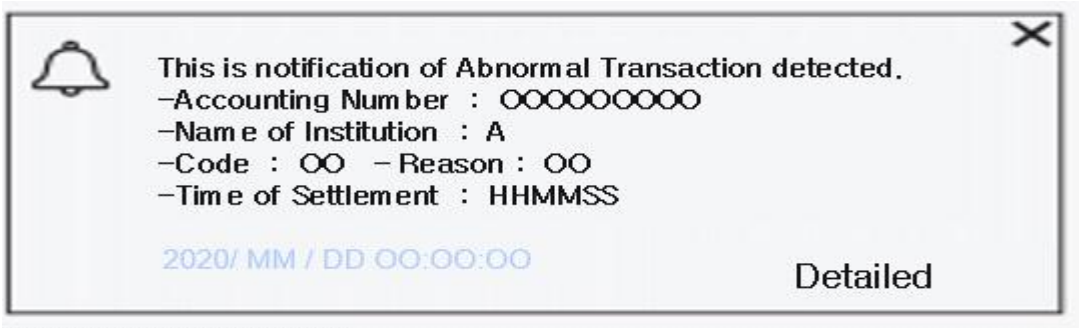
	Name	# of Failures	Amount of Damage
1	A	1	0
2	B	1	0
3	C	1	0
4	D	2	125,555,849
5	E	2	0
6	F	1	0
7	G	1	0
8	H	1	0
9	I	3	0

Source: Bank of Korea

Fourth, there is also a function to detect abnormal transactions. This function works in two situations. First, when the individual payment amount exceeds twice the highest payment amount per transaction in the previous year, and second, when a new transaction occurs between participants who have no transaction history in the previous year. When this happens, the system immediately issues an alarm and notifies all parties involved, including the Bank of Korea.

<Figure 3-11>

Notification of Abnormal Transaction

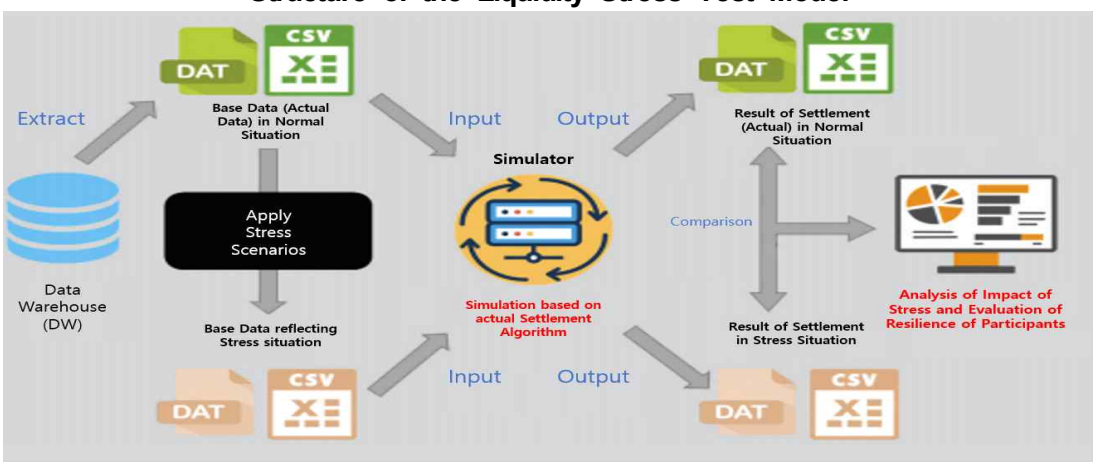


Source: Bank of Korea

Fifth, if an incident such as an IT failure occurs at a participating institution, the institution must report the details of the incident to the Bank of Korea without delay. This report is made through the BOK-Wire+ platform, and the incident information sent by the institution is stored in a data storage and displayed on the monitoring screen. This rapid reporting system allows both the Bank of Korea and the participating institution to respond to the incident situation in a timely manner. The default of an individual participating institution can have a spill-over effect on several other participating institutions, which poses a systemic risk that can lead to instability in the entire payment system. The Bank of Korea has developed a liquidity stress test model to identify and respond to such risks in advance.

<Figure 3-12>

Structure of the Liquidity Stress Test Model



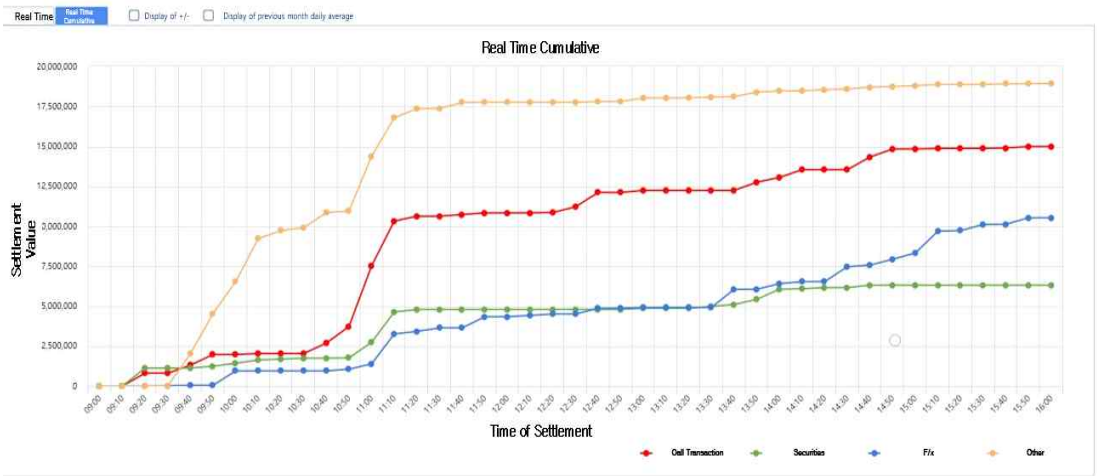
Source: Bank of Korea(2019)

Figure 3-12 shows the details of the liquidity stress test model. The main results derived from this test include the size of systemic risk (spill-over) among participating institutions, especially the size of unsettled transactions, and network connectivity, which indicates how participating institutions are connected to each other. By utilizing this model, the Bank of Korea can proactively prepare for systemic risk and provide advance guidance to participating institutions so that they can respond to risks.

Sixth, the Payment and Settlement Information System shows all information about the payment and settlement involving BOK-Wire+. Figure 3-13 shows the screen of the system. This system shows the liquidity and credit risks that occur during the settlement process, as well as the real-time settlement status. In this system, real-time data is collected at 10-minute intervals.

<Figure 3-13>

Screen-shot of Funds Transfer Status



Funds Transfer Details

	Time	Sending Inst.	Receiving Inst.	Amount	Type	System
1	16:04:39	A	B	20,000	Other	Won Fund Transfer
2	15:59:37	C	D	3,337	F/X	Won Fund Transfer
3	15:59:37	C	B	2,223	F/X	Won Fund Transfer
4	15:52:53	E	F	40,000	Call Transaction	Call Transaction
5	15:52:44	G	H	36,000	Call Transaction	Call Transaction
6	15:51:29	I	E	10,000	Call Transaction	Call Transaction
7	15:51:29	I	E	5,000	Call Transaction	Call Transaction
8	15:51:00	D	J	69,728	F/X	Won Fund Transfer
9	15:51:00	D	J	250,000	F/X	Won Fund Transfer
10	15:51:00	D	I	75,088	F/X	Won Fund Transfer

Status of Settlement Risk

	Time	Name	Content	Amount	Settlement	Time of Settlement
1	15:52:53	E	Intraday Overdraft	32,375	X	
2	15:50:00	C	Change in size of payment(-)	5,560	X	
3	15:39:12	E	Intraday Overdraft	7,375	O	15:51:29
4	15:06:55	K	Intraday Overdraft	17,993	O	15:11:00
5	14:30:00	L	Change in size of payment(+)	929,560	X	
6	14:10:00	M	Change in size of payment(-)	1,672	X	
7	14:10:00	O	Change in size of payment(-)	28,027	X	
8	14:10:00	P	Change in size of payment(-)	17,048	X	
9	14:00:12	Q	Intraday Overdraft	863	O	14:35:50
10	14:00:07	R	Intraday Overdraft	28,809	O	14:02:17

Source: Bank of Korea

(3) Quarterly Monitoring

The purpose of quarterly monitoring is not to manage routine settlement risks, but to identify new events that may cause settlement risks, such as the enactment or revision of system operation rules of the operating institution, the participation of new financial institutions in the system, and changes in the governance structure of the system operator. Liquidity risk and credit risk are continuously monitored through real-time and monthly monitoring activities, and are effectively managed by utilizing the net settlement risk management tool and the intraday liquidity facility. The monitoring conducted on a quarterly basis mainly focuses on identifying legal risks and operational risks. The monitoring targets are as shown in Table 3-12.

The questionnaire on the payment system is divided into general status, enactment/revision of laws and regulations, computer failures, credit and liquidity risks, etc., and the questionnaire on general status in the monitoring survey includes the following items.

- Status of organization for payment & settlement system operation and risk management
- List of participating organizations
- Details of cases that operating hours have been temporarily extended or changed
- Details of instructions, recommendations or request for cooperation regarding the operation of the system, sent to participants
- Operating cost to equity capital ratio
- Operating expenses and revenue by major business area

<Table 3-12>

Payment Systems under Quarterly Monitoring

Operator	Systems Under Quarterly Monitoring
Korea Financial Telecommunications & Clearings (KFTC)	- 12 retail payment systems operated by KFTC
Korea Securities Depository (KSD)	- Bond settlement system - Inter-institutional Repo settlement system - Institutional stock investors settlement system
Korea Exchange (KRX)	- KOSPI market settlement system - KOSDAQ market settlement system - Derivatives settlement system
NongHyup Federal Association[1)]	- Inter-member settlement system
SuHyup Federal Association[1)]	- Inter-member settlement system
National Forestry Cooperative Federation[1)]	- Inter-member settlement system
Korea Federation of Savings Banks[1)]	- Inter-member settlement system
Korea Federation of Community Credit Cooperatives[1)]	- Inter-member settlement system
National Credit Union Federation of Korea[1)]	- Inter-member settlement system
Hana Bank[2)]	- FX funds transfer system
Woori Bank[2)]	
Kookmin Bank[2)]	
Shinhan Bank[2)]	

Note: 1) NongHyup, SuHyup, forestry cooperatives, and savings banks, community credit cooperatives, credit unions are non-bank depository institutions. A federation of each type of these depository institutions plays a central bank for their members. All members hold a current account at their Federation and inter-member fund transfers are settled through their current accounts at their Federation. Moreover, the federation is a participant at retail payment systems and takes care of funds transfers between their members and non-members (other participants in retail payment systems). It also provides intraday settlement liquidity to their members.
2) Commercial bank that is a settlement member of CLS System.

Source: Bank of Korea

Questions regarding “the enactment and revision of laws and regulations” are as follows:

- Status of enactment, revision, or promotion of relevant laws and regulations

- Status of revision or establishment of internal rules and procedures
- Status of agreement or contact change with participant
- Status of other legal measures

Questions regarding “operational risk” are as follows:

- Experience of IT failure and recovery: ⅰ) Breakdown date, ⅱ) Breakdown duration, ⅲ) Breakdown generating organization, ⅳ) Contents and causes of the Breakdown, ⅴ) Recovery contents and completion time and ⅵ) Backup system operational status
- General operation of IT system: ⅰ) Status of IT system operation organization and increase or decrease of professional manpower, ⅱ) Introduction, change, and expansion of computer capacity of major IT systems, ⅲ) Change of operation method or risk management procedure of IT system and ⅳ) Inspection on the operation of the IT system (self and external institutions)
- Establishment and operation of BCP (Business Contingency Plan): ⅰ) Establishment or modification of contingency plan in BCP, ⅱ) Implementation of simulation, training, emergency training, etc for BCP or IT emergency plan
- Other operational risk management: ⅰ) Operational risk caused by natural and human disasters and measures taken to respond to the risk and ⅱ) Other operational risk measures

(4) Risk-based Monitoring

(a) Monitoring Indicators

The Bank of Korea developed monitoring indicators representing settlement risk while strengthening settlement risk management after the 2008 global financial crisis. In this process, it referred to BCBS (2013), which develops indicators for intraday liquidity risk. BCBS (2013) presents seven indicators: 1) daily maximum

intraday liquidity usage, 2) available intraday liquidity at the start of the business day, 3) total payments, 4) time-specific obligations, 5) value of payments made on behalf of correspondent banking services, 6) intraday credit lines extended to customers, 7) intraday throughput. In 2020, the Bank of Korea developed 11 monitoring indicators.

The first indicator is intraday liquidity usage (ILU). ILU is calculated as the difference between the amount received and the amount transferred, and the calculation formula is as equation (1). This indicator does not consider the source of funds such as the account balance of the participating institution and the intraday liquidity support. i, s represents participant and time, respectively. x represents the amount transferred (outgoing payment), and y represents the amount received (incoming payment).

$$ILU_{i,t} = \sum_{s=0}^{t} (y_{i,s} - x_{i,s}) \quad (1)$$

The second indicator is the intraday liquidity usage cap (ILUC). This indicates the intraday liquidity that participating institutions can receive from the Bank of Korea. The Bank of Korea introduced the intraday liquidity facility (intraday current account loans) in 2000 to provide settlement liquidity to financial institutions participating in BOK-Wire+. For an explanation of this, please refer to Chapter II.

The third indicator is the intraday liquidity usage rate (ILUR). The denominator of the intraday liquidity usage rate (ILUR) is the intraday liquidity usage cap (ILUC) and the numerator is the intraday liquidity usage (ILU). This indicator shows how much the participants rely on the central bank liquidity for intraday settlement. The formula for the intraday liquidity usage rate is as follows:

$$ILUR_{i,t}(\%) = \frac{ILU_{i,t}}{ILUC_i} \times 100 \quad (2)$$

The fourth indicator is Available Intraday Liquidity (at the Beginning). Available Intraday Liquidity (AIL) indicates the liquidity held by the participating institution at the beginning of each business day. Available Intraday Liquidity

(AIL) is calculated as the sum of the current account balance (CADB) and the intraday overdraft limit (ILUC), as shown in the formula below.

$$AIL_{i,0} = CADB_{i,0} + ILUC_i \tag{3}$$

The fifth indicator is the Available Intraday Usage Rate (AILUR). The Available Intraday Usage Rate (AILUR) shows how much of all liquidity available to a participant has been used. The Available Intraday Liquidity Usage Rate is expressed as the ratio of intraday liquidity usage to available intraday liquidity.

$$AILUR_{i,t}(\%) = \frac{ILU_{i,t}}{AIL_{i,0}} \times 100 \tag{4}$$

The sixth indicator is the intraday liquidity coverage ratio (ILCR). This ratio compares available liquidity with demand for liquidity. The intraday liquidity coverage ratio (ILCR) is expressed as Equation (5).

$$ILCR_{i,t} = \frac{\sum_{s=0}^{t} x_{i,s}}{\sum_{s=0}^{t} y_{i,s} + AIL_{0,t}} \tag{5}$$

The remaining indicators include Time-specific Obligations (ND), Net Debit Cap (NDC), Net Debit Cap Utilization Ratio (NDCUR), Queueing Payments Rate (QPR), and Intraday Throughout.

(b) Application of 70% Rule to Net Debit Cap Utilization Rate

In order to ensure smooth operation of BOK-Wire+, it is very important for participating institutions to manage intra-day liquidity at an appropriate level. The key point to this intra-day liquidity management is to set the net debit cap appropriately and maintain a certain level of settlement liquidity to prevent the net debit cap from being fully utilized.

Accordingly, the Bank of Korea recommends that BOK-Wire+ participating

institutions use up 70% or less of their net debit cap. If a participating institution's net debit cap utilization rate exceeds 70%, the Bank of Korea requests the participating institution to increase its cap or increase (hold) more settlement liquidity.

In particular, the warning level for the net debit cap utilization rate has been set at 70% since 2011. According to Article 21 of the 「Regulation on the Operation and Management of Payment and Settlement Systems」, the Governor of the Bank of Korea may adjust the collateral of financial institutions participating in the net settlement arrangement (within the range of 120% of the collateral amount) in consideration of the net debit cap utilization rate. Accordingly, as shown in Table 3-13, the collateral amount of four domestic banks and two foreign bank branches with poor net debit cap management may be increased. Conversely, the collateral amount of domestic banks and two foreign bank branches with good net debit cap management can be reduced.

<Table 3-13>

Evaluation Components of the Collateral Deposit Ratio

Evaluation Item (%)	Rank	Adjustment (%)	Number of Institution	
			Domestic Bank	Foreign Bank Branch
- Amount of Net Debit Cap (40)	A	-20	2	1
- Daily Average of Net Debit Cap Utilization Rate(30)	B	-10	2	1
	C	0	N_1[2)]-8	N_2[2)]-4
	D	+10	2	1
- Net Debit Cap Utilization Rate Exceeding Warning Level[1)] (30)	E	+20	2	1

Note: 1) Sum of net debit cap utilization rates exceeding warning level (70%) (When the rates exceed 90% of the cap, double the sum)
2) N_1 and N_2 respectively indicate the number of domestic banks and foreign bank branches, both of which participated in net settlement.
Source: Bank of Korea (2020)

<Table 3-14>

Net Debit Cap Utilization

(unit: %, number)

	2019	2020	2021	2022	2023
Net Debit Cap Utilization Rate[1)]	17.2	17.6	18.3	15.9	16.1
The Number of Breaking the Warning Level	83	109	171	80	39

Note: 1) Average of daily net debit cap utilization rates of all participants
Source: Bank of Korea

Meanwhile, as shown in Table 3-14, the net debit cap utilization rate is quite stable and remains at a low level. And the number of times the cap utilization rate exceeded 70% increased from 2019 to 2021, then plummeted to the 2019 level in 2022, and dropped to 39 in 2023. According to the Bank of Korea (2024), this is because the domestic IPO offering amount (KRW 3.3 trillion) in 2023 decreased significantly compared to 2022 (KRW 15.6 trillion), which led to a decrease in IPO subscription and refund fund movement, and many participants increased their net debit caps.

D. Cases related to Risk-based Supervision and Oversight

(1) Tmon and WeMakePrice Incident

(a) Overview and Cause of the Incident

In July 2024, Tmon and WeMakePrice, Korea's leading e-commerce platforms, were unable to settle sales payments to sellers. At first, it seemed like the settlement process was temporarily delayed, but it turned out that Tmon and WeMakePrice ultimately failed to settle sales payments to sellers. The unsettled amount amounted to KRW 1.279 trillion, and the number of sellers suffering financial damage reached 48,124 (Segye Ilbo, 2024).

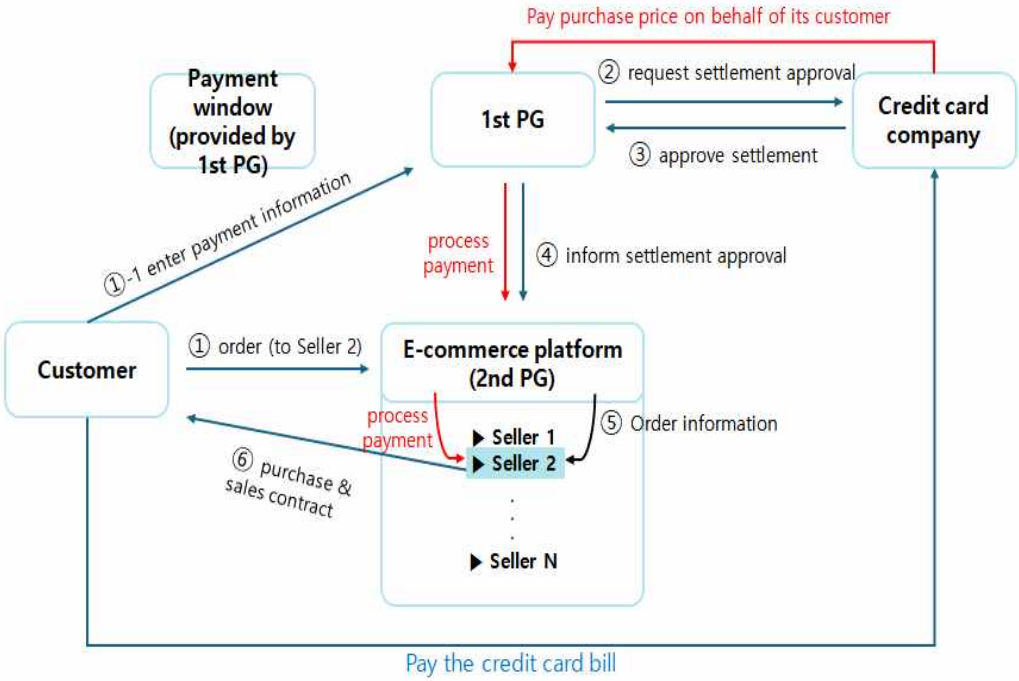
How could this happen? When a customer pays with a credit card at Tmon and WeMakePrice, the credit card company pays the purchase price to Tmon and WeMakePrice through a payment gateway (so-called “1st PG”). Next, Tmon and WeMakePrice pay the sales funds to the seller after deducting a certain fee from the funds received from the credit card company. It was revealed that Tmon and WeMakePrice paid the sellers with a time lag (payout period) of up to two months from the funds received from the credit card company. It was also revealed that Tmon and WeMakePrice did not keep the sales funds separate from their own assets, but used the money as operating funds. The reason Tmon and WeMakePrice were able to hold and control the funds in this sales proceeds process was because Tmon and WeMakePrice acquired a license for payment gateway (PG), becoming so-called second PG.

In other words, the causes of the incident are as follows. First, the scope of

the payment gateway license is set too broadly, so the payment gateway can hold and control the sales proceeds. Second, because holding and controlling the sales proceeds entails settlement risk, payment service providers who wish to obtain a payment gateway license must meet strict criteria, but the payment gateway license requires only a registration procedure, not a permit. Third, an e-commerce platform that has obtained a payment gateway license can decide the settlement cycle (payout period) in agreement with the seller. In general, e-commerce platforms have greater negotiating power than sellers, so e-commerce platforms can extend the settlement cycle. Fourth, e-commerce platforms have no obligation to separate the sales proceeds from their own assets and manage them accordingly.

<Figure 3-14>

E-commerce Platform Payment Process



Source: Shin (2024)

(B) Lessons and Implications of the Incident

This incident shows how important it is to apply the 'same action-same risk-same regulation' principle to payment service supervision.

First, a payment gateway is generally a service that helps online stores make payments in online transactions. Therefore, a payment gateway provides IT services in the payment process and cannot be considered to directly involve in the payment process. Therefore, a high level of supervision is not required for a payment gateway, and a license can be acquired through a 'registration' procedure rather than a 'authorization/permission' procedure. However, when an e-commerce platform acquires a payment gateway license, it is effectively permitted to hold and control the sales proceeds. A service that simply assists payment is different from a service that holds and controls the sales proceeds. Therefore, The payment gateway that simply assists payment and the payment gateway that holds and controls the sales proceeds should be treated differently. In other words, if an e-commerce platform wants to hold and control customer funds, it should acquire a separate license, not a payment gateway.

In this regard, we can refer to the case of India. In India, e-commerce platforms directly settled sales proceeds and problems with settlement delays frequently occurred. Therefore, starting in 2020, the Reserve Bank of India created a new "payment aggregator" license that can handle sales proceeds on e-commerce platforms. In addition, payment aggregators were required to manage sales proceeds in an escrow account rather than directly (Reserve Bank of India, 2021).

Meanwhile, Australia is also working on reforming its payment service licensing system. PG work is classified as "payment technology and enablement services". Services that hold and control sales proceeds will be classified as "payment facilitation services" (Treasury, 2023). Therefore, payment gateways in Australia do not directly settle or hold funds. In addition, payment service providers that handle payment facilitation services are required to entrust sales proceeds to a bank and hold additional liquidity in accordance with the "client money rule"that is suggested by the Treasury (Treasury, 2023).

(2) MergePoint Incident

(a) Overview and Cause of the Incident

MergePoint was a type of prepaid payment method (formal legal name is

electronic prepayment means). Consumers can purchase MergePoint and then use them to purchase items at offline or online stores. The advantage of MergePoint was the additional benefits such as high discount rates. For example, consumers could purchase MergePoint with a face value of 100,000 won for 90,000 won and purchase items worth 100,000 won. Therefore, MergePoint was getting popularity. MergePoint affiliated stores included restaurants, large marts, and convenience stores, and consumers could purchase daily necessities with MergePoint and enjoy discounts.

On August 11, 2021, the issuer of MergePoint (Mergeplus) announced that they would limit the use of MergePoint to local retail stores and that only 10% of the face value would be refunded in response to any refund request. On August 12, when MergePoint became virtually unusable, a large number of MergePoint refund requests arose. However, Mergeplus, the issuer of MergePoint, had already lost its ability to pay, and the unrefunded amounts are estimated to be 100 billion won (Electronic Newspaper, 2024).

The MergePoint incident occurred due to lax supervision of prepaid electronic payment instrument issuers and insufficient protection measures for prepaid electronic payment instruments. MergePoint is a type of Ponzi scheme. In order to prevent such an incident, thorough protection of customer funds for prepaid payment instruments is necessary.

(b) Amendment of the 「Electronic Financial Transactions Act」

The Financial Services Commission took advantage of this incident to push for revisions to the 「Electronic Financial Transactions Act」 in order to strengthen supervision over the issuance and management of prepaid electronic payment instruments (officially called “electronic prepayment means”). The revised Act was passed at the plenary session of the National Assembly in 2023 and was implemented from September 2024.

First, the scope of electronic prepayment means subject to supervision has been greatly expanded. Previously, an electronic prepayment means was subject to supervision only if it could be used at 11 or more merchants or if it could purchase goods and services from two or more industries. Otherwise, it did not

need to be registered as an electronic prepayment means and was excluded from supervision by the Financial Services Commission. Under the revised Act, all electronic prepayment means, except those with one merchant, must now be registered with the Financial Services Commission. However, considering the burden on small businesses, if the issuance balance and total issuance amount are below a certain amount, the registration obligation is exempted. This specific amount standard will be determined after assessing the industry situation and collecting opinions.

Second, specific measures have been introduced to effectively protect the prepaid customer funds. The issuer of the electronic prepayment means must separately manage the customer funds through trust, deposit, or payment guarantee insurance. The separately managed customer funds must be invested in safe assets, and cannot be offset or seized, and cannot be transferred or provided as collateral. In particular, the preferential payment right for customer funds has been legally guaranteed to protect the rights of users. Through these measures, the users' funds can be protected more safely and effectively. Now, even in the event that the issuers of the electronic prepayment means goes bankrupt or ceases business, users can safely get their prepaid funds back.

Third, the revision of the Act fostered new business practice rules that PSPs who issue electronic prepayment means must comply with. If the PSPs unfairly reduces the number of affiliated merchant stores or changes the terms of use to the disadvantage of users, a clause that customer funds are guaranteed to be fully refunded must be stated in the terms and conditions and users must be notified of this.

In addition, restrictions were placed on the provision of economical benefits by PSPs who issue electronic prepayment means. Benefits such as discounts or cashback can only be provided by PSPs with a certain level of financial soundness, and the amount provided as such benefits must also be managed separately. These measures will protect the rights of users in the prepaid electronic payment market and prevent PSPs from competing for indiscriminate benefits, thereby contributing to establishing a sound market order.

3. Risk-based Supervision and Oversight of the NRB

A. Overview

PSD, NRB has been entrusted with the responsibility to develop, expand, promote, supervise and regulate payment and settlement related activities in Nepal. PSD has been functioning as the regulator as well as supervisor for payment-related institutions, activities, and mechanisms in Nepal. The key functions and responsibilities of PSD are as follows:

- Formulate policy provisions to promote digital payments,
- Issue license to eligible institutions as Payment System Operators (PSOs) and Payment Service Providers (PSPs),
- Regulate licensed PSOs and PSPs,
- Oversight of PSOs and PSPs,
- Operate Real Time Gross Settlement (RTGS) System.

The Section 5 of the Payment and Settlement Act, 2019 has specified that no institution can operate as a PSO or a PSP without obtaining the license form this Bank. Similarly, Section 42 of the act has empowered PSD, NRB to inspect, monitor and supervise the payment-related activities of licensed institutions. PSD can also issue necessary directions (as per Section 45) of the Payment and Settlement Act, 2019.

To exercise the regulatory and supervisory capacities bestowed by the act to PSD, several legal and policy arrangements have been made by the Bank. Payment and Settlement By-laws, 2020, (First Amendment, 2023) Payment System Oversight Framework, 2018, Payment System Inspection and Supervision By-laws, 2078, and Procedure for Onsite Inspection of Payment-related Activities of Banks and Financial Institutions, 2024 among others.

B. Legal and Policy Provisions in Nepal

Nepal Rastra Bank has formulated several policies, By-laws, rules, guidelines,

directives have been formulated to create secure, reliable and sustainable payment ecosystem in Nepal.

(1) Legal Arrangements

The payment system development is driven by the objective to develop a secure, healthy and efficient system of payment, set aside in the NRB Act, 2002[73]. The following legal and policy arrangements have been made for the regulation of payment systems in Nepal:

<Table 3-15>

List of Legal and Policy Arrangements for Regulation of Payment Systems in Nepal

S.N.	Policies	Year	Recent Amendment
1	Licensing Policy for Payment Related Institutions	2016	2023
2	Payment Systems Oversight Framework	2018	
3	Standard Operating Procedure for Daily Liquidity Facility	2018	2023
4	Retail Payment Strategy, 2019	2019	
5	National Payment System Development Strategy	2019	
6	Payment and Settlement Act, 2019	2019	
7	RTGS System Rules-2019	2019	
8	Payment & Settlement Bylaws, 2021	2021	2023
9	Payment System Oversight Manual, 2021	2021	
10	Digital Lending Guidelines	2021	
11	Nepal QR Standardization and Framework Guidelines	2021	
12	Payment System Inspection & Supervision Bylaws	2022	
13	Cyber Resilience Guidelines	2023	

Source: NRB

(2) Payment and Settlement Act, 2019

Payment and Settlement Act, 2018 is approved by Federal Parliament of Nepal. The scope of the Act is to develop, expand, promote, supervise and regulate

73) Under Section 4(c) of the Nepal Rastra Bank Act, 2002, one of the major objectives of NRB is to develop a secure, healthy, and efficient system of payment has been specified.

cheque clearing, payment and settlement system. It has identified several payment instruments. It has mentioned the licensing provision, structure of board, business operation, reporting, documentation. It has delegated rights to Nepal Rastra Bank for regulation and supervision of financial institutions to create and maintain sound payment ecosystem. There is also provision for conflict resolution, proceedings, crime and punishment.

(3) Regulatory Arrangements

(a) Payment and Settlement By-laws, 2020 (First amendment, 2023)

Under the authority granted by Section 46 of the Payment and Settlement Act, 2018, Nepal Rastra Bank has established a set of By-laws for the regulation and supervision of Payment Service Providers (PSPs) and Payment Systems Operators (PSOs). These By-laws empower the Payment Systems Department (PSD) to develop secure, reliable, modern, and stable payment systems. In accordance with the bylaws, the PSD is authorized to:

- Issue licenses to PSPs and PSOs.
- Issue directives.
- Inspect PSPs and PSOs before and after issuance of license.
- Establish Real Time Gross Settlement (RTGS).
- Operation and management of Payment Switch and Payment Gateway.
- Implement Cross Border Payment mechanism.
- Conduct public awareness campaign for the promotion electronic payment mechanisms.
- Conduct research activities to analyze status of digital payment.

(b) Rules, Policies & Guidelines

① Licensing Policy for PSPs and PSOs (Revised, 2023), 2022

The policy is formulated based on the clause 10 of **Payment and Settlement**

By-laws 2020 (First Amendment, 2023), and is approved to provide licenses to PSPs and PSOs.

- It clarifies the licensing procedures for PSPs and PSOs.
- It also defines the PSPs and PSOs.
- It includes steps of awarding license, renewal, dismissal procedures.
- It includes required minimum paid of capital for PSPs and PSOs.

(c) Nepal QR Standardization Framework and Guidelines 2021

- Quick Response (QR) code payments became familiar and its increased adoption around the globe compel us to adopt it. We needed to implement it by defining a framework and standard guidelines.
- QR Code standardization defines Acquirer, Customers, Issuers, Merchants, Network Members, Payment System Operators, Payment Service Providers, QR Code, Scheme/Network
- The eligibility and responsibilities of Issuers, Acquirer and other stakeholders are defined.
- The settlement mechanism, fee/charges, Risk and Compliance, Information Security, customer grievance handling is defined.

(d) RTGS System Rules-2019, Version 03

- It is brought into effect after the implementation of RTGS system in Nepal Rastra Bank.
- It includes RTGS participation, responsibilities, payment processing, system operation rules, accounts structure and management, business continuity management, issue resolution and change management.
- It defines membership criteria, participation modes, appointment of intermediary agents, service provider responsibilities and participants responsibilities.
- It defines payment and settlement life cycle that includes payment types, message types, payment and settlement time/period.

(e) Daily Liquidity Facility SOP (Revised, 2023), 2019

- It smoothens the daily settlement process in RTGS system operation.
- It defines Daily Liquidity Facility (DLF), Overnight Liquidity Facility (OLF), Collateral management Account, Settlement Account.
- It includes process of using DLF for RTGS participants, OLF management and procedure.

(f) Digital Lending Guidelines, 2021

- It defines the digital lending procedure, eligibility of customer, loan amount limit, loan period, responsibility of customer and lender, condition of black listing, Fee and charges, risk mitigation procedure.
- The means of digital payment are increasing day by day, so the number of transaction and value of transaction are also increasing.
- As an enhancement in digital payment digital lending guidelines helps market to ease the short-term lending procedure.

(g) Cyber Resilience Guidelines

- Based on the Guideline of Cyber Resilience issued by Bank for International Settlement (BIS), Nepal Rastra Bank has also issued Cyber Resilience Guidelines for business continuity.
- It includes management of cyber risks, cyber resilience strategy, cyber resilience framework.
- It also defines the role of senior management, identification, protection, detection, mitigation of potential risk in system operation.
- It defines response and recovery mechanism. The recovery procedure from cyber incidents, awareness, testing and training provisions are mentioned in it.

(h) Payment Systems Related Unified Directives

NRB has issued Payment Systems-related Unified Directives, 2023; consisting 16 directives applicable for licensed institutions (PSOs/PSPs/BFIs). In includes directives related to Card System, Electronic Cheque Clearing, Internet Banking, Mobile Banking, Mobile Wallet, Branchless Banking, RTGS System operation. The directives are issued to ensure regulatory compliance and minimum corporate governance standards. Considering the possibility of systemic risk and growing risks related to ML/TF/PF, PSD has issued directives related to risk management, consumer protection, AML/CFT/CPF, system and transaction security.

(4) Supervisory Arrangements

Under the supervisory function of NRB, PSD undertakes both on-site and off-site supervision activities through the oversight function of the department. The major objectives of inspection and supervision activities are as follows[74]:

- Inspecting the adherence of licensed institutions to Nepal's legal provisions (acts) as well as policies, directions, circulars, notices issued by NRB from time to time.
- Assessing the overall financial condition of licensed institutions.
- Assessing the system security, transaction related risks and their mitigations implemented by licensed institutions.
- Assessing the documents/ information sought by NRB from licensed institutions.

As per the Payment System Oversight Manual, 2021 and Payment System Inspection and Supervision By-laws, 2021 the supervisory function of the department has been categorized under the following:

(a) On-site Inspection

As per the Section 42 of the Payment and Settlement Act, 2019, Payment

74) Section 6 of Payment System Inspection and Supervision Bylaws, 2078 covers the objectives related to inspection and supervision. Similarly, Section 8 specifies the procedure to be followed for inspection and supervision by PSD. Section 9 specifies the types of inspection and supervision activities (Onsite, off-site, Special, and Monitoring Inspections)

System Inspection and Supervision By-laws, 2021, and Chapter III-Onsite Oversight, Section 3.1 of the Payment System Oversight Manual, 2021; PSD can undertake onsite inspections of licensed PSOs and PSPs. Onsite inspection is conducted by NRB to ensure that enough and secure technological environment have been maintained in the entity.

The on-site inspection process generally involves the following three steps:

① Inspection Planning

In this phase, the inspection team defines the inspection's scope by reviewing all available information, such as the off-site supervision report, previous on-site inspection reports, and documents provided by the institution.

② Inspection Procedure

The process begins with an introductory meeting with the CEO and top management of the institution. During this stage, the team gathers relevant and necessary data and information in detail.

③ Evaluate the Compliance Status

The compliance functions are thoroughly assessed based on the following criteria:

- Payment and Settlement Act, 2019
- Payment and Settlement By-laws 2020 (First Amendment, 2023)
- Payment System-related Unified Directive
- Cyber Resilience Guidelines, 2023
- Notices and Circulars
- Applicable Accounting Standards

The on-site inspection activities are broadly categorized as following:

① Periodic Inspections

Periodic inspections are scheduled inspection as part of a planning of the activities. The onsite inspections are carried out at least once in every two years as per the action plan of PSD.

The frequency of these inspections is determined by:

- Important changes in the design of the systems,

- The availability of resources,
- Results of monitoring reports
- Results of the reports on compliances with the rules and manuals, etc.

② Special Inspection

Special inspections are unscheduled activities carried out as and when necessary, based on the analysis of data carried out as part of the continuous monitoring activity or on notices of special circumstances, as reported or otherwise. The department may undertake special inspections based on the information from the public media, and request, information, direction, or petition from government agencies or information received from any other sources.

③ Follow-up/Monitoring Inspections

The follow up inspection is carried out to assess the implementation status of the instructions/directions given on the earlier occasions in the course of inspection/supervision.

(b) Off-site Inspection

The off-site oversight/ inspections are undertaken based on the analysis of data/information provided by licensed institutions on a periodic basis. As per Section 25(2) of the Payment and Settlement Act, 2019, the licensed institutions are required to complete their statutory audit within 4 months of the completion of the fiscal year. They are also required to get approval on the financial statements from NRB before publishing them for the general public. Based on the documents submitted by the institutions, PSD undertakes the off-site supervision of licensed institutions.

C. Policy Arrangements for Supervisory Functions

The following policy arrangements have been made for inspection and supervision activities:

(1) Payment System Inspection and Supervision Bylaws, 2021

Payment System Department can:

- Conduct onsite and office inspection of PSPs and PSOs to check whether the rules, regulations, orders, circulars and instructions issued by this bank have been complied with.
- Direct particular PSPs and PSOs, if there are remarks (comments) is found during the inspection for improvement of payment ecosystem.
- Identify the payment related risk and take necessary action to mitigate those risks.

(2) Payment System Oversight Manual, 2021

The Payment System Oversight Manual, 2021 serves as a guide for implementing the oversight function of payment and settlement systems. The document has classified Nepalese payment system and has specified off-site as well as onsite oversight requirements, procedures, and reporting requirements to be followed by PSD.

(3) Payment Systems Oversight Framework, 2018

- One of the central bank's functions is to oversee payment systems, with a primary focus on efficiency and safety.
- The way that supervision and oversight are different is that supervision approaches problems from a prudential solvency and liquidity perspective, whereas oversight takes a guideline and resolution-based approach from a payment system viewpoint.
- One of the NRB's primary responsibilities is to oversee the national payment system, which involves monitoring both planned and current systems and instruments, evaluating them against these goals, and, if necessary, enacting reform to increase safety and efficiency.
- The key aspects are:
    - Ensure sound legal foundation

- Enhance risk management and control
- Integration and interoperability of different payment systems
- Assess reach and range of payment services
- Prevention of market from abuse and frauds
- Safeguard customers and ensure their protection
- Review competitiveness in the market

D. Risk Based Regulation / Supervision in Nepal

A risk-based oversight framework for payment service provider is vital for maintaining the stability, security, and compliance of financial services. This framework focuses on systematically identifying, assessing, and mitigating risks in a prioritized way. A well-crafted risk-based oversight framework is essential, as it protects customer interests and supports the overall stability and growth of payment-related organizations within the country. Implementing such a framework allows organizations to effectively navigate challenges, uphold trust, and remain resilient in an ever-changing financial environment.

Risk categories for PSPs/PSOs are based on the organization's business activities and those risks can be classified broadly into Operational Risk: Financial Risk: Legal Risk: Reputation Risk: Systemic Risk: AML/CFT Risk: Liquidity Risk: Settlement Risk: Business Process Risk etc.

Risk Rating is another major aspect to measure the risk and risks are typically categorized as High, Medium, or Low, depending on their frequency and severity. High risk can cause significant damage to the company and the entire payment system ecosystem, while low risk has minimal impact. Risks are rated on a scale generally typically from 1 to 5

Principally, PSD follows compliance based prudential supervision practices as of now but in practice, NRB also cover some part of inspection report identifying risks and oversight of risk in the PSPs and PSOs. While conducting onsite examination, inspection team also consider and review the risk related policies, its implementation, discussion and oversight status by the board of the entity and prepare the onsite report for its approval and implementation.

The supervision of licensed institutions is undertaken following the Payment System Inspection and Supervision Bylaw, 2021, Payment System Oversight framework, 2018, and Payment System Oversight Manual, 2021.

Realizing the growing importance of risk-based supervision, PSD is in process of drafting a risk-based supervision framework, based on which a risk-based approach shall be implemented for the supervision of licensed institutions, their products and services, geography of operations, etc.

PSD has issued AML/CFT Supervisory Framework and Risk Based AML/CFT Supervision Manual for Payment Systems Operators and Payment Service Providers, 2023 to focus the ML/TF/PF related risks associated with payment system. The major objectives of the framework are as below:

- To understand ML/TF risks and vulnerabilities in the payment sector.
- To assess the adherence of the licensed institutions to the relevant laws, rules, and regulations on AML/CFT on a regular scheduled basis as well as for special circumstances.
- To assess the effectiveness of the control measures implemented by the licensed institutions with respect to the standards.
- To develop general criteria, policies and standards for the conduct of payment services activities or the operations of systems, either generally to be adhered by payment system operator/ service provider or for a specific institution.

The framework is applicable to payment related institutions (PSOs/PSPs), instruments (payment cards, mobile banking, internet banking, e-Wallets, and any other evolving payment instruments), payment systems (large value payment systems and retail payment system). Section 2.3 of the framework specifies that the NRB can apply proportionate and dissuasive sanctions if misconduct or failure of the institution to meet regulatory requirements are found.

NRB has functionalized Money Laundering Prevention Supervision Division, a specialized division to oversee the compliance of licensed institutions and BFIs to FATF requirements, Anti-Money Laundering Prevention Act, 2008, Anti-Money Laundering Prevention By Rules, 2017, and AML/CFT/CPF requirements set aside by the bank (Directive No. 14/080 of Payment-related

Unified Directives, 2023). In the F.Y.2023/24, 2 AML-CFT focused solitary inspections were conducted by the division.

4. Policy Implications

Risk-based regulations and supervision for Payment Service Providers (PSPs) and Payment Service Operators (PSOs) impact the stability, security, and efficiency of the financial system. Some of the key policy implications in this regard are:

a. Dynamic Oversight and Regulatory Approach:

Risk-based regulations allow regulators to focus on the areas of highest risk within PSPs and PSOs, ensuring that resources are allocated efficiently. Such regulations help in identifying and addressing potential threats before they can cause significant harm. Similarly, policies must be adaptable to changing risk environments. In this regard, regulators need to regularly update frameworks to address emerging risks, such as cyber security related fraud and threats as well as new technological developments.

b. Improved Risk Management Practices:

PSPs and PSOs should implement robust risk management systems to comply with regulations by implementing policies and procedures for risk identification, assessment, and mitigation which the central risk management function.

c. Liquidation, Merger and Acquisition:

The increasing competition among PSPs for the same user base requires creative strategies for acquiring and retaining customers. Building and maintaining a reliable infrastructure, implementing advanced data analytics and risk assessment tools, acquiring users, and complying with regulations can be financially challenging for smaller PSPs.

Smaller PSPs and PSOs may find it challenging to meet the regulatory requirements, which may lead to increased costs and a potential need for

industry consolidation or liquidation for their business and financial substantiality and meaningful exit from the market.

d. Increased Consumer Protection:

PSPs and PSOs prioritize consumer protection by mitigating risks that could lead to financial loss or service disruption. As a result, it builds trust in digital payment systems and encourages broader adoption.

e. Transparency and Accountability:

Policies that require transparent reporting and accountability mechanisms help consumers make informed decisions and hold providers accountable for their services. Government and regulator can investigate and supervise in depth on the transactions made by PSPs and PSOs.

f. Balancing Innovation and Risk:

A risk-based approach can foster innovation by allowing PSPs and PSOs to experiment with new technologies and business models within a regulated environment. Regulators can provide a regulatory sandbox and innovation hub, where new products can be tested under regulatory surveillance. Risk related policies should maintain a balance between encouraging innovation and ensuring that risks associated with new technologies are effectively managed.

g. Systemic Risk Reduction and Resilient Payment:

Risk-based regulations help maintain the stability of the payment system and prevent systemic failures as it helps to address risks in critical areas. PSPs and PSOs need to build resilience against disruptions that may arise from financial instability, technological failures, or external shocks.

h. Regulatory Cooperation in Cross-Border Payments and Regulations:

In a globalized financial system, risk-based regulations should be harmonized across borders to prevent regulatory arbitrage and ensure that PSPs and PSOs operating internationally are held to consistent standards. Effective risk-based

supervision requires increased collaboration between national and international regulators to share information, coordinate oversight, and respond to global risks jointly.

i. Regulatory Adaptation:

Regulations must adapt to address new risks associated with innovations such as blockchain, artificial intelligence, crypto-assets and CBDC. Policymakers need to stay ahead of technological advancements to ensure effective oversight.

j. Assurance of Cyber security:

Increasing reliance on digital payment systems necessitates a strong emphasis on cybersecurity within the regulatory framework. Policies should mandate regular assessments and updates to cybersecurity measures. For this, policies such as advanced encryption, multi-factor authentication and others is needed. Effective implementation of Cybersecurity guidelines issued by regulators to BFIs, PSP and PSO to prevent fraud, prioritize data security, and offer innovative services.

To sum up, risk-based regulations and supervision for PSPs and PSOs helps to create a secure, resilient, and dynamic payment ecosystem to respond emerging risks while supporting innovation and growth. It focuses on targeted oversight, enhanced risk management, consumer protection, innovation encouragement, systemic stability, global cooperation, compliance costs, market entry barriers, and adaptation to technological changes.

5. Policy Recommendations

A. Long-term & Mid-term Issues

(1) License Framework (Different Supervision by Function)

The Nepal Rastra Bank broadly divides payment service providers into PSOs

and PSPs, and divides PSPs into commercial bank and non-bank PSPs. As of September 2024, there are 9 non-bank PSOs and 26 non-bank PSPs.

This current broad classification of payment service providers has several drawbacks. First, the same supervision can be applied to payment service providers with somewhat different characteristics or risk levels. For example, the types and sizes of risks posed by PSPs that simply act as payment gateways and PSPs that issue e-money are different. Since the latter poses greater risks, stricter supervisory standards should be applied to the latter.

In particular, PSPs that hold and control (customer) funds in the payment settlement process should be regulated through a separate license. In this regard, it is necessary to carefully refer to the case of the Reserve Bank of India introducing a license called "payment aggregator." A payment aggregator is involved in the settlement of transactions between an e-commerce platform and a merchant boarded on the platform. It collects the sales funds from customers and provides them to the merchant after the sales trade is finalized. A payment aggregator (PA) looks similar to a payment gateway (PG), but a PA is different from a PG in that it handles sales proceeds (or customer funds). As the size of e-commerce increases and the amount of e-commerce transactions increases, the Reserve Bank of India established a PA license in 2020 to properly manage credit risks that may arise in the e-commerce payment process.

In Korea, the Timon & WeMakePrice insolvency incident occurred in July 2024, when e-commerce platforms Timon and WeMakePrice failed to pay sales proceeds, causing damages exceeding 1 trillion won. In order to prevent such risk situations in advance, the licensing framework should be subdivided according to the principle of "same function-same risk-same supervision." If a separate license for PA is not created, the supervision of electronic money issuers can be applied equally to PSPs who hold and control sales funds on the payment process of e-commerce. If PAs or PGs are not included in the scope of supervision, supervision of these payment service providers should begin.

In addition, supervision of e-money institutions that recharge prepaid funds should be strengthened. Since e-money issued by e-money institutions is a means of payment and also a "money", in order to maintain the "singleness of money," e-money institutions should safely manage e-money issuance funds (received by

customers in exchange for e-money) and ensure smooth refunds of e-money (convertibility into private or public monies). Therefore, 100% of the issuance funds should be separated from e-money institutions' own assets and stored in a safe institution (mainly a bank) through deposits, trusts, etc.

In addition, since institutions entrusted with this also have credit risk – banks also have the risk of bankruptcy – there should be specific guidelines on how to manage customer funds so that the entrusted institution can safely manage customer funds. Above all, customer funds should be protected from the bankruptcy or insolvency of the e-money issuer or custodian bank (entrusted institution, also called settlement bank).

Regarding the reorganization of the licensing framework, we can refer to the case of Australia. The Treasury, Australian financial authority, has a plan to categorize payment functions into ① stored-value facilities, ② issuance of payment stablecoins, ③ payment instruments, ④ payment initiation services, ⑤ payment facilitation services, ⑥ payment technology and enablement services, and ⑦ cross-border transfer services, and apply supervisory standards appropriate to each function.

(2) Assessment Based on PFMI

It is necessary to select regular assessment targets (SIPSs) and determine the assessment cycle through the procedure of designating important payment and settlement systems. Korea used to have an assessment cycle of 2 years, but recently changed it to 3 years.

In the case of Nepal, since there are many improvement tasks and risk factors to be resolved, it is desirable to set the evaluation cycle to 2 years and periodically check whether recommendations as a result of assessment are achieved or not.

To this end, PFMI should first be adopted as an assessment criterion, and the main contents of PFMI can be incorporated into the oversight and supervision system of the Nepal Rastra Bank (NRB).

The following are very important in risk-based supervision and oversight.

First, in the case of a deferred net settlement type fund settlement system,

credit exposure occurs during the clearing and settlement process, and settlement liquidity must be maintained sufficient to cover the net debit obligations of the Top 2 participating institutions that generate the maximum credit exposure during the day.

Second, the financial market infrastructure must have clear regulations and procedures to completely handle all credit losses related to the debt of participants to the financial market infrastructure. Namely, Operators must be insulated from any losses and credit risk from defaults or insolvency of participants.

Third, the NRB must have a business continuity plan to handle incidents that cause major operational disruptions. This plan should include operating a second business processing center and restoring IT systems within two hours (2-hour Recovery Time Objective).

(3) Automation of Information (Data) Collection

Since the Payment and Settlement Department (PSD) of the Nepal Rastra Bank is short of manpower, the time spent on the oversight process can be reduced to improve the efficiency of the oversight. This is (ultimately) establishing a real-time monitoring system. When the Bank of Korea upgraded BOK-Wire+ in 2020, it automated the information collection-analysis-feedback process. By doing this, the Bank of Korea was able to reduce the number of manpower spent on real-time monitoring and improve the quality of real-time monitoring. In other words, automation of settlement data collection is a prerequisite for effective monitoring.

There are several things to consider regarding the automation of information collection. First, not only the Nepal Rastra Bank but also banks participating in the RTGS System should automate data processing.

Second, the proportion of inter-bank settlements processed using the “General Ledger” system should be reduced and the proportion of settlements through the RTGS system should be increased. This will eradicate the practice of using large checks for inter-bank settlements.

Third, information on indirect participants should also be collected and

accumulated to the NRB. Only then can the NRB properly manage the systemic risk starting from indirect participants. In the case of Nepal, since not all banks directly participate in the retail payment system, the Nepal Rastra Bank must secure information on the settlement liquidity and financial status of indirect participants in a timely manner. Only then can the NRB collect information on the total liquidity within the payment system and the settlement liquidity of each participating institution in a timely manner and conduct effective monitoring.

Establishing an information collection system requires a considerable amount of funds, so it is not easy to establish it in a short period of time. However, if the NRB promotes the establishment of the system through ODA, it can be established over a period of 4 to 5 years. Not only the ADB, but also major countries provide ODA for developing countries, and ODA projects are actively being carried out in the payment and settlement sector. For example, the Korea Financial Telecommunications and Clearings Institute has experience in establishing a payment system in Cambodia. Korea's ODA begins with a preliminary feasibility study, followed by the government's Knowledge Sharing Program (KSP), and then the Korea International Cooperation Agency (KOICA)'s project implementation. The construction of an information collection system corresponds to an IT system and does not require new technology to build it, so it can be easily built once the cost issue is resolved.

B. Short-term Issues

(1) Introduction of Risk-Based Monitoring

According to the materials provided by the Nepal Rastra Bank, the Bank does not conduct extensive monitoring. It mainly utilizes on-site examinations as a tool for supervision and oversight. However, since the on-site examination cycle is quite long, it is difficult to quickly identify how risk factors are dynamically changing and what new risk factors are through on-site examinations.

Therefore, periodic monitoring should be conducted in addition to on-site examinations, and the monitoring cycle can be set in various ways. It is recommended to conduct weekly or quarterly monitoring. Weekly monitoring

focuses on collecting data that helps identify risks, such as payment amount, queueing time, settlement delay time, number of settlement delays, and maximum net debit obligations. In addition, the data collected through weekly monitoring can be accumulated to identify risk trends. Quarterly monitoring focuses on collecting information on significant changes that have occurred in system operators and participating organizations (e.g., enactment and revision of risk-related regulations, changes in IT systems).

The task of collecting payment-related data through monitoring or other channels and analyzing them is very important. The Nepal Rastra Bank has not automated the information collection process yet, but based on its strong supervisory authority, it can request payment and settlement data from system operators and participants. The Bank cannot obtain data in real time to analyze risks, but it can analyze payment and settlement data ex post facto.

To briefly introduce the Bank of Korea's experience, the Bank of Korea was not able to fully automate the collection of payment data in 2007, and had no choice but to obtain net settlement data from the Korea Financial Telecommunications and Clearings Institute, the operator of the retail payment system. The risk that requires the most attention in the payment system is credit risk, and credit risk management is important in the net settlement process. Therefore, the Bank of Korea obtained net settlement data from the KFTC in 2007 to measure the credit risk inherent in the net settlement process, and to measure whether settlement can be completed during the day if the participant with the largest net debt goes bankrupt, and how much the settlement liquidity will contract due to the bankruptcy of this participant. This analysis took about three months, and through this, risk analysis capabilities and skills were developed, and the analysis skills were refined to conduct additional analysis.

In this way, the Nepal Rastra Bank can also analyze the level of credit risk and systemic risk and use the results of this analysis as a reference when establishing payment and settlement policies or managing risk plans

(2) Improvement on IT Security and Cyber Resilience

In 2019, Nepal presented the Digital Nepal Framework (DNF) and proposed

eight digital initiatives, one of which is the financial sector. The digitalization of the financial sector in Nepal is progressing rapidly, and IT risks are also increasing accordingly. According to media reports, there were an attack on the SWIFT system and payment switch of Nepal Commercial Bank. Therefore, a regulatory framework should be established to secure IT security and cyber resilience.

The Nepal Rastra Bank has prepared the QR Standardization and Framework Guidelines in 2021 and the Cyber Resilience Guidelines in 2023. The Cyber Resilience Guideline is based on the BIS guidelines and includes the definition of response and recovery mechanisms, procedures for recovering from cyber incidents (awareness, testing, training).

However, it must be emphasized that the most important thing is that the payment system operators and participating institutions comply with these guidelines. For example, even if the RTGS system operated by the Nepal Rastra Bank complies with a high level of cyber security, if the IT systems of participating institutions are vulnerable to cyber risks, the RTGS system of the Nepal Rastra Bank may be exposed to cyber risks as well.

Therefore, a business continuity plan should be established with a focus on cyber resilience, and education and training should be strengthened to practically secure business continuity. Above all, in order to achieve the principle of system restoration or resumption of operation within 2 hours (2-hour Recovery Time Objective), ① possible IT incidents should be identified, and ② a recovery scenario should be created for each IT incident. Even in the case of the Bank of Korea, resumption of operation within 2 hours may not be possible depending on the severity of the IT incident.

Therefore, it is important to secure an alternative means of payment & settlement in addition to efforts to increase the speed of resumption of operation. To this end, ① securing a dual system, ② conducting regular scenario-based recovery training, and ③ response training focused on highly plausible scenarios are important.

Meanwhile, it should be emphasized that security of physical IT facility is also very important in relation to IT security. When I visited the Central Bank of Nepal last August, the payment and settlement department (PSD) was located in

a temporary building, not the main building of the Nepal Rastra Bank, and the degree of security did not seem very high. The physical security of the main IT facilities needs to be strengthened.

C. Other Issues

(1) Human Resources Development

The size of payment and settlement department of the Nepal Rastra Bank is quite small, but its work is diverse, including license authorization, inspection examination), establishment of supervisory regulations, monitoring, and CBDC planning. In the case of the Bank of Korea, about 100 employees are in charge of these tasks. Therefore, the size of the payment and settlement department should be expanded and training about knowledge of payment and settlement systems and risk management should be provided to employees working at the department to raise experts in this area.

Basically, the Nepal Rastra Bank adopts rotation as a principle of human resources management, but if a large number of employees move to other departments at one time, the handover of work may not be done properly, and the know-how or qualitative information (soft information) of the outgoing employees may not be properly transferred to the newly transferred employees.

Therefore, even if the principle of rotation is applied, the number of transfers should be minimized. For example, if the team size is 3, the number of personnel transfers should be limited to 1. Even if the principle of rotation cannot be abandoned, the employees in Payment Settlement Department (PSD) should be transferred to any departments closely related to PSD (e.g., the Banking Supervision Department, the IT Department). In addition, it is desirable to conduct on-site inspections of financial institutions with support from other departments.

(2) Synergy of the Roles of Overseer-Operator-Facilitator

A central bank plays the roles of monitor, operator, and facilitator in the

payment system, and these three roles are not separate from each other but are closely related. In other words, the Nepal Rastra Bank can utilize the roles of operator and facilitator in performing oversight and supervision.

For example, by promoting QR standardization and IT system standardization, the IT aspects of participating institutions can be standardized, which will greatly help in managing IT risks. In other words, by introducing requirements or implementing standardization that minimize risk factors, the need for oversight and supervision can be reduced.

Another example is that if there is a payment or settlement process where settlement risks are continuously realized, the central bank can control the risk by directly operating it.

IV. Cross Border Payments: Its Modality And Procedure

1. Overview

Cross-border payment is transactions between individuals, companies, or banking institutions in different countries. One can use various modes of payments to make international payments such as bank transfers, credit card payments, digital wallets, and mobile payments. Broadly, cross-border payments can be classified as wholesale payments and retail payments. Wholesale payments are conducted between financial institutions to support their customers' activities and also to facilitate international borrowings, foreign exchanges, and trading of securities etc. On the other hand, retail payments are carried between individuals and businesses. Remittance is one of the prominent activities under retail payments.

Due to globalization, the acceleration of international trade, and the surge of e-commerce businesses, the demand for faster and easier cross-border payment is continuously increasing. Cross-border payments play a crucial role in driving globalization, empowering businesses to thrive in international markets and expand their reach. The value of cross-border payments is estimated to reach $250 trillion by 2027, representing a 60% increase in a decade[75].

Despite being central to international trade and economic activity, several issues and challenges exist in cross-border payments. Cross-border payment has not been able to foster international trade to a promising height attributing mainly to high costs, low speed, limited access, and insufficient transparency. According to the World Bank's Prices Worldwide database, the global average cost of sending $200 from one country to another is 6.35 percent as of March 2024[76]. The cross-border payments often take several days to settle and incur high costs due to frictions such as - a complex regulatory requirement that varies as per jurisdictions, truncated data due to different messaging standards used and rigid structure of messaging format, different operating hours across different time zones as many, depending upon the countries various correspondent bank might

75) Bank of England (2023)
76) The World Bank Group (2024).

be involved in the network for the funds to reach the destination causing delays and adding costs and in many cases individuals and businesses are unable to accurately predetermine the cost of making payments thereby creating uncertainty while making business decisions.

There has been growing popularity of retail payments through mobile banking using QR codes and such has also expanded into cross-border transactions. The recent developments in cross-border QR payment include linkages in South East Asian region viz., Malaysia and Indonesia; regional payment connectivity between Malaysia, Singapore, Thailand, the Philippines, Vietnam, and Brunei; India and Singapore; India and Mauritius; India and Sri Lanka; India and Bhutan; India and France; India and UAE; emergence of AliPay+ with integration of payments across China, Thailand, the Philippines, Malaysia, South Korea, Pakistan, India, Bangladesh, Indonesia etc.

2. Cross-Border Payments in Korea

Cross-border payment and settlement service refers to the process of transferring funds and making payments across borders and within different legal jurisdictions. Foreign exchange transactions by financial institutions, overseas remittances, corporate imports and exports, overseas investments, credit card use in foreign countries, and purchases from overseas online shopping malls all generate cross-border payments. In order to process international payments, it is necessary to transfer the local currency held by a citizen of a country to a person living abroad in foreign currency. To this end, central banks of each country, including the Bank of Korea, are working closely together to ensure smooth linkage between their own payment systems and cross-border payment systems.

A. FX Settlement System

Foreign currency remittances, which transfer the currency of a country to a counterparty in another country, have traditionally been made through correspondent banks. Korean banks open accounts with banks in foreign countries

and use these accounts to transfer money. These foreign banks are called correspondent banks. For example, if an individual residing in Korea requests a domestic bank to send money to his family member living abroad, the bank will ask the correspondent bank in the foreign country where the family member lives to send the money to the family member's account. The correspondent bank will then send the funds and notify that the transfer has been made. These messages are distributed in a standardized format through SWIFT, which is used by financial institutions around the world.

On the other hand, unlike general remittance transactions, the payment and settlement through foreign exchange transactions is exposed to foreign exchange settlement risk due to time differences between countries as the purchase currency is received and the sale currency is paid. A domestic bank that has sent the KRW in advance cannot know whether the transfer has been completed until it receives and confirms the USD from a foreign bank. If the foreign bank goes bankrupt during this time, the domestic bank that sent the KRW may not receive the USD it purchased. In fact, when the German Herstadt Bank went bankrupt in 1974, American banks that had previously paid marks through correspondent banks in Germany suffered huge losses because they were unable to receive the US dollars they had purchased. After this incident, similar large and small incidents occurred frequently.

To prevent such foreign exchange settlement risks, central banks and major commercial banks in advanced economies, in cooperation with the BIS, have established a system of simultaneous foreign exchange settlement that enables the simultaneous purchase and sale of currencies. Major global banks around the world have jointly established a special bank, Continous Linked Settlement (CLS) bank, in New York to settle both buying and selling currencies simultaneously. The CLS bank directly participates in the central bank settlement system of all settlement currency countries and eliminates foreign exchange settlement risk at its source by only paying the purchased currency to participating institutions that have paid the amount of the sold currency to the CLS Bank in each country.

The CLS system is participated by major financial institutions around the world, including Korea's financial institutions, and settles multiple currencies by simultaneously exchanging buying and selling currencies during a common global

settlement time zone for 18 major currencies, including KRW. CLS settles only the difference through multilateral netting, reducing the amount of liquidity required compared to correspondent banking, where funds are settled on a transaction-by-transaction basis. As of the end of 2023, more than 70 commercial banks worldwide are CLS settlement members and more than 25,000 financial institutions utilize the CLS system.

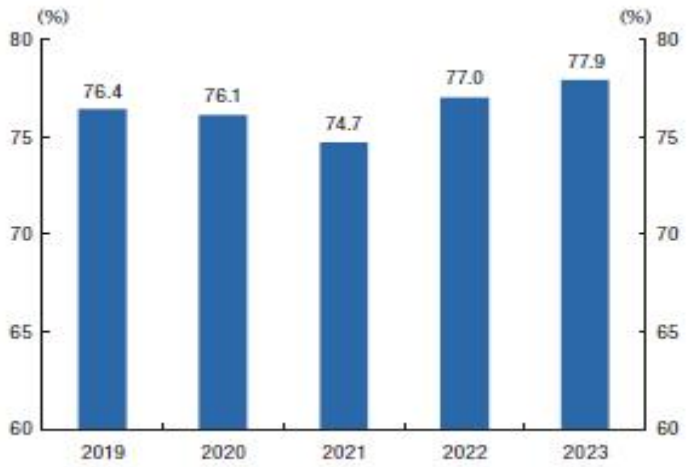
In 2004, BOK established a linkage system between BOK-Wire+ and CLS banks, and Kookmin Bank and Korea Exchange Bank were officially registered as CLS settlement member banks. In 2008, Shinhan Bank was added as a CLS settlement member bank, bringing the number of members that have settlement accounts with CLS banks and directly process CLS settlement to three. In December 2014, Korea added non-bank financial institutions, which are defined as other foreign exchange institutions under the Foreign Exchange Transactions Act, to the CLS system to manage foreign exchange settlement risk. Non-bank financial institutions' participation in the CLS is indirect through domestic settlement members which are direct participants.

In 2023, the total amount of foreign exchange simultaneous settlement through the CLS system averaged USD 88.9 billion per day, with domestic and foreign institutions accounting for 41.9% of the total. Next came settlement between domestic institutions (30.5%), settlement between foreign institutions (20.6%), settlement between domestic and foreign institutions, and settlement between foreign and foreign institutions (0.7%). In 2023, the proportion of CLS settlement that reduce foreign exchange settlement risk due to settlement timing mismatches was 77.9%, up 0.9 percentage points from the previous year. This increase in the proportion of CLS settlement by domestic financial institutions has resulted in a significant reduction in the risk of settlement timing mismatch. Figure 4-1 shows the average daily proportion of CLS settlement over the past five years.

The CLS system is monitored through the CLS Oversight Committee, which consists of the central banks of 17 settlement currency countries. BOK participates in the CLS Oversight Committee and conducts oversight activities on the CLS bank and system together with other CLS central banks. BOK monitors and inspects domestic financial institutions participating in the CLS system on a

daily basis, including the status of payment execution and payment liquidity management. In addition, BOK is actively encouraging new participation in the CLS system by non-participating financial institutions and participating in activities of international consultative organization such as the CLS Oversight Committee to monitor trends in related discussions.

<Figure 4-1>
Proportion of FX Transactions Settled in CLS (daily average)



Source: BOK (2024a)

B. Korea's Initiative to Enhance Cross-Border Payment Systems

(1) G20 Cross-Border Payments Service Improvement Program

With the deepening internationalization of the global economy, the efficiency of cross-border payment services, including cross-border remittances, has become a major issue as global trade expands and the number of migrant workers increases. The 2020 G20 Finance Ministers and Central Bank Governors' Meeting identified improving the efficiency of cross-border payment services as a top priority, and in response, a task force of international organizations, including the BIS, established a roadmap for improving cross-border payment services and a comprehensive implementation plan. The FSB has set quantitative targets to be met by 2027 for cross-border wholesale payments, cross-border retail payments,

and cross-border remittances to make cross-border payments faster and cheaper to access.

As the G20 cross-border payment service improvement program will have a significant impact on the private industry, including Korean foreign exchange banks and fintech companies that handle cross-border remittances, BOK is also reviewing the current status of cross-border payment services and promoting improvement measures in line with the G20 roadmap.

BOK examined the status of Korea's cross-border payment services based on the FSB's quantitative assessment indicators and found that Korea's cross-border payment services generally met the target level in terms of cost and access, but fell short in terms of speed and transparency. The cross-border wholesale payment services failed to meet the speed target as it takes 1-3 days to process, while there is more than one cross-border payment channel as payments are made through the CLS system and correspondent banks. In terms of transparency, it was found that it was difficult to check the processing time and status of the payment after the domestic institution issued the payment instruction and deposited it into the recipient's account, which did not meet the transparency standard.

Cross-border retail payments meet the FSB standard of no more than 1% with an average fee rate of 0.85%. In terms of accessibility, it meets the standard (at least one) as it is available in a variety of channels, including in-branch, online, and mobile. On the other hand, in terms of speed, SWIFT GPI service is able to complete transfers within the same day and check the status of transfers at any time, but it does not meet the FSB standard due to the relatively limited number of countries covered by the service. In terms of transparency, it was also found to fall short of the standards, with the exception of the SWIFT GPI service.

For overseas remittances, the average cost was found to be 5.03%, which is higher than the FSB standard (3%), but lower than the G20 average. Speed varied by channel, ranging from as little as 10 minutes to as much as five days, with money transfer operators (MTOs) such as MoneyGram allowing remittances to be made globally in less than an hour, but at a much higher fee than banks. In terms of accessibility, it meets the FSB's target by allowing for a variety of

channels to be used, similar to cross-border retail payments. However, transparency has been shown to be difficult to confirm in most cases until the payment is deposited into the recipient's account. Table 4-1 shows the results of BOK's survey on the status of cross-border payment services in Korea in relation to the FSB quantitative assessment indicators.

<Table 4-1>

Survey of Korea's Cross-Border Payment Services

Challenges	Market Segment		
	Wholesale	Retail	Remittances
Cost	-	average cost 0.85%	average cost 5.03%
Speed	1－3 days	1－5 days	10 minutes－5 days
Access	Have at least one cross-border payment channel: CLS systems, correspondent banks	Have at least one cross-border payment channel: bank teller, online, mobile, post office, etc.	
Transparency	Transaction costs and terms of use can be checked by domestic payers at any time, but it is difficult to check the required time and processing status until the money is deposited into the recipient's account.		

Source: BOK (2021)

(2) Cooperation System to Promote the Use of Local Currencies between Korea and Indonesia

BOK has announced that it will launch a bilateral local currency transaction (LCT) framework with the Bank Indonesia (BI) starting September 2024. This follows a memorandum of understanding signed in May 2023 and an agreement on the framework's operational guidelines signed in June 2024. The initiative is part of efforts to expand bilateral trade by promoting the use of local currencies in the settlement of trade transactions between Korea and Indonesia, and marks an important milestone in strengthening financial cooperation between the two

countries.

Under the LCT regime, Appointed Cross Currency Dealer (ACCD) banks will help reduce transaction costs for importers and exporters by allowing bilateral current transactions to be settled in local currencies. To this end, a direct exchange rate of KRW/IDR has been provided, and relevant regulations have been revised. This will ultimately facilitate trade between Korea and Indonesia and contribute to increasing transaction efficiency by mitigating currency risk.

In addition, BOK signed an MOU with the BI in July 2024 to promote mobile payment convenience in both countries. The MOU aims to accelerate close cooperation on cross-border payment interoperability and establish a framework to facilitate cross-border payment connectivity between the two countries. The implementation of the MOU will not only promote the digital economy and finance in Indonesia and Korea, but will also benefit the tourism sector given the large number of tourists traveling between the two countries. The MOU reflects the implementation of the 2022 bilateral cooperation agreement between BOK and BI, and is expected to create cheaper, faster, more inclusive, and more transparent cross-border payments between both countries. More importantly, it will play a pivotal role in promoting the digital economy and finance in both countries and is an important step in creating a more efficient financial environment.

(3) Advancing Agora projects

In April 2024, seven central banks, including the BIS and BOK, announced the launch of the Agora Project to explore ways to improve cross-border payment and settlement. They will form a public-private partnership (PPP) with a number of private financial firms that will be recruited through the Institute of International Finance (IIF). The Agora Project explores the possibility of improving the monetary system by use of the tokenized commercial bank deposits and the tokenized wholesale central bank money. In particular, it will examine whether it is possible to solve and activate problems in cross-border payment and settlement such as overseas remittances, beyond the domestic case-centered experiments that each country has conducted so far.

The Agora project is designed based on the Unified Ledger concept proposed by the BIS and verifies that tokenized bank deposits and tokenized institutional central bank currencies can be seamlessly integrated into a programmable financial platform. This will enhance the functionality of the monetary system and provide new solutions utilizing smart contracts and programming while maintaining the existing two-tier central bank-commercial bank structure. Smart contracts can open up new opportunities for businesses and individuals, including new ways of making payments and enabling forms of transactions that are currently impractical or unfeasible.

Current cross-border payments have been criticized for being slow and costly due to the overlap of different legal, regulatory, and technical compliance requirements, time zone differences, and other challenges. In addition, procedures to ensure financial integrity, such as anti-tax evasion and anti-money laundering procedures, add complexity as the same procedures are repeated multiple times for the same transaction, depending on the number of intermediaries. The Agora project is a major public-private partnership (PPP) project that is expected to overcome the structural inefficiencies of the current cross-border payment settlement process.

The BIS has published a notice to survey private financial institutions' willingness to participate, and the role of recruiting and acting as an intermediary for private participants is performed by the Institute of International Finance(IIF). In September 2024, the BIS and the IIF completed the selection of more than 40 private institutions to participate in the Agora project, and the design phase is underway.

3. Initiatives to Enhance Cross-Border Payments

A. G20 Roadmap

Recognizing the need for faster cross-border payment, the fifteenth G20 summit was held in Riyadh, Saudi Arabia, where the leaders of G20 countries committed to enhancing cross-border payments. Following this, the FSB in collaboration with the BIS and other relevant international bodies, developed a roadmap to

fulfill the commitment to promote cross-border payment. For several years, FSB's work revolved around stocktaking the cross-border payment landscape by assessing existing challenges and arrangements, developing 19 building blocks, and establishing a roadmap to address the challenges and frictions. In 2021, the FSB published the quantitative targets to be achieved by 2027, for each market segment namely, wholesale payments, retail payments, and remittances to make the cross-border payment faster, cheaper, and easily accessible.

<Table 4-2>

Target for the Cross-Border Payments Roadmap

Challenges	Market Segment		
	Wholesale	**Retail**	**Remittances**
Cost	No target set due to difficulty of estimating average cost across markets.	Global average cost of payment to be no more than 1%, with no corridors with costs higher than 3% by end 2027.	Global average cost of sending $200 remittance to be no more than 3% by 2030, with no corridors with costs higher than 5%.
Speed	75% of cross-border wholesale payments to be credited within one hour of payment initiation for crediting and reconciliation (or within one hour of the pre-agreed settlement date and time for forward-dated transactions) and for the remainder of the market to be within one business day of payment initiation, by end-2027. Payments to be reconciled by end of the day on which they are credited, by end-2027.	75% of cross-border retail payments to provide availability of funds for the recipient within one hour from the time the payment is initiated. Payment is considered initiated once the payment order is received by the payer's payment service provider and the transaction is considered complete once the recipient receives the fund. For the remainder of the market to be within one business day of payment initiation, by end-2027.	75% of cross-border remittance payments in every corridor to provide availability of funds for the recipient within one hour of payment initiation and for the remainder of the market to be within one business day7, by the end of 2027.
Access	All financial institutions (including financial sector remittance	All end-users (individuals, businesses or banks) to have at least one option	More than 90% of individuals (including those without bank

Challenges	Market Segment		
	Wholesale	Retail	Remittances
	service providers) operating in all payment corridors to have at least one option and, where appropriate, multiple options (i.e. multiple infrastructures or providers available) for sending and receiving cross-border wholesale payments by end-2027.	(i.e. at least one infrastructure or provider available) for sending or receiving cross-border electronic payments by end-2027.	accounts) who wish to send or receive a remittance payment to have access to a means of cross-border electronic remittance payment by end-2027.
Transparency	All payment service providers are to disclose information regarding total transaction cost (sending and receiving fees including those of any intermediaries, FX rate and currency conversion charges), expected time to deliver funds, tracking of payment status, and terms of service.) the payers and payees, by end-2027.		

Note: Reprinted from Targets for Addressing the Four Challenges of Cross-Border Payments: Final Report by Financial Stability Board, 2021 (https://www.fsb.org/wp-content/uploads/P131021-2.pdf). Copyright 2021 by Financial Stability Board.
Source: FSB (2021)

The FSB has emphasized three priority themes. The first is to improve payment system interoperability and speed of transactions while reducing costs. The second priority is to establish a supportive environment for a comprehensive legal, regulatory, and supervisory framework to minimize issues caused by inconsistent rules and regulations. The third priority is to enhance cross-border data exchange and standardize messaging formats. To reach roadmap targets, the IMF and World Bank have been providing technical assistance for accessing payment systems, extending operating hours, integrating payment systems, applying AML/CFT rules, and harmonizing ISO 20022 standards[77].

77) IMF and World Bank (2023)

B. Swift GPI and Swift Go

One of the remarkable revolutions in the cross-border payment environment is Swift Global Payments Innovation (GPI) introduced in 2017. The Swift GPI has enabled businesses to track their payment status from start to end in real-time. The Swift GPI has expedited faster payments across the globe, with nearly 50% of GPI payments received by beneficiaries within 30 minutes, 40% in under 5 minutes, and almost 100% within 24 hours. It also provides beneficiaries access to banks or parties involved in the transaction and processing fees, exchange rate costs, and processing times. (Swift, n.d.) While Swift GPI supports high-value payments, Swift Go launched in 2021, is another facility serving small and medium-sized businesses and individuals to make their low-value payments faster and with competitive fees.

C. ISO 20022

Another breakthrough is the development of the ISO 20022, an international standard for exchanging electronic messages. The new standard of exchanging data messages allows messages to be detailed with extensive information and context, structured as well as granular thereby fostering interoperability across different financial systems and removing data truncation. Many countries across the globe have migrated to the new standard, like India, China, Japan and Bangladesh while many countries are in the process of adopting the ISO 20022.

D. Fast Payments Systems (FPS)

FPS have increasingly become popular due to their real-time availability of funds to the beneficiary, and processing of payments 24 hours a day, 7 days a week, and 365 days a year (24/7/365). According to the World Bank data, around 70 countries worldwide have adopted fast payment systems. Many countries have successfully integrated their national payment systems, capitalizing on convenience, speed, and cost-effectiveness. The Southeast Asian countries have spearheaded this movement. PromptPay and PayNow linkage of Thailand

and Singapore respectively was integrated in 2021, allowing users to make real-time low-value payments of up to SGD 1,000/THB 25,000 daily. In 2023, the Monetary Authority of Singapore and the Reserve Bank of India, interlinked Singapore's PayNow and India's UPI, to transfer money in real time via QR code or mobile number. In addition, Singapore has connected its instant payment system with Malaysia and Indonesia.

E. Project Nexus

The BIS Innovation Hub has recently delivered the blueprint for Project Nexus, a multilateral payment scheme that will connect the instant payment system (IPS) of several countries through a single hub. Central banks of Singapore, Malaysia, Thailand, the Philipines, and India have signed the agreement for Project Nexus and currently working towards jointly connecting their domestic IPS through Nexus. The project will allow countries to connect to the fast payment system of all other countries in the network, rather than establishing individual connections with each country[78]. We can see a similar multilateral payment system already in place in Europe, TIPS (Target Instant Payment Settlement), launched in 2018, which settles payment in multi-currency Euro and Swedish Krona, and facilitates money transfer across Europe with just mobile numbers[79].

4. Cross-Border Payments: Recent and Emerging advances from Global Perspective

A. India

In India, NPCI International Payments Limited (NIPL) was incorporated on April 2020, as a wholly owned subsidiary of the National Payments Corporation of India (NPCI). NPCI, an umbrella organization for operating retail payments and settlement systems in India, is an initiative of the Reserve Bank of India (RBI) and the Indian Banks' Association (IBA) under the provisions of the

78) BIS Innovation Hub (2023).
79) European Central Bank (2024)

Payment and Settlement Systems Act (2007), for creating a robust payment and settlement infrastructure in India. NIPL is devoted to the deployment of NPCI's indigenous, successful Real-Time Payment System – Unified Payments Interface (UPI) and Card Payment Network – RuPay, outside of India. India's UPI linkages with other countries are:

- UPI and Singapore Paynow linkages to enable faster remittances between two countries
- NIPL and the Royal Monetary Authority (RMA) of Bhutan have partnered to allow UPI QR-based payments through the BHIM App in Bhutan
- NIPL and the Central Bank of Oman have agreed to link UPI to its payment system
- NIPL's Bhim UPI was made live at NEOPAY terminals, the payment subsidiary of Mashreq Bank across the UAE
- NIPL signed a deal with Liquid Group, which is the cross-border digital payments provider, to enable QR-based UPI payments' acceptance in 10 countries including Malaysia, Thailand, Philippines, Vietnam, Singapore, Cambodia, Hong Kong, Taiwan, South Korea, and Japan.

<Table 4-3>

Cross-Border Digital Payment Initiatives of NIPL, India

	Countries	Partner Entities	Details
1	UAE	NEOPAY the payment subsidiary of Mashreq Bank	UPI
2	UAE	Mercury Payments Services	RuPay
3	Singapore	Network for Electronic Transfers (NETS)	UPI (P2M) and RuPay
4	Singapore	Banking Computer Services Pte Ltd.	UPI-PayNow (P2P)
5	Nepal	Nepal SBI Bank Ltd.	RuPay card in ATMs and payments in Nepalese POS
6	Nepal	Himalayan Bank Limited	RuPay card payments in Nepalese POS
7	Nepal	Fonepay Payment Service Limited	UPI (P2M) payment at Nepalese QR merchants
8	Bhutan	Royal Monetary Authority of Bhutan	RuPay cards and UPI

	Countries	Partner Entities	Details
9	France	e-Commerce	P2M with UPI at Eiffel Tower
10	Mauritius	Instant Payment System (IPS) app of Mauritius	UPI and IPS integration for P2M
11	Mauritius	MauCAS card, Mauritius	RuPay cards in ATM and POS in Mauritius and India
12	Sri Lanka	LankaQR, Sri Lanka	Indian travellers to Sri Lanka to make QR payments with UPI.

Source: NRB

B. China

Alibaba and Tencent are the fintech giants in China that have had a major impact in the shift away from cash through the introduction of mobile payment platforms, AliPay and WeChat Pay. For cross-border payments, they have enabled overseas users to link international cards and thus make payments from those apps. Similarly, the institutions have entered into agreements with many international acquirers enabling the Chinese tourists travelling abroad to make payments using their apps.

C. Sri Lanka

As the national payment network that functions under the guidance and supervision of the Central Bank of Sri Lanka (CBSL), LankaPay is regarded as one of the best PPP in the region. The entity is owned by the CBSL along with other licensed public and private commercial banks operating in the island nation. For cross-border transactions, it has integrated its EFT switch with an international clearing house (like India's NPCI for integrating with UPI) and network aggregator (eg. Alipay+).

D. Bangladesh

In Bangladesh, digital remittances, especially through mobile wallets, offer

excellent coverage, efficiently reaching customers across the country. The proportion of BRAC Bank remittance transactions that were received digitally, in either a bank account or mobile wallet, increased from 37 percent in 2019 to 75 percent in 2020[80]. The domestic e-Wallets in Bangladesh have partnered global payments networks such as TerraPay, to allow real-time cross-border money transfers for receiving remittances in the domestic e-Wallets.

E. Malaysia

Payments Network Malaysia Sdn Bhd (PayNet) in Malaysia is the national payments network. Bank Negara Malaysia (BNM) is PayNet's largest shareholder, with eleven Malaysian financial institutions as joint shareholders. PayNet has enabled cross-border payments such that Malaysian can use mobile banking app or e-Wallets to scan and pay in Indonesia (QRIS), Singapore (NETS), Thailand (PromptPay) and China (Alipay and Alipay+). Similarly, these country's mobile banking and e-Wallet can scan DuitNow QR in Malaysia for scan and pay. Similarly, they can also transfer funds to a recipient in other countries instantly by using mobile or national identification numbers[81].

The global practices on cross-border digital payments reveal that in most countries initiatives for enabling cross-border payments have been taken from the Government or the Central Bank itself. In addition, the national payment infrastructures of the countries are being integrated with the similar infrastructure of the foreign counterparts to make such cross-border payments possible.

5. Cross-Border Payments Case Study of Nepal and Korea

A. Nepal

(1) Background

The NRB has been empowered under the Nepal Rastra Bank Act "to develop

80) https://migrantmoney.uncdf.org/resources/insights/shifting-from-cash-to-digital-remittances-during-the-pandemic-a-case -study-of-brac-bank-in-bangladesh/#references.

81) Bank Negara Malaysia (2022)

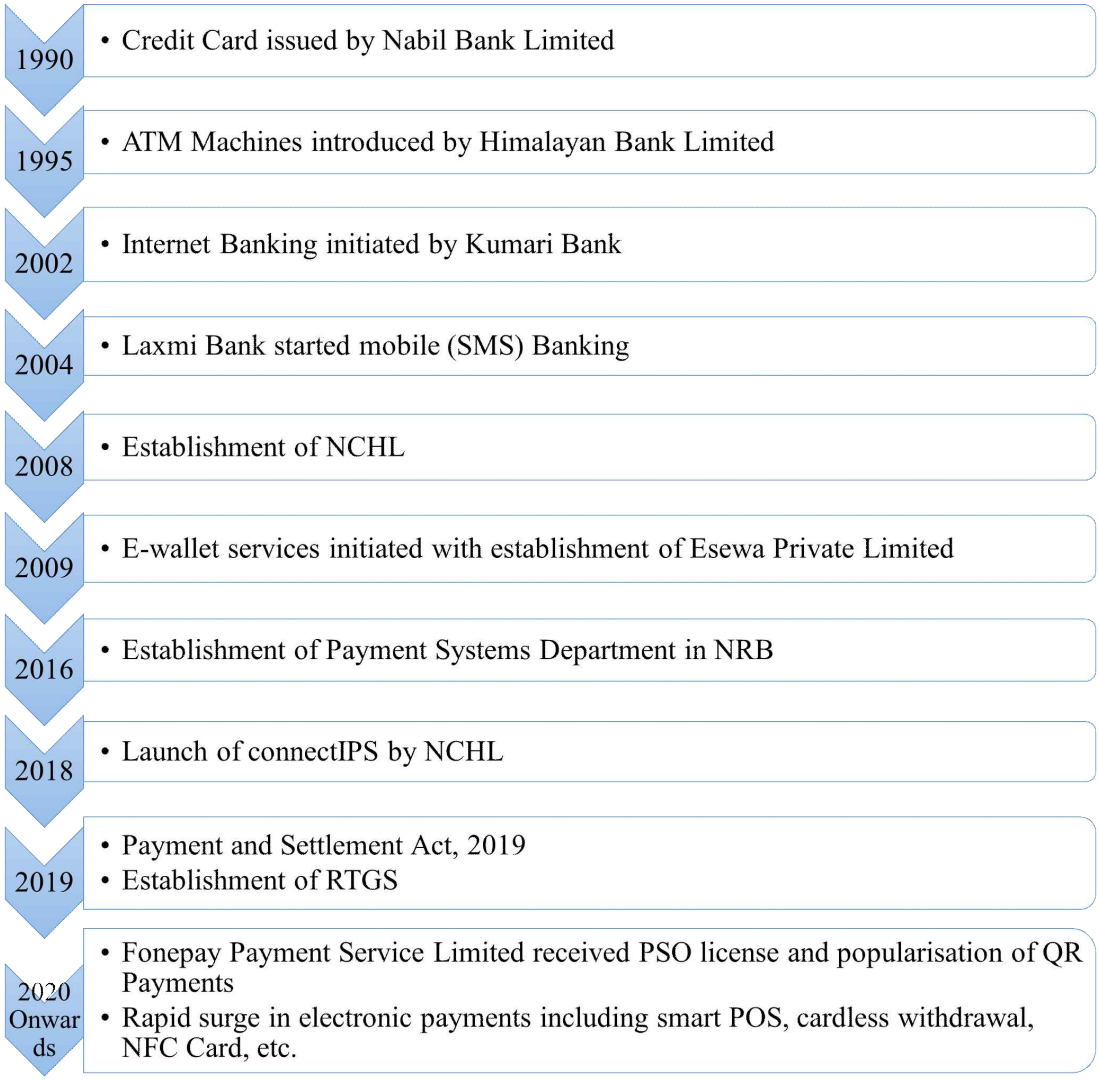
a secure, healthy and efficient system of payments" in Nepal. NRB has been discharging its responsibilities for the modernization of payment systems in Nepal through its policy decisions including the NRB Strategic Plan, National Payment System Development Strategy (NPSDS)[82], monetary policies, and other various policies/directives. NRB's first strategic plan (2006-2010) prioritized building infrastructure for automated clearing which led to the establishment of Nepal Clearing House Limited (NCHL) in 2008. To further strengthen Nepal's payment system, the Nepal Payment System Development Strategy (NPSDS) was formulated in 2014 and followed by the establishment of a dedicated Payment System Department (PSD) in July 2015. Pillar VII of NPSDS has envisioned having international remittances and other cross-border payments distributed rapidly and conveniently in Nepal, and cost-efficient from the perspective of end users. The government's Digital Nepal Framework (DNF) launched in 2019 further supports digital initiatives. It has identified eight key sectors: agriculture, health, education, energy, tourism, finance, urban infrastructure, and digital foundation. Before the establishment of NRB in 1956, Indian rupees were widely used alongside Nepali rupees. NRB expanded its reach across Nepal, successfully phasing out circulation of Indian currency from September 1966 onwards.

This growing trust in the Nepali Rupee laid the groundwork for the modern payment system. While cash and coins were the major medium of payments in Nepal and with the establishment of the Clearing House in 1968, interbank cheque payments were initiated. With advancements in technology, banks and financial institutions introduced card payments, internet banking, and SMS banking in the 1990s and 2000s, gradually shifting the country from cash to less-cash transactions. The evolution of the digital payment system in Nepal is presented below in Figure 4-2.

82) https://www.nrb.org.np/contents/uploads/2019/12/Nepal_National_Payment_System_Development_Strategy.pdf

<Figure 4-2>

Evolution of Digital Payment System in Nepal



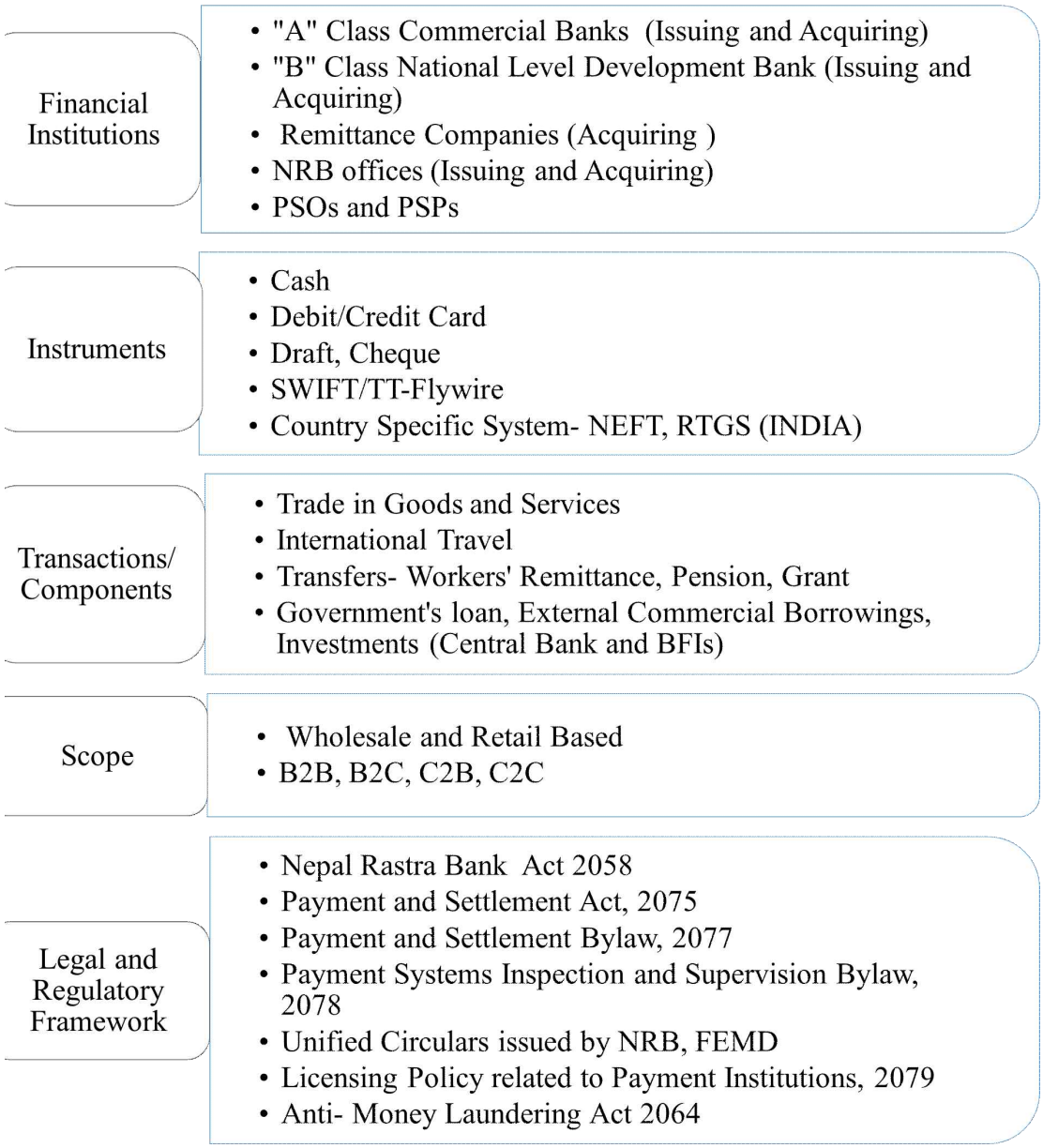
Source: NRB

(2) Eco-system of Cross-Border Payments

The existing eco-system cross-border payments in Nepal include financial institutions, instruments, transactions and their types, and legal and regulatory environment.

<Figure 4-3>

Cross-border Payments Financial Institutions, Instruments, Transactions, and Legal and Regulatory Framework



Source: NRB

(a) Financial Institutions

The institutions involved in cross-border payments comprise “A” class commercial banks, “B” class development banks, "C" class finance companies,

money transfer operators, payment service providers, payment system operators and offices of NRB. Commercial banks and national-level development banks are engaged in both acquiring and issuing activities relating to cross-border transactions whilst other development banks, finance companies, money transfer operators, and payment service providers are approved for acquiring only. Payment system operators can integrate with international systems for issuing and acquiring instruments issued outside Nepal.

(b) Cross-Border Payment Instruments

The existing payment rail for cross-border transactions of Nepal includes cash, card networks, draft, SWIFT, quick response code, and country-specific network like National Electronic Fund Transfer (NEFT) and Real Time Gross Settlement (RTGS) with India.

(c) Card Networks

The presence of global card networks including Visa, MasterCard and Union Pay International enables both inward and outward transfer in Nepal. The inward transactions can be done through other networks as well such as Diners/Discover, American Express, JCB, AMEX, Wechat and Alipay. For outbound card transactions, the debit and credit card issued against the NPR savings account is acceptable in India and Bhutan with settlement in NPR/INR. However, for other countries, a special purpose USD or convertible FCY-based card is issued and the limit is defined as per the regulation of NRB.

(d) Draft

Traditionally, the draft was the key instrument of cross-border transactions involving travel and trade. Though its usage has declined over the years, it is still used in import payments and occasionally for international travel.

(e) SWIFT/Correspondent Bank

SWIFT is a global messaging system whereby payment instructions or orders between bank accounts are communicated using a secure network. In correspondent banking, the commercial banks of Nepal tie up with foreign banks for the transfer of funds. SWIFT is the most used cross-border payment platform in Nepal.

(f) Country-Specific network

Nepal has collaborated with India for cross-border transactions through India's National Electronic Fund Transfer (NEFT). Under this platform, the key facility used is the "Indo Nepal Remittance Scheme" which was launched in May 2008 by RBI in collaboration with NRB to facilitate the transfer of funds from India to Nepal (one way only) by Nepali migrant workers. Further, this scheme was extended to trade payments and pensions in August 2021. Under this scheme, remittances are sent from India to Nepal by the sender through any of the NEFT-enabled branches in India. Beneficiaries in Nepal can get remittance in their accounts in Nepal SBI bank, other banks, or cash through Prabhu Money Transfer (a licensed remittance company by NRB). Besides this scheme, some banks use the RTGS system for cross-border transactions and payments between Nepal and India.

(3) Cross-Border Digital Payments Initiatives of Nepal

Some of the major cross-border digital payment initiatives involving Nepalese licensed payment institutions are as follows:

- Everest Bank Limited has received approval from NRB to integrate its ATM Switch with the National Financial Switch for NPCI Rupay Card Acquiring on December 4, 2019.
- NMB Bank Limited has received approval from NRB to act as an acquirer and settlement bank of WeChat Pay in Nepal on December 10, 2019.
- Himalayan Bank Limited has received approval from NRB to act as an acquirer of Ali Pay in Nepal on December 27, 2019.

- Fonepay Payment Service Limited has received approval from NRB to Integrate WeChat Pay and NPCI International Payment Limited into its system for acquiring transactions on October 22, 2020.
- Gateway Payment Service Limited has received approval from NRB to perform acquiring transactions by integrating with NPCI International Payment Limited on December 31, 2021.
- Nepal SBI Bank Limited has received approval from NRB for Rupay Card Acquiring by integrating with NPCI on March 30, 2022.
- As per the decision of the 17th meeting of the National Payment Board on April 23, 2023, PSD was directed to coordinate and facilitate NCHL to integrate with NPCI for Digital Retail Payments including QR payments. NCHL signed a MOU with NPCI International Payments Limited on May 26, 2023.
- Fonepay Payment Service Limited has been approved by NRB's letter dated February 11, 2024, to acquire merchant payments through a quick response code in collaboration with NIPL of India. This service has gone live since February 28, 2024.
- NRB signed an agreement with the RBI for the integration of NPCI's Unified Payments Interface (UPI) with the National Payment Interface (NPI) on February 15, 2024.

(4) Existing Provisions on Cross-Border Payments

- Payment and Settlement Act (2018) and Payment and Settlement Bylaws (2020) have the provisions of approving/licensing payment system related entities viz., PSO and PSP, and approval for addition or deletion of payment instruments as specified in clause 14(2) of the Act. The payment instruments listed in Section 31 of the Payment and Settlement Act (2018) specifies cash, cheques, SWIFT, internet banking, mobile banking, cards, etc.
- Licensed PSO has been required paid up capital of NPR 800 million to engage in instruments issued in Nepal to be used for payment transactions abroad as specified in Section 9 of Licensing Policy Related

to Payment Institutions (2022). Section 9 of the Licensing Policy has a provision for PSOs to engage in cross-border transactions.

- NRB's notice in 2020 has made provision for acquiring of remittances inward digitally, in compliance with NRB Remittance Bylaws, which requires to have remittance business license and approval of each foreign counterparty, involved in sending remittances into Nepal. Moreover, NRB circular in 2023 also allows the inflow of funds into Nepal through commercial banks and national-level development banks.
- As per Unified Circular 2023 of NRB has allowed cross-border acquiring transactions through electronic instruments as stated in Circular No. 5, cross-border issuing/payment transactions through banking instruments other than cash, cards, etc. as stated in Circular No. 7, cross-border issuing/payment transactions through banking/payment instruments as stated in Circular No. 8 and Circular No. 10, cross-border acquisition and payments through banking/payment instruments as stated in Circular No. 17, cross-border payments through banking instruments as stated in Circular No. 20, cross-border inward remittances through digital mediums as stated in Bylaw No. 38 of NRB Remittance Bylaws of 2022, remittance inflows into Nepal through digital mediums as stated in NRB notice in 2020, and NRB has provisions for several payment instruments viz., cash, draft/TT, SWIFT, electronic cards etc. for cross-border acquisition and payment transactions.
- There has not been any limit on wholesale cross-border payments as such. However, there exists a limit on retail cross-border payments, depending on the purpose of the transaction, currency of the transaction, instrument being used, nature of the transaction (issuing or acquiring), etc.

B. Korea

(1) Background

As discussed earlier, Korea's cross-border payment channels are the CLS

system and correspondent banking system. In the case of retail payment channels, in addition to the correspondent banking system, there are remittance networks operated by remittance companies and a cross-border shared network which interconnects banking shared networks of neighboring countries[83].

(2) Cross-Border Shared network[84]

The cross-border shared network is a system that enables payments between countries by interlinking the payments network of each country. As of 2023, it is linked to six countries including Malaysia, the Philippines, Vietnam, Thailand, Indonesia, and the United States. It provides ATM services between countries that can withdraw local currency from overseas ATMs and remittance services between countries that can make cross-border remittances in real time.

In addition, the cross-border shared network is promoting the expansion of target countries and providing new services in connection with the Asian Payment Network (APN) common hub from 2018[85].

Overseas cash withdrawal through the ATM service of the cross-border shared network can reduce the international brand fees (1% of the transaction amount) paid to global card companies such as VISA and MasterCard. Overseas remittances using the cross-border remittance services between countries can also cut down fees such as SWIFT fees, and at the same time, the recipient's account information can be checked in real time before the remittance instructions, thereby preventing erroneous remittances.

(a) Cross-border ATM services

Cross-border ATM services interlink ATM networks in each country, allowing

83) In addition, global credit card networks such as VISA, MasterCard, AMEX, UnionPay, and JCB, which are partnership with domestic credit card companies and financial institutions, also support retaill payments among countries.

84) This part mainly referred the KFTC (2022).

85) APN is a private consultative group founded in 2006 by six ATM operators in four ASEAN countries. Currently, 13 institutions from 12 countries participate in APN. The main goal of the network pursued in its inception was interconnecting and standardizing the ATM/POS networks of member institutions. Currently, it organizes discussions and joint projects regarding the provision of regional cross-border payment services and the technological standardization..

customers who hold their cards to withdraw local currencies or to inquire account balances from overseas ATMs that are connected to their accounts.

In the 2000s, the need for local currency withdrawal due to increased visitor exchanges between countries and the rise in foreign residence population, but at the time, most domestic cash cards were useless overseas, so domestic customers had to pay high fees to global card companies for overseas local currency withdrawal services.

Cross-border ATM services between countries can be divided into initiation transactions in which Korean customers withdraw local currency at overseas ATMs and entrusted transactions that foreign customers can withdraw KRW from ATMs in Korea. In fact, initiation transactions recently account for more than 90% of overall cross-border ATM services.

(b) Cross-border remittance services

Cross-border remittance is low-cost real time overseas money transfer services harnessing the networks established among foreign institutions to provide cross-border ATM services. In the 2010s, increases in cross-border remittances created demands for higher efficiency in the conventional remittance services. Furthermore, the size of remittances made by expatriates working in Korea constantly increased. This raised issues of reducing remittance fees for migrant workers from low income countries, resulting in the resolution of G20 in 2011 to limit low-value remittance fees not more than 5% of transaction. The transaction and settlement currency for bilateral cross-border remittances is the USD. Participants in Korea conduct net settlements in USD with the settlement banks, and the recipient bank and sender bank convert USD received from Korea into local currencies to deposit them. The service has gone live with NAPAS (National Payment Corporation of Vietnam), Vietnam's electronic payment service provider in 2014 and with Thailand's ITMX (National Interbank Transaction Management and Exchange Company) in 2020[86].

As of 2022, 11 banks and financial investment companies are providing the

86) NAPAS was licensed in 2004 by the State Bank of Vietnam for providing financial switching and electronic payment services. The institution is linked with 1,700 ATMs, 270,000 POS terminals, and 46 commercial banks in and out of Vietnam.

service[87].

(3) Korea-Indonesia Cross-Border Payment Project

This project aims to support Korean (Indonesian) consumers to make mobile-based QR easy payments without global cards such as Visa or MasterCard at Indonesian (Korean) merchant stores. To achieve this, consumers and sellers must go beyond simply recognizing QR codes (Stage 1 standardization) and exchange purchase and payment information with the payment service provider of the consumer as well as seller through a switching institution and perform payment and settlement.

In the case of overseas usage transactions (outbound), it is necessary to select a domestic switching agent and payment service provider that will be interlinked to enable Korean consumers to process payments at Indonesian merchant stores using domestic easy payment apps. On the other hand, in the case of domestic receipt transactions (inbound), it is necessary to select a Korean KR QR that Indonesian consumers can recognize via their own pay app and that is compatible with their own QR (QRIS).

As a preliminary work, BOK conducted a survey of ASEAN tourists in April 2024 and confirmed the high demand for QR-based easy payment services linkage between the two countries[88]. In addition, interviews with domestic easy payment service providers such as BC Card, Kakao Pay, and GLN that have been conducting easy payment service business with ASEAN countries confirmed that almost all domestic companies wish to participate in QR-based easy payment service linkage with Indonesia.

Figure 4-4 illustrates the QR-based easy payment linkage model with Indonesia.

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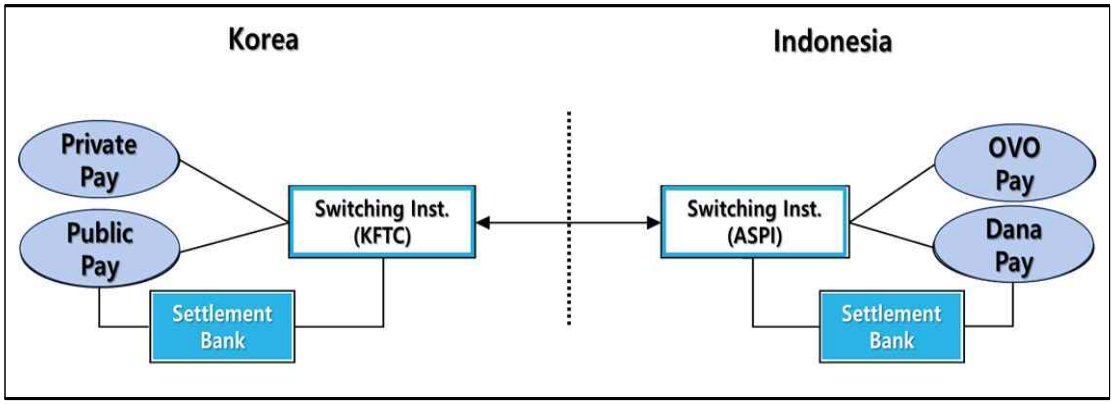
87) Up until now, only outbound remittances from Korea to Vietnam or Thailand are available. The remittance limit per transaction is set to USD 5,000. The remittance fee is KRW 30,000-36,000 for a USD 3,000 remittance to Vietnam, which is significantly lower than the fees for SWIFT (KRW 46,000) and specialized remittance companies (KRW 84,000).

88) A survey on demand for QR-based linkage services (survey on payment method usage behavior of ASEAN visitors) was conducted on a total of 180 tourists visiting Korea from five ASEAN countries (60 from Indonesia, 30 from Vietnam, 30 from Thailand, 30 from Singapore, and 30 from the Philippines).

<Figure 4-4>

Korea-Indonesia QR-based Easy Payment Linkage Model



Source: BOK

Meanwhile, the basic directions for successfully promoting QR simple payment linkage with Indonesia are as follows:

- Based on mutual reciprocity: Improve payment convenience for Korean and Indonesian citizens visiting each other.
- Central bank leads the project: The central banks of both countries will lead the discussion on principles and methodologies for QR easy payment linkage, but the review of technical conditions, business profitability, etc. will be entrusted to the private sector later.
- Settlement in the domestic currency of both countries as much as possible: The government and central bank are currently discussing the matter, and major banks have expressed their intention to participate in the relevant settlement business.
- Establishment of a payment channel cheaper than global card companies: In the process of linking QR within Indonesia, the fee is around 2.0%, which is about 1.0% point cheaper than global card networks such as Visa and MasterCard which are approximately 3.0%.
- Promote participation of as many merchants and consumers as possible: Consider the expandability of the merchant scale so that payment convenience can be improved for many customers of both countries.
- Prefer MPM (merchant presented mode) where the seller presents the QR: Apply QR easy payment linkage method with Malaysia, Thailand, and Singapore.

<Box 4-1>

ASEAN+3 Cross-Border Payment Linkages

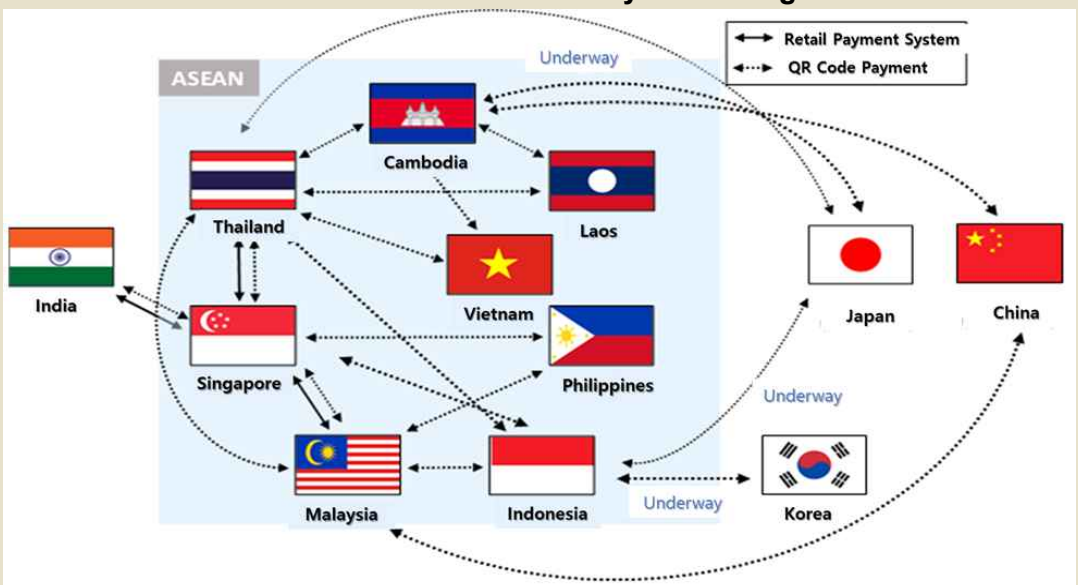
Based on the advantage of low installation costs, the proportion of ASEAN customers using QR code-based mobile easy payment services is reaching 60%, indicating that QR code mobile easy payment services are being utilized as a means of digital financial inclusion within ASEAN+3.

ASEAN+3 has established the ASEAN Payment Connectivity project to strengthen economic and financial cooperation within the region, and is actively promoting the linkage of bilateral QR-based mobile easy payment and instant funds transfer systems, and is also seeking connections with Japan and China.

To this end, the main goal was to reduce dependence on global card networks such as VISA and MasterCard for cross-border payments and to build an indigenous payment network within the region. Among the key goals, the settlement between ASEAN currencies can be said to be the key. Currently, Indonesia settles in USD for QR linkage with Singapore, but settles in its own currency for QR linkage with Malaysia and Thailand.

<Figure 4-5>

ASEAN+3 Cross-Border Payment linkages



Source: BOK

(4) Private Sector Cross-Border Easy Payment

Exchanges with ASEAN countries are increasing, with the number of mutual visitors between ASEAN+3 and Korea reaching 10 million. Accordingly, Korean payment service providers are actively pursuing QR-based mobile easy payment partnerships with ASEAN+3 countries such as Thailand, the Philippines, Malaysia, Singapore, Vietnam, Japan, and China so that visitors can utilize easy payment at a lower cost than global card networks. To this end, Korean payment service providers are making the most of three major strategies: direct recruitment of merchants, 1:1 direct partnerships with overseas service providers, and partnerships through separate intermediary platform operators.

(a) Direct recruitment of merchants

It is used when a Korean payment service provider already has a large number of users and the overseas counterparty's single sales volume is large. For example, Lotte Duty Free shop in Korea supports the use of Alipay (China), Wechat Pay (China), and PayPal (USA) for the convenience of overseas tourists.

(b) 1:1 direct partnerships with overseas service providers

This is a strategy in which a Korean payment service provider with a large number of users partners with a large number of small overseas merchants. This is because it is more efficient than directly securing overseas merchants by partnering with a simple payment service provider in the other country that already has a large number of merchants. Examples include the partnerships between ‘Kakao Pay (Korea) – PayPay (Japan)’ and ‘Naver Pay (Korea) – Line Pay (Japan). Meanwhile, in this process, domestic companies are aggressively pursuing overseas expansion, such as acquiring overseas local companies or conducting joint investments, as in the case of ‘BC Card (Korea)-Paynet (Malaysia).’

(c) Partnerships through separate intermediary platform operators.

When Korean payment service providers try to secure multiple merchants in multiple countries at the same time, the network effect of the platform can increase the number of affiliated service providers, which is the most preferred strategy. Representative examples include Alipay+ (China), GLN (Korea), and Netstars (Japan). The Alipay+ platform provides QR payment services to Korean tourists visiting ASEAN through affiliated merchants of ASEAN payment service providers participating in the platform in partnership with Kakao Pay in Korea. Conversely, it also provides QR payment services in Korea to ASEAN tourists visiting Korea through partnerships with Dana (Indonesia) and g-cash (Philippines). The GLN (Korea) platform has also partnered with local ASEAN payment service providers to enable Korean tourists visiting ASEAN countries such as Thailand, Singapore, and Vietnam to make QR-based payments locally, or is currently in the process of doing so.

6. Policy Implications

While enabling cross-border payments opens doors to global opportunities, they also come with inherent risks. Some key issues/risks to be considered for cross-border payments include: AML/CFT, compliance, settlement, reconciliation, dispute resolution, interoperability, cyber security, data privacy, fraud and fraudulent, foreign exchange, misuse of foreign exchanges, adverse impact on country's balance of payments etc.

A careful approach to risk mitigation is essential to ensure the secure and sustainable adoption of the technology, capacity enhancement, and cross-border coordination. With growing dependency among economies throughout the globe, there is increased demand for international payment services. Enabling digital payment channels can improve the speed, cost as well as transparency of cross-border transactions. It promotes faster and more cost-effective payment processing. This benefits businesses and consumers by reducing transaction costs and friction. It can also help to promote financial inclusion by expanding financial services to previously unbanked populations, especially in rural areas where remittances are a major source of income. A streamlined cross-border payments system can increase Nepal's attractiveness to foreign investors and

businesses, leading to economic growth opportunities. In addition, the need to facilitate cross-border transactions could be a driving factor towards innovation and the introduction of new technologies.

Since remittances from Nepalese workers overseas are a major source of foreign exchange for Nepal, the development of cross-border payments can improve the speed and costs associated with it. An efficient cross-border payment system also increases transparency and promotes formal channels for conducting transactions. It can further assist Nepal bound tourists to have better payment experiences and is also expected to increase their spending and stay in Nepal. However, it is important to implement appropriate policy measures to minimize the risks associated with excessive outflows and capital flight to avoid potential pressures on foreign exchange reserves.

Cross-border transactions pose a significant potential for Nepal to update its payment infrastructure and drive economic progress. By tackling challenges and tactically enacting policies, Nepal has the potential to cultivate a flourishing and accessible financial environment.

To sum up, in order to successfully implement the cross-border payment system linkage with countries that have economic and financial cooperation relations with Nepal, the following points should be noted from a strategic perspective:

- Based on a survey of the needs of end-users and stakeholders such as PSOs and PSPs in both countries.
- Prioritize countries with deep exchanges in terms of personnel and trade.
- Improve domestic systems with a linkage method that ensures interoperability.
- Public sectors such as central bank play a leading role.
- Focus on meeting domestic conditions related to the four targets (Table 4-2) set by the FSB.

In addition, it is considered important to secure domestic laws, payment system operation rules, messaging standardization, and system technical capabilities to meet the prerequisites for multilateral cross-border payments linkage in the form of hub and spoke, such as Project Nexus.

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Contents	Authors
Ⅰ. Introduction	Kang Kyeong-Hoon
Ⅱ. Electronic Fund Transfers: Large Value Payments and Retail Payments	Jeon Kyungjin NRB
Ⅲ. Risk Based Regulation and Supervision for Payment Activities of PSPs and PSOs	Hyun Junghwan, NRB
Ⅳ. Cross Border Payments: Its Modality and Procedure	Lee Sangki, Jeon Kyungjin NRB