

Mizuho Financial Group Banking System Failure **April 1 through early May in 2002 at Mizuho Bank**

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The serious banking system problems disrupted the new banks' operations following the April 1 launch of Mizuho Bank and Mizuho Corporate Bank into which Dai-ichi Kangyo Bank Ltd., Fuji Bank Ltd. and Industrial Bank of Japan Ltd. had been consolidated under the management of Mizuho Holding in Tokyo. The Mizuho Bank's important first day in business was tarnished by the ATM (automatic teller machine) transaction errors and delayed automatic debits for utility and credit card bills. The biggest banking system failure in history caused chaos, from which the recovery took more than one month until the bank's operations went completely back to normal. A long period of failed discussion among the three banks about whose computer systems would survive the merger left insufficient time for the implementation period of a relay system to bridge the banking systems. The bank group went ahead with integration and the operation of the unified banking system, despite the testing period of the unified operation was not long enough for the large-scale operation.

1. Event

As part of the finance-industry reorganization, Dai-ichi Kangyo Bank Ltd., Fuji Bank Ltd. and Industrial Bank of Japan Ltd. were consolidated into Mizuho Bank Ltd. and Mizuho Corporate Bank Ltd. under the management of Mizuho Holding in Tokyo. The new Mizuho Bank's first day in business (April 1, 2002) was tarnished by the ATM (automatic teller machine) transaction errors in which debits were made from accounts although customers did not receive cash from the machine, as well as unprocessed scheduled automatic debits for utility and credit card bills. The banking system failed to process 105,000 automatic debits scheduled for April 1. Delayed debits backlogged, and the number of delayed debits reached 2.5 million by the end of April 5. An additional 30,000 double debits were found between April 1 and April 5. The biggest banking system failure in history caused chaos, from which the recovery took more than one month until the bank's operations went completely back to normal.

2. Course

On August 20, 1999, Dai-ichi Kangyo Bank, Fuji Bank and Industrial Bank of Japan announced a wide-ranging alliance to create the world's largest bank through a joint holding company.

In December 1999, the banks agreed on the plan to integrate the entire Mizuho Bank system, which primarily serves individuals and small and medium-sized companies, on the existing Dai-ichi Kangyo Bank system in April 2002.

Mizuho Holding Inc. was established on September 29, 2000, as the holding company of Mizuho Financial

group, to become the integrated body of Dai-Ichi Kangyo Bank, Fuji Bank and Industrial Bank of Japan.

In December 2000, the banks reviewed their original plan of banking system integration and agreed on postponing it until April 2003 and interfacing the three banks' systems. The interface scheme would take the Dai-ichi Kangyo Bank system as the primary banking system, and a relay system for bridging the primary system and the two banking systems of Fuji Bank and Industrial Bank of Japan.

However, the program added to handle logical connection between the primary system and the relay systems had a bug that would cause a specific problem in certain circumstances. The bug was undetected during the connection and load tests conducted prior to the banking operation on April 1.

The relay system plan was adopted unanimously by the Mizuho Holdings board on May 10, 2001.

The Financial Services Agency (FSA) evaluated the integration scheme of the Mizuho Financial Group's new banks from March through June 2001. It expressed concern about the delay in preparation for the scheduled integration and reminded the company of the issues of its integration scheme.

In December 2001, the banks agreed that among the Mizuho Corporate Bank branches, the ones running the Dai-ichi Kangyo Bank system would process data of more than 50,000 accounts including large corporations and financial institutions, instead of the ones running the Industrial Bank of Japan's system. The original plan specified the Bank of Japan's system to process the data; however, it was later found that the system was not well suited for mass data processing.

The banks notified their corporate customers of the changes in the bank and the branch codes effective on April 1, and requested appropriate changes to be made to their scheduled transactions as well as to the transactions data in the Japanese Bankers Association format. Fuji Bank and Industrial Bank of Japan would take the bank code of Dai-ichi Kangyo Bank, and some branch codes would change on April 1, 2002.

In early March 2002, the engineers tested the integrated banking system for debit transactions.

On March 22, the Mizuho Holding management committee received from the banking system division the status report saying that preparation for the new banking system was coming along almost as scheduled. It decided to go ahead with the scheduled integration of banking systems.

The engineers did not thoroughly test the new system for its overall processing load in a large-scale operation with various transaction requests, including requests of invalid debit transactions, because there was not enough time to conduct such an exhaustive test.

The banks started processing account data on March 30, two days before the first day of the new banks in business. The batch processes for all-ocating data to the three banking systems were interrupted by mismatches of bank and branch codes because of account data containing both the old and new codes. A programming bug also caused errors during processing debit transaction data in non-FSA formats. Although the program was manually debugged, processing was delayed, resulting in more than 50,000 unprocessed account and transaction data. The bank group went ahead with the scheduled system integration, assuming that the delay in data processing would not affect on the new banks' operations as

long as all would be completed processing by the end of April 1.

On April 1, the three banks were officially and legally combined into two companies, Mizuho Bank and Mizuho Corporate Bank. ATM transaction errors started to occur at the Mizuho Bank branches. The ATMs at branches formerly operated by Fuji Bank only accepted the ATM cards provided by the former Fuji Bank. While customers had no problem with the former Fuji Bank ATM cards at branches formerly operated by Fuji Bank, ATMs at other new Mizuho Bank branches dispensed no cash although debits were made from the accounts.

Mizuho Bank disconnected the relay systems from the primary banking system. It found the cause of the ATM transaction errors at around 13:00.

While operators manually corrected the transaction and money remittance errors, more than 100,000 automatic debits were backlogged.

This inadvisable manual correction resulted in another issue, loss of account data, to arise. The bank later discovered that the confidential data of account holders were accidentally disposed of.

On April 2, the ATM systems were restored.

On April 4, the bank reported publicly the delay in automatic debits.

On April 5, the bank reported 2.5 million delayed debits since April 1. More than 30,000 double debits were found.

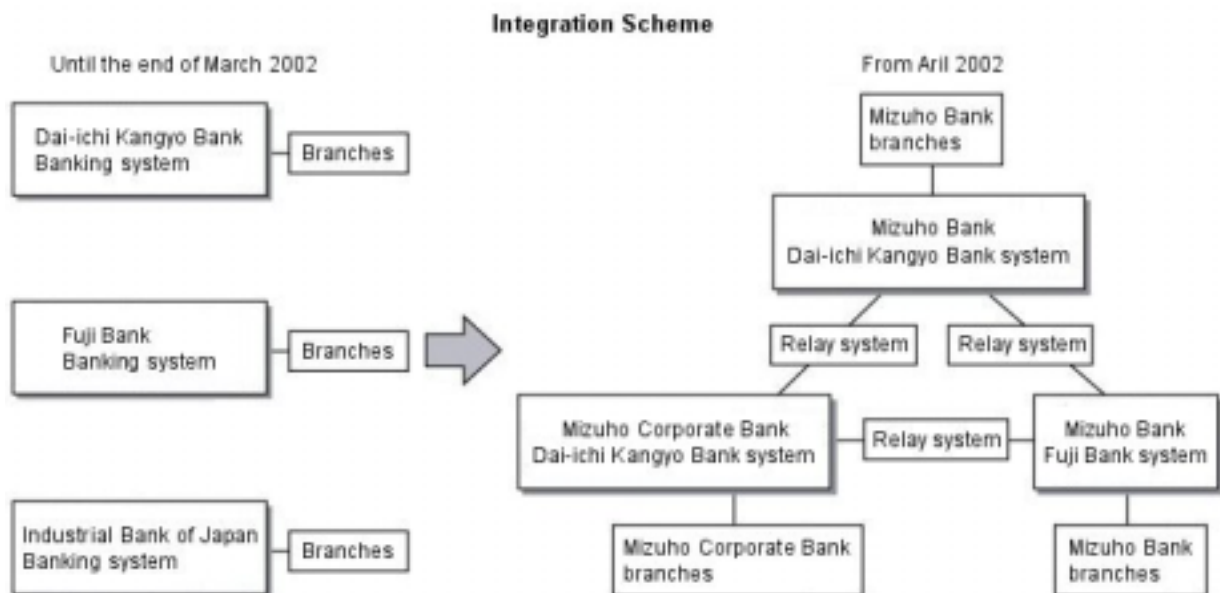


Figure 1. Banking System Integration Scheme

On April 8, an additional 30,000 double debits were found (restored by April 9)

On April 9, the backlog of automated debits was reduced to 150,000. The president of Mizuho Holdings

had a press conference after he testified in a congressional hearing that the bank would be able to normalize operations in April.

On April 11, additional delayed debits were found, resulting in a backlog increase to 400,000.

On April 18, the backlog of automated debits was cleared except for a substantial delay in forwarding of credit advices.

On April 30, month-end 12 million automatic debits were processed normally as scheduled.

On May 8, FSA and the Bank of Japan decided to conduct an emergency inspection.

On May 21, FSA dispatched the financial regulator to inspect Mizuho Bank on-site.

On May 21, the president of Mizuho Holdings said at a press conference that the bank was expecting a loss of 1.8 billion yen attributed to the banking system failure.

3. Cause

(1) Technical factor (direct cause)

a. ATM transaction errors

The Mizuho Bank's primary banking system (previous Dai-ichi Kangyo Bank system using the Fujitsu mainframe) was not modified properly.

The program added to handle logical connection between the primary system and the relay systems had a bug that caused a specific problem in certain circumstances. It was an oversight during the program development.

b. Delayed automatic debits

- Invalid information in the transaction request data.

- A bug in the program developed for processing debits transaction for bridged banking network.

The problems surfaced only under certain conditions such as "data of different types or categories are combined in a certain manner during processing" when "data overflow or excessive transactions accumulated in the data storage area for the relay computer".

The first bug fix failed to correct the programming errors and caused the recurrence of the online banking system failure on April 8.

c. Insufficient testing period of the unified operation and load tests.

Program development always accompany bugs. Thorough operational testing and debugging were critical for the unified system before bringing them on-line. Testing should have simulated the real large scale banking operation and various complicated situations.

(2) Corporative factor (principal cause)

a. Delayed decision on the system integration scheme (problems during planning)

The merger lacked the dominating party that can effectively take charge, and the three banks simply could not agree on whose computer systems would survive the merger. The system integration scheme changed a few times until the three banks reached a settlement.

The three banks should have proposed the most adequate scheme after assessing the requirements on the unified banking system and evaluating the existing banking systems of the three banks. Instead of determining the system that would survive the merger, the three banks knocked out a compromise, involving relay systems to simply bridge the existing systems of the three banks. This temporizing scheme involving relay systems was not inadequate itself; however, delay in decision making resulted in insufficient period for testing and systems integration.

The scheme lacked the architecture concept. When making changes in banking systems such as integration, it is best to choose the time of year when processing volume is smaller. April 1 has been usually the busiest day of the year for the three banks, and scheduling system changes on such a day was not advisable. In addition, the three banks that merged into Mizuho were too fixated on their schedule to perfect the systems integration, which compounded the problem.

b. Delay in preparations for system integration

Problematic management organization for the integration project.

The Mizuho Holding management committee did not receive accurate status reports in a timely manner, while there had been evident delays in preparation for the scheduled system integration. The three banks independently performed preparation towards the scheduled system integration without reporting status to each other or to the holding company.

The CEOs (chief executive officer) of the three banks knew of the delay after receiving several reports in 2001 from their banking system divisions. The CEOs simply instructed their banking system divisions to make up for the delay without looking into details.

c. The bridging systems were not tested thoroughly for their performance and processing loads before bringing them on-line.

d. The Mizuho Holding management committee went ahead with integration and the operation of the unified banking system, despite the delay in preparation and risks of system failures during the real banking operation.

4. Immediate Action

- (1) FSA dispatched the financial regulators to inspect Mizuho Bank, and the Bank of Japan inspected Mizuho Holding and Mizuho Corporate Bank on-site. The inspections took a month to investigate the cause of banking system failures and reviewed the handling of problems as well as the banks' measures for preventing recurrences of system failures.
- (2) FSA issued a business improvement administrative order to Mizuho Holding.

The order includes measures for preventing system failures and responses, as well as improvement in administration and unified banking system to help preventing recurrences of system failures and clarifying management's responsibility.

Because of the estimated large sum of development cost for the unified banking system and risks of system failures during the development, it called for drastic prevention measures such as improvement in management of system development and administration, reorganization of the banking system division, reinforcement of the auditing system, active involvement of the management committee in the system development project, better communication and information sharing among the three banks. FSA also ordered to create guidelines that enable prompt responses and adequate resolutions to system failures. Although Mizuho had guidelines for actions in case of system failures prior to the merger in April, they lacked customer-oriented instructions of how to respond to individuals and corporate customers and announce schedules of restoration.

5. Countermeasure

(1) In response to the system failures, Mizuho formed the system failure special committee that includes outside consultants.

(2) Establishment of corporate governance system

Rivalry and power struggle among the three banks resulted in delay of the schedule and contributed to the system failures. Such organizational issues must be eliminated to construct efficient management systems.

Mizuho proposed reorganization of its administrative structure to consolidate sound and efficient management.

Some management officers of the three banks was to be let go to make the reporting system efficient so that Mizuho Holding can control the banks' operations.

The management committees of the new banks were previously structured to include equal number of officers from the three banks as a compromise to the rivalry and power struggle among the three banks, which contributed to the inadequate business practice. Mizuho planned to restructure the organization after reviewing the administrative structure as well as the development scheme of the unified banking system.

(3) The three banks decided not to independently prepare and develop banking systems prior to integration, which led to an absence of exchanging development status among three banks and contributed to system failures. The new development scheme encouraged cooperation of the engineers of the three banks to jointly develop the integrated banking system.

6. Summary

Although the consolidation of the three banks created the world's largest bank by assets and integrating the

three banks' systems required enormous tasks, this incident revealed poor corporate management and excessive optimism over the new business and the mission-critical system integration, which may also be observed across industries. It is critical for banking business to build a fault-free computer system. In particular, fault-free banking information and account systems are mission-critical to the bank. It is unavoidable for any merger of banks to unify such mission-critical systems. Mizuho group had been preparing for the scheduled system integration on April 1, 2002 since the previous year; however, the unified banking system was developed through a trial and error process to which the cause of system failures was attributed.

The management committee of the new banks multiplied in number after merger by keeping all members of the three banks, a practice commonly observed in any mergers. Without having the dominating party that can effectively take charge, all administrative decisions required unanimous agreement of the three banks. Rivalry and power struggle among the three banks resulted in delayed decision on the system integration scheme and one-year postponement of the original integration plan. This delay ended up leaving insufficient time for performance testing of bridging systems, data preparation and load testing for the large-scale operation. While three banks had evident delay in preparation for the system integration, they were too fixated on their schedule in April to allow the Mizuho Holding management committee making appropriate judgments on the delay. Corporate factors including poor management and communication greatly contributed to the incident. Mizuho group bears heavy responsibility as the banking group that caused general chaos involving thousands transaction errors and delayed debits.

This incident caused immeasurable damage to the society and showed problems of the information society. It also proved how much benefit the Japanese economy receives from information technology (IT) and made one reaffirm the significance of it in the society. System failures have also been reported in the finance and the aviation industries. The pressing need for thorough inspection and maintenance of information systems are obvious.

Since this incident led to potential crisis of confidence in the Japanese financial system and the financial administration, Japan needs to emphasize significance of information systems and encourage investment and education to the IT industry as well as to the organizations that utilize the technology.

7. Knowledge

- (1) System failures generally occur on the systems that bridge external systems to the mainframe.
- (2) Systems require thorough tests including connection, stress tests, enhancement tests, and fault tolerance before bringing them into the real operation.
- (3) A system design requires a clear architecture concept to begin with.
- (4) Integration of systems for merger requires detailed review of the existing systems to propose the most rational approach and scheme.
- (5) The administration executives must have better understandings on the significance of mission-critical

systems for business operations.

- (6) Reorganization and rationalization of the executive management is essential for successful corporate merger. It is irrational in business perspective to keep all executives and employees or to form the management committee with the same number of executives from companies involved in the merger.

8. Background

Starting with the Bank of Tokyo-Mitsubishi UFJ, there had been a series of incidents of system failures at financial institutions such as Mizuho Bank, Post Office Savings Bank and IY Bank (current Seven Bank, Ltd.). The system failures surfaced to be ATM transaction errors resulted from problems in the bridge connection between banking network systems and the mainframe.

There were also social factors that contributed to these incidents: diversification of services and radical reorganizations in the finance industry observed in the recent years. Merger of banks as we have seen in the Bank of Tokyo-Mitsubishi UFJ and Mizuho Bank requires significant revisions of banking systems. Such banking systems must also offer capabilities of debit transactions and networking with Post Office Savings Bank and credit unions, which significantly increase the system load.

Electronic transactions offer direct business between sellers and buyers without an intervening party. Such transactions require a high availability transaction processing solution commonly developed on an open system environment, rather than on a legacy system environment. While such a solution offers high availability and consistent, short response times to enable online real-time processing of mass transaction data, it requires relatively complex network architecture. Many corporations and manufacturers now face difficulties in catching up with e-commerce trends and implementing new transaction solutions.

Unquestioning belief in information systems is another problematic factor observed commonly in government agencies and industries in Japan. Unlike the quick economic recovery of the IT industry in the U.S., declining stock prices of many IT companies in Japan has been putting a damper on already faltering investments since the collapse of the asset-inflated economy in 1990's. Many IT companies are still struggling with sluggish corporate growth without being able to alleviate their staffing shortage. While many companies brought new IT technologies to their work environment, an inadequate employee training is preventing them to take full advantage of their updated information systems. Some of the leading manufacturers recently announced large layoffs of more than 90,000 employees; however, most of the layoffs are targeting those who joined the companies through the mass hiring during the boom of home appliances, not the ones who joined them after the coming of age of the Internet. This also proves that corporations have a serious shortage of employees who are familiar with the recent information technologies.

9. On the Side

Expanding a system simply by adding capabilities to the existing one can go just so far until it creates load

imbalance or processing inefficiency. The system integration in this case failed due to the network architecture shown in Figure 2. The bank should have created a new banking network as shown in Figure 3 after assessing requirements and restrictions of the new banking system.

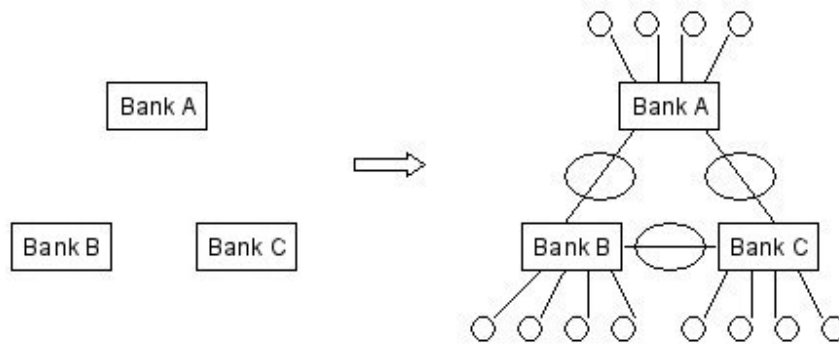


Figure 2. Adopted System Integration Scheme

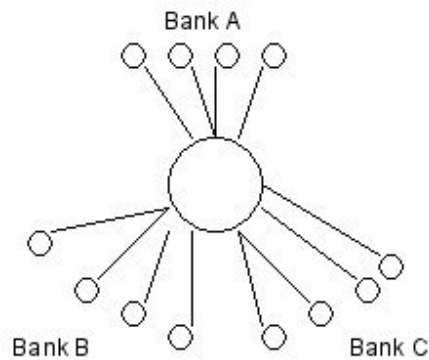


Figure 3. Desirable System Integration Scheme

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