

Investigation Report (Summary)

June 15, 2021

System Failure Special Investigative Committee

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Revised on July 5, 2021:

Some of the expressions have been revised in line with the announcement of “Preventing further incidents of IT system failures” on June 15, 2021.

I Outline of the Investigation

1 Establishment of the Committee

From February 28, 2021 to March 12, 2021, a total of four IT system failures (collectively, the “System Failures”) occurred in Mizuho’s core banking system, MINORI (“MINORI”) at Mizuho Bank, Ltd. (“MHBK”), which is a subsidiary of Mizuho Financial Group, Inc. (“MHFG”), and as a result, customers were greatly impacted such as many ATMs becoming out of order, and customers' bankbooks/cards remaining inside the ATM and not being returned to the customers for a long period of time. In view of the seriousness of the situation, MHFG established an independent investigative committee composed of outside experts and professionals who have no vested interest in MHFG and MHBK, and Committee members were appointed by March 22. MHFG resolved to accept the Committee’s investigation into the cause of the System Failures and its evaluation of the appropriateness of and recommendations on the measures to prevent further incidents that MHFG and MHBK had formulated from the Committee’s neutral and fair perspective.

The Committee is composed of Chairman Shuji Iwamura (attorney-at-law, T&K Partners, former Superintending Prosecutor of the Nagoya High Public Prosecutors Office), Committee Member Keiko Unotoro (Toyo Gakuen University and former Director General of the Economic Affairs Bureau of the Japan Fair Trade Commission), and Committee Member Seiji Nishikawa (former Executive Vice President CIO and Managing Director of Information Systems Department of NTT Docomo, Inc.) and Committee Member Naoki Kadotani (attorney-at-law, T&K Partners). In addition, 10 lawyers from T&K Partners, 13 lawyers from Nagashima Ohno & Tsunematsu, Docomo Systems, Inc., Accenture Japan Ltd. and KPMG FAS Co., Ltd. participated in the investigation as the research assistants of the Committee.

2 Method of Investigation

The Committee took the following measures: (1) detailed examination of related materials, (2) interviews (subjects: 116 related executive officers and employees, 282 times in total) and field surveys, (3) digital forensic investigation (subjects: 44 involved executive officers and employees, emails examined: 14,166), (4) questionnaire survey (subjects: 557 involved executive officers and employees), and (5) establishment of a hotline and responding to reports made to the hotline (including MHRT and MIDS (defined below) in addition to MHFG and MHBK; 39 reports were obtained through the hotline). In addition, the Committee conducted other investigations that it deemed necessary, and held a total of 12 committee meetings.

II Outline of IT System, MINORI

MINORI is the core banking system at MHBK and Mizuho Trust & Banking Co., Ltd., and was developed in July 2019 to realize complete unification of the banking systems in response to a large-scale system failure that occurred in 2011. The migration from the previous system has been completed.

Regarding MINORI, MHBK delegated system development and maintenance to Mizuho Research & Technologies, Ltd. (“MHRT”), a wholly owned subsidiary of MHFG, which is in charge of system development, and delegated the system operation, including monitoring, to MI Digital Services Co., Ltd. (“MIDS”) which is an affiliated company.

III Outline and Cause of the System Failures

After understanding the facts about the occurrence of the System Failures and the situation after the each of the four failures that occurred, the Committee analyzed various causes by generally dividing into the categories of (1) “occurrence of system failure” and (2) “delay in system recovery after occurrence / increase in customer impact.” The Committee conducted its analysis from the perspective of underlying organizational factors and corporate culture in consideration of cause analysis related to large-scale system failures that have occurred in the past in addition to “IT system mechanism factors,” “human factors affecting system operations,” and “business management factors.” The outline is as follows:

1 System Failure on February 28, 2021

(1) Outline of the Facts

A. Situation behind the Occurrence of the System Failure

This was the first of a series of failures, and due to a system failure that occurred in MINORI, there was significant impact on customers including many incidents occurring in which bankbooks/cards became stuck in MHBK’s ATMs when the customer tried to conduct transactions and the bankbooks/cards were not returned, and most of the ATMs were shut down at the same time.

The origin of this was the e-Account batch switching process for the changeover to Mizuho e-Accounts (MHBK started offering Mizuho e-Accounts that do not issue bankbooks in January 2021 and the batch processing by the system was to switch existing accounts that meet certain requirements to Mizuho e-Accounts). MHBK outsourced this work to MHRT and it was implemented on the last Sunday of the month (February 28, 2021). The mechanism of this system failure is as follows.

First, during the operations for thee-Account batch switching process that started at 8:24 am on the same day, (1) at 9:50 am, update processing such as to the revocation information management table (when conducting update processing such as deposits, account closure, bankbook entries, etc., the table stores transaction information necessary for actions such as after-the-fact revocation of completed transactions) exceeded the capacity of the index file (a file that contains information (index)

used for purposes such as speeding up database searches) of MINORI's time deposit system and utilization became 100%.

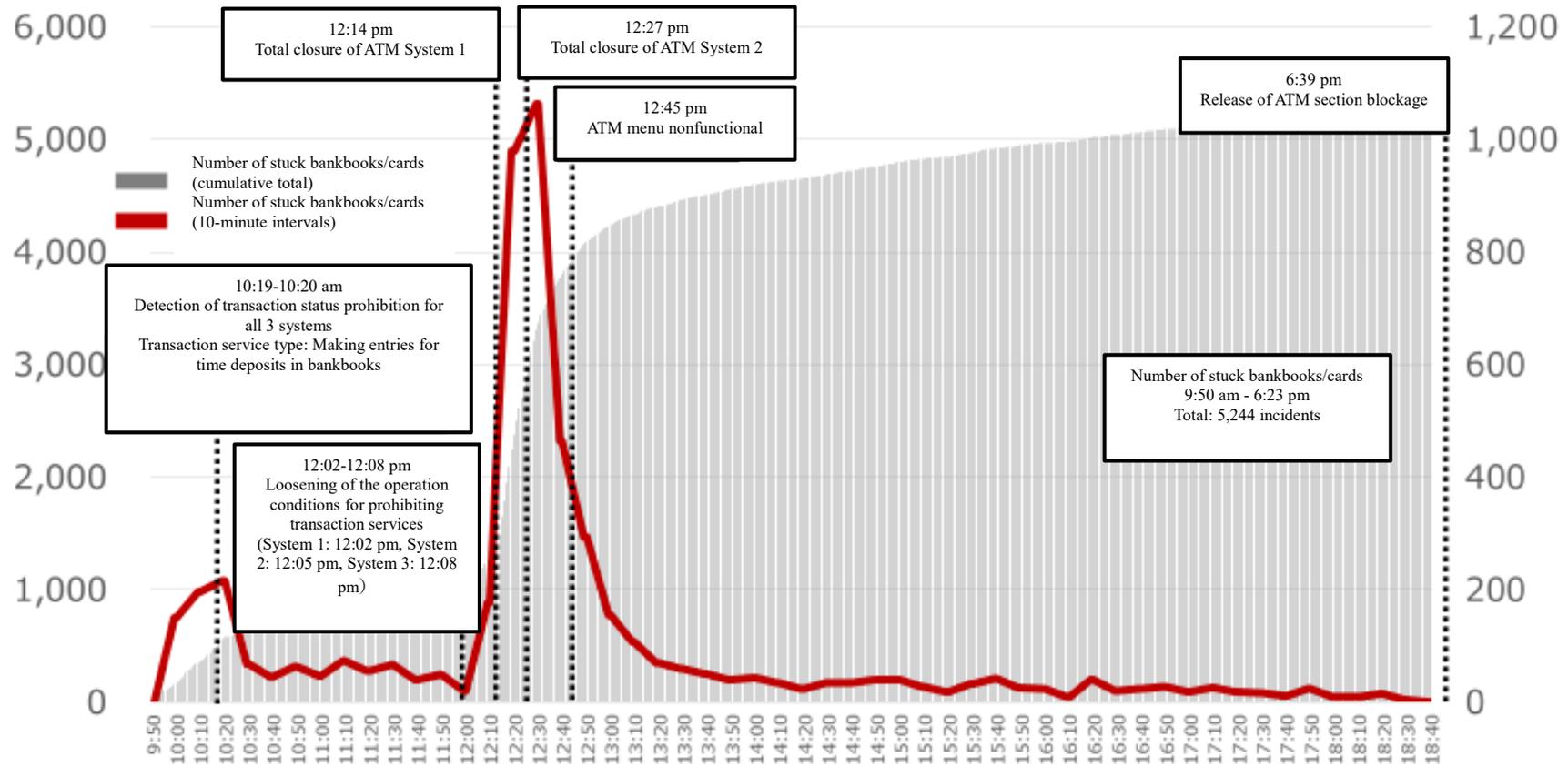
Due to this, (2) update processing of the revocation information management table in the time deposit system could not be conducted, and subsequent update transactions of time deposit transactions became impossible (update transaction error). When an update transaction error occurs in a transaction from an ATM, the default setting is that the inserted bankbook/card is retained by the ATM, and therefore incidents occurred where the bankbook/card of customers who tried to make a time deposit transaction from an ATM became stuck in the ATM and for some customers, the CIF's (abbreviation of customer information file, a database that contains information about customers such as the customer's name and address) exclusion function (a function to prevent simultaneous updates from subsequent transactions for the same CIF for the purpose of maintaining consistency on a transaction-by-transaction basis; "CIF Exclusion Function") could not be canceled. Then, due to the above-mentioned update transaction error affecting the time deposit, automatic revocation (returning the already executed transaction service for the product to the state before execution when an error occurs during the processing of the transaction service) was executed. There was no data required for revocation (update transaction) in the revocation information management table, and automatic revocation became impossible (automatic revocation error).

Due to the accumulation of the double error of the above-mentioned update transaction error and automatic revocation error, (3) at 10:00 am on the same day, MINORI's common transaction system (the central hub that manages and controls the overall operation of each system in MINORI and the flow of transactions) started to block ATM processing and other sections, which are the entry ways for transactions, in order to prevent a complete shutdown of the system, and as the blockage progressed, (4) many errors occurred in ATM transactions other than time deposit transactions, and bankbooks/cards were frequently stuck in ATMs.

The figure below shows the changes in the number of bankbooks/cards stuck in ATMs after the system failure occurred.

Number of stuck bankbooks/cards
(cumulative total)

Number of stuck bankbooks/cards
(10-minute intervals)



B. Situation after the System Failure

(a) Status of response toward system recovery

There were approximately 6,400 error messages between 9:50 and 10:05 am on the same day, and the error messages were displayed on the screen of the integrated operation terminal used by MHRT (the terminal for performing various operations such as system log investigation, command execution, and terminal operation restrictions in the production environment by the development department). The error was also displayed on the screen of the integrated operation platform system used by MIDS (a system for the operation department to perform various operations such as monitoring error messages, job operations, and command execution). At around 10:00 am on the same day, the MIDS staff member who immediately recognized this communicated it to the responsible MHRT staff member by telephone.

In response to the occurrence of these errors, MHBK and MHRT worked to identify the cause of the failure and towards recovery, took measures such as suspending the centralized ledger batch processing (one of the automatic system processes which is responsible for the execution function of ledger entry processing and the accompanying functions (checking, executing, returning results, etc. of received data) related to data requested by each business area (direct debit/direct payroll deposit, periodic rollover, batch change of registration information, etc.)), loosened the operation conditions for prohibiting transaction services (a function of MINORI that automatically refuses to process the transaction service when a system error occurs more than a certain number of times in the transaction service), turning off the menu related to time deposits from the on-screen transaction menu of ATMs and Mizuho Direct (MHBK's online banking service), expanding the capacity of the index file, and canceling the CIF Exclusion Function.

However, MHRT recognized the obstruction of the ATM processing section at 5:10 pm on the same day, more than 7 hours after the error was detected, and the restart of the ATM processing section was completed at 6:39 pm on the same day.

(b) Impact of system failure on customers and status of response

Due to the above failures, customers were impacted by (1) suspension of ATM operations (up to 4,318 ATMs), (2) stuck bankbooks/cards (total of 5,244 cases), and (3) partial inability to make transactions using ATMs and Mizuho Direct.

For stuck bankbooks/cards, MHBK's customer service department collected and returned bankbooks/cards by remote operation from the ATM center which is the base for monitoring ATMs and by dispatching security companies and sending branch staff to the affected locations. However, these measures could not keep up with demand due to the large number of stuck bankbooks/cards, and February 28 was a Sunday, so many customers' bankbooks/cards were stuck in the ATMs for a long time. Many customers could not leave the location without any information until they could

successfully make contact with MHBK, and were left stuck at the ATM for a long time. In addition, there were many cases where multiple customers' bankbooks/cards were stuck in the same ATM, since the menu screen of ATMs which had retained bankbooks/cards returned to the same appearance as usual even after the error occurred.

Only 1,244 stuck bankbooks/cards were returned to customers on the same day, and from the next day onward, bankbooks/cards stuck in the ATMs continued to be collected and returned, upon confirming the desired return method with the customer (visiting the branch, by postal mail, etc.). The number of returns was 5,152 by March 7, one week after the system failure, and all were returned by April 22.

(2) Cause

A. Occurrence of System Failure

It was not that there was a defect in the structure or configuration of MINORI itself, but rather there were factors that caused damage originating in the human aspect of operating it. The main points are as follows.

First, there was insufficient awareness of the risk of exceeding the memory capacity of the index file of the revocation information management table. The reason that this seemingly rudimentary mistake of exceeding the capacity of the above index file occurred during the operation of the abovementioned e-Account batch switching process is that, in the first place, there was no awareness in MHRT that the data volume of the index file will increase each time there is online processing of such data. The background behind this is that after the basic design of MINORI, while the specifications were changed to reside in the memory section (the section using memory, which is a storage device capable of high-speed processing), information regarding such specification changes and the necessity for strict capacity management were not properly passed on and shared within the organization. As a result, in the e-Account batch switching process, there were overlapping mistakes in the work including defects in preparations such as recognizing this as a risk and investigating the impact by testing in advance and overlooking the signs of memory overcapacity that were detected the day before the system failure occurred.

Second, regarding bankbooks/cards stuck in ATMs, there were many chances to notice that the specifications for the circumstances under which ATMs should retain such media are needlessly broad, such as errors in ATM transactions which occurred in June 2018 resulting in 1,821 stuck bankbooks/cards. Despite this, MHBK continued using such specifications without any special consideration, and the delay in the change of such specifications ended up inflicting serious damages to customers. It can be said that the reason behind this system failure is an organization-wide lack of imagination and sensitivity to the inconveniences and disadvantages that stuck bankbooks/cards cause to customers.

B. Delay in System Recovery/Increase in Customer Impact

(a) Factors related to the IT system side response

The main reasons for the delay in system recovery were (1) the confirmation of ATM processing section blockage was significantly delayed, and (2) during the recovery process, taking measures to loosen operating conditions of the transaction service prohibition function that automatically prohibits transactions when a system error occurs and as a result, causing frequent occurrence of serious errors and accelerating blockage of ATM processing sections, and (3) delay in measures blocking the impact on other system sections due to the disconnection of the time deposit system that caused the errors.

In particular, regarding (1) above, a large number of error messages were displayed on each of the screens from 9:50 to 10:05 am as described above, but MHRT did not recognize this quickly and accurately and although at least the key aspects of the situation were immediately communicated to MHRT's system department team by telephone, MHRT was not able to effectively ascertain and utilize this information for early recovery. The background behind this is the lack of oversight of MHRT on that day, lack of communication within the system department, a weak response framework for system failures occurring outside of business hours, and lack of training drills for system failures.

In addition, the system department was skewed toward the handling of configuration issues, so it lacked the perspective needed to ascertain what was actually happening to the customers who were using the ATMs, and was not utilizing this perspective for system recovery. Therefore, it lacked an overall perspective of the system failure situation, which led to a delay in system recovery itself.

(b) Factors related to the response to customers

At the same time, the customer service department also showed a passive attitude of waiting for the system to be restored and lacked the organized action to quickly address the inconveniences and disadvantages that customers were actually encountering. In addition, although the system department and the customer support department each proceeded to collect information, there was insufficient coordination regarding specific customer support. Therefore, in the situation where bankbooks/cards were stuck in ATMs, measures to shorten the waiting time for customers such as notifying them that they will be contacted and the bankbooks/cards will be returned at a later date, and measures to prevent more bankbooks/cards from becoming stuck, including posting posters notifying the suspension of use of the ATM at the ATM locations were delayed, and the impact on customers increased.

The background behind this is the lack of foresight and awareness of the impact of system failures on customers, and the lack of preparedness for customer protection against ATM failures occurring outside of business hours, including training drills.

(c) Organization-wide factors

For the entire organization, including management, there were problems with the following points.

First, in MHBK, information coordination and inquiries between related departments dealing with system failures were complicated, and it was not possible to share information on the occurrence and subsequent developments in the situation regarding the system failures in a timely and appropriate manner. Also the crisis management framework, which is expected to centrally collect/aggregate information related to system failures from all system departments and customer service departments, and analyze it and formulate/implement countermeasures, was not functioning properly and many involved parties seemed to be merely observing the situation instead of acting. For example, there was a delay in establishing a temporary organization (Emergency Response Project Team), which was not convened until 5:00 pm. This Project Team is established in emergency situations and takes measures such as information gathering, impact analysis, decisions on response policy, and giving instructions on actions to be taken.

Second, in the initial response, the impact of the system failure was underestimated, and information sharing with management was delayed, which very likely impaired the speed and accuracy of the response. In addition, the flexibility to reassess the effects of system failures in a timely and appropriate manner in response to changes in the situation and rethink the response was lacking.

C. Cause common to A and B above

The fragility of the system maintenance and operation management framework is both a cause of the system failure itself and the delayed system recovery. Personnel who were familiar with MINORI were reassigned when transitioning from the stage of building MINORI to putting it into operation. In doing so, there was not enough awareness of the need to emphasize the securement of stable system operation as critically important, which may have led to the weakening of the system maintenance and operation management framework.

2 System Failure on March 3, 2021

(1) Outline of the Facts

At 7:58 pm on the same day at an MHBK data center, the network card in the network device broke down, and the communication status became unstable for three minutes before switching to another system. Since it was automatically switched to another system, the communication status returned to normal 3 minutes after the breakdown. During that time, (1) 29 bankbooks/cards were stuck in ATMs, and (2) 7 purchase transactions of “Numbers” (lottery tickets) through ATMs and Mizuho Direct were not completed.

(2) Cause

A. Occurrence of System Failure

The cause was a memory failure in the network card which broke down, but for this type of network card, breakdown itself is unavoidable, and the number of such breakdowns is low and can be considered to be within the range of generally possible equipment breakdown.

If communication continues to be unstable, it is configured to automatically switch to the sub-system in 3 minutes, and this configuration itself is not considered unreasonable.

B. Response to Customers after Occurrence

Even though the number of bankbooks/cards stuck in ATMs was 29, which was considerably smaller than that at the time of the system failure on February 28, the number of such items returned to customers on the day was only 14, and there were complaints that calls to the ATM center were not connected. As with the February 28 system failure, there was a lack of awareness of customer impact.

3 System Failure on March 7, 2021

(1) Outline of the Facts

When MHBK released a program related to the delinquent interest collection function for consumer loan products, there was a mistake in the program design that was originally required to incorporate the initialization process, so at 6:08 am on the same day, an error occurred during batch processing of centralized ledger entries for time deposits in consolidated accounts.

MHBK and MHRT released a fix for the omission of the initialization process, and at 1:42 pm time deposit transactions were restored.

The customers who received an error when trying to make time deposit transactions at ATMs and Mizuho Direct were notified that a failure had occurred and that the transactions were unsuccessful, and the circumstances were explained. In addition, some ATM time deposit services were suspended to prevent bankbooks/cards from becoming stuck in ATMs. No particular problems such as delays were found in such response.

(2) Cause

As mentioned above, the direct cause was a relatively rudimentary design mistake of the program related to consumer loans, and the background behind it was (1) design mistakes were overlooked at each stage of the project design/development process at MHRT, which is the outsourcer, and the external vendor, which is a subcontractor of MHRT, and there were inadequate checks at MHBK and (2) insufficient management of MHRT subcontractors, and inadequate systems in place to detect design mistakes.

4 System Failure on March 12, 2021

(1) Outline of the Facts

A. Situation behind the Occurrence of the System Failure

At 11:39 pm on March 11, 2021, (1) communication between the storage device and the server was cut off due to a breakdown of the communication control device in the storage device that exists in the common infrastructure of MINORI, and the business systems running on the server stopped. Of these, (2), the centralized ledger batch processing was delayed due to the suspension of the integrated file transfer function (a business system that transfers files and other data between platforms which is required for centralized ledger batch processing), which caused (3) delayed processing, mainly for foreign exchange remittances.

B. Situation after the System Failure

(a) Status of response toward system recovery

Immediately after detecting an error on the common platform at 11:39 pm on March 11, the storage device was restored, but the connection between the storage device and the server did not recover even after the communication control device was replaced. It was finally recovered by restarting the server, and it took 6 hours and 41 minutes to recover all the servers, and 6 hours and 59 minutes to recover the integrated file transfer function.

After the integrated file transfer function recovery, centralized ledger batch processing was restarted in sequence, but the process was not completed by the specified time limit because the proper recovery procedure was not taken in the foreign exchange system.

(b) Impact of system failure on customers and status of response

263 outbound remittances to other domestic banks could not be completed by the end of the day on March 12, and 761 inbound remittances for foreign exchange could not be completed by the end of the day on March 12. In addition, the explanations to customers were carried over to the next business day, except for some customers who were responded to on the same day. As a follow-up measure, for remittances to other banks in Japan, the negotiations with the receiving bank, including in regard to the receipt date, were made on the assumption that MHBK would pay the back value costs such as interest and exchange fees incurred when conducting the payment processing dated March 12. Regarding the incomplete processing of payment guidance on the day of March 12 for foreign exchange inbound remittances, the recipients were contacted, and the intended receipt date was confirmed, and as of March 31, all payments were confirmed as being complete.

(2) Cause

The direct cause of the system failure was the breakdown of the communication control device in a storage device at one of MHBK's external service providers, and no particular fault is found with MHBK or MHRT regarding the device breakdown.

As for the delay in system recovery and the increase in customer impact, first of all, in terms of system support, as mentioned above, the reason that restarting the server in the lead up to the recovery of the storage device required time was that there was a lack of preparation for the recovery procedure and additionally there was a lack of agreement with the external service provider on the recovery time in the storage usage service contract. In addition, in the foreign exchange system, omission of checks on basic matters such as confirmation that data transmission was successful and confirmation of the number of processes in the centralized ledger batch processing were mentioned as reasons why the appropriate recovery procedure was not taken after the integrated file transfer function restoration, and in addition the lack of an overall control function for restoration work in the foreign exchange system, inadequate information coordination with related departments in the restoration process, and inadequate training drills for troubleshooting are factors which have been identified.

In terms of the response to customers, with regard to foreign exchange transactions, because a large number of transactions were not completed during the day, most of the customers did not receive an explanation until the next business day. Factors behind this include a lack of strong awareness of the importance of ensuring that transactions are completed on time for customers whose transactions are time-sensitive, a passive attitude of waiting for the completion of system recovery work, a lack of system failure simulations conducted in advance, and a lack of coordination with the system department.

IV Summary of Causes

The Committee does not find a common cause in the mechanism of MINORI and its periphery IT systems for the series of system failures. However, in light of the cause analysis related to the System Failures described in III and the commonality with the points which were the causes of the system failure incidents in 2002 and 2011, the human aspects common to the System Failures identified by the Committee fall into these three categories: (1) deficient organizational capability to respond to crisis situations, (2) deficient IT system management, and (3) deficient focus on the customer's perspective, and at the root of these three points, there is (4) underlying conditions or a corporate culture that prevent straightforward improvement. All of these should be recognized as basic issues in future efforts to prevent further incidents, as will be recommended below.

The first issue is deficient organizational capability to respond to crisis situations. In general, the ability to respond as an organization is closely maintained via horizontal communication between each department in the organization and vertical communication between upper and lower levels of the organization. It is effectively demonstrated by functioning as an organic unit as a whole

organization, and its true value is tested especially when an unexpected situation (unexpected crisis event) occurs.

However, at the time of the System Failures, which were unexpected crisis events, not only did the coordination between departments in order to properly ascertain information not function well (horizontal communication), but the emergency response framework that should also be responsible for centralized information aggregation did not function effectively, and the communication of information with the management team was not sufficient, as exemplified by the delay in reporting to the management team and the delay in setting up the Emergency Response Project Team (vertical communication), and as an organization, it can be said that crisis response capabilities were noticeably weak.

Second, regarding the issues related to deficient IT system management, with the stable operation of MINORI being a crucially important aspect of management strategy, it is necessary to make constant efforts to appropriately address MINORI's structural issues such as the magnitude of the impact of system failures, the “black box” effect from the aging of the system structure, and recovery and minimization of customer impact in the event of a failure. Appropriate resource allocation, including personnel and budget, based on a risk-based approach, and appropriate IT management based on robust IT governance are important. However, in the case of the system failure on February 28, insufficient awareness of the risk of exceeding the capacity of the index file in the revocation information management table, inadequacy/insufficiency of the information collection capabilities in regards to the system operation management and system failure recovery response, and in the case of the system failure on March 7, insufficient testing related to consumer loans, an inadequate management framework for the external service provider, and in the case of the system failure on March 12, with respect to the recovery response in case of system failure, lack of training drills, issues in management framework for the external service provider, and issues with the information sharing framework of customer support departments were recognized, and in general, IT governance and IT management did not function sufficiently, and the IT system management was vulnerable.

The background behind this was: (1) there was insufficient consideration regarding the impact of reassigning IT personnel after the migration to MINORI, and (2) there was insufficient preparation for a crisis occurring on weekends, holidays, and after business hours when more thorough risk management should have been conducted. Also, in light of the fact that (3) system failures were repeated, it seems that the underlying cause is the low sensitivity to IT system risk throughout the organization from the management team down.

Third, regarding the issues related to deficient focus on the customer's perspective, MHFG has made “Customer First” the first of the Mizuho Values, which are described as “the shared values and principles of Mizuho’s people, uniting all executives and employees together to pursue our Vision” as

a statement of its corporate philosophy. As such, all matters should be considered from the customer's point of view, and preventing any adverse effect on the customer should be given top priority.

However, as seen in the fact that customers were forced to suffer a great deal of inconvenience due to the system failure on February 28, (1) there is a lack of awareness of the ATM bankbook/card capturing mechanisms and the impact that causes, and (2) in responding to a system failure in an emergency, not sufficiently making an effort to do as much as possible in consideration of customer interests. In addition, (3) it cannot be denied that there was insufficient awareness of customers who use ATMs and Mizuho Direct, as they are “invisible customers” from the bank’s perspective.

Fourth, regarding issues related to underlying conditions or corporate culture, in the event of the emergency situations arising from the System Failures, involved parties were observed to have a lackluster stance toward curtailing and resolving issues through proactive and self-directed action that goes beyond their own direct responsibilities. In addition, at the time when the details of the System Failures and the impact on customers were not completely clear, they refrained from making statements and acting based on the perception that doing so is a risk.

The reason why executive officers and employees lack such a proactive and willing attitude is that they did what they could do within the limited scope of their direct responsibilities rather than taking the risk of having a liability issue by actively speaking out, as there seems to be a corporate culture in which this is the rational choice as an action within the organization.

V. Evaluation and Recommendations for Measures Formulated by MHFG and MHBK to Prevent Further Incidents

MHFG and MHBK have implemented or are planning or considering implementing various measures to prevent further incidents from the perspectives of (1) IT systems, (2) response to customers / crisis management, and (3) organization / corporate culture. Based on the causes of the System Failures, all of these perspectives are considered to be effective, comprehensive, and appropriate. In particular, the appointment of externally-hired personnel to key positions is highly commendable as an opportunity to bring new perspectives to the entire organization and change the corporate culture. Therefore, assigning suitable personnel to the right positions will be key to achieving this.

In regards to measures to prevent further incidents, it is not enough to change the organization, rules, and procedures superficially and formally, rather it is essential to ensure the effectiveness and continuity of the measures. For that purpose, it is necessary for management to clearly indicate the purpose of the measures and what the goal is, to inform all executive officers and employees, and to have them take the initiative with a sense of purpose. The basic issues described in IV above should be used as guidelines for efforts to prevent further incidents.

Only with constant, continuous efforts and by conducting regular follow-ups, will it be possible to ensure the effectiveness of these measures.