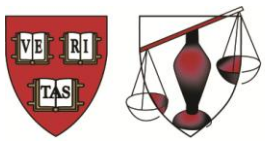

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Translated, abridged and revised from original report prepared for Local Authorities Systems Development Center.

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Municipal Government ICT in 3.11 Crisis:
Lessons from the Great East Japan Earthquake and Tsunami Crisis

By Mihoko Sakurai and Jiro Kokuryo
Keio University

Abstract

A structured field surveys of ICT divisions in 13 municipalities in areas devastated by the Great East Japan Earthquake and Tsunami on March 11, 2011 revealed 1) lack of ICT business continuity plans (BCP), 2) importance (and lack of) comprehensive data backup policy, 3) necessity to deal with diverse situations, 4) importance of organizing collaborative network among governments and private sectors, 5) importance of securing power and network supply among many other observations. Recommendations are made based on the findings on how to formulate BCP that can deal with diverse range of situations, and policies in creating collaborative network of diverse range of organizations to protect vital information infrastructure in crisis. Strong interests were shown toward the use of cloud technologies for future backup purposes.

Special note

In the course of conducting this survey, we met with numerous municipal government employees. Many of them, despite being victims themselves, worked tirelessly to resume operation of resident service counters. Others were forced to work under horrifying work conditions in areas where the tsunami had washed away everything in its path. Employees of municipal governments in Fukushima Prefecture, whose lives were uprooted by the nuclear accident and who had to leave their hometowns for indefinite periods of time, worked together diligently to support local residents.

We must not assume that they have quietly resigned themselves to the harsh reality they experienced. They possess immense mental and emotional strength to look adversity in the face and carry on their duties with a strong sense of commitment, despite knowing that they may never receive any recognition or praise for their efforts. We were greatly impressed by them and their strength served as the driving force behind this report.

41 employees of municipality and prefectural governments affected by the disaster participated in this survey. We would like to express our sincere gratitude and respect to each one of them for their cooperation in a difficult situation.

1. Introduction

This report analyses and summarizes the results of field surveys conducted at the Information and Communications Technology (ICT) divisions of 13 municipalities in Iwate, Miyagi and Fukushima Prefectures that were devastated by the Great East Japan Earthquake and Tsunami on March 11, 2011. The survey covered damages caused and the status of recovery, as well as opinions on measures that must be implemented in the future.

The analysis and summary was carried out with the following three objectives:

1) To document the action taken by the ICT divisions during the disaster
2) To organize support requests manifested during the survey from the officials of municipal governments of the affected areas to the central governments
3) To prompt discussion regarding the future action that must be taken by the ICT divisions of municipal governments

Key observations from the research can be summarized as follows:

(1) ICT BCP(business continuity plan) did not exist prior to disaster

Although each prefectural government had created regional disaster response plans, none of the ICT divisions at each of the municipalities had drawn up a business continuity plan (BCP), and emergency responses were mostly left to the discretion of each affected site. As described in (2) below, taking into consideration the different situations that could ensue a major disaster, it may be necessary to create a flexible emergency response plan for the future that assumes various possibilities, rather than a stereotypical one that envisages only one situation.

(2) Diverse situations among locations existed, requiring non-uniform measures

The expectations of ICT divisions and the requisites for and processes towards recovery varied greatly depending on several factors, including structural damage to government facilities and server rooms, loss of data, whether power supply and network connectivity could be resumed immediately, whether communication tools such as cell phones remained functional; and the degree of mass emergency evacuation to locations outside the affected area.

(3)There were temporal shifts in expectations towards ICT functions requiring timely measures

Immediate response measures in the municipalities that experienced major devastation focused on saving lives and guiding survivors to evacuation centers, and in some areas little priority was given to reopening resident service counters (there was however a sense of urgency regarding the need for access to residents' personal information in order to facilitate rescue operations). Some ICT divisions even dispatched employees to do relief work with just skeleton staff remaining at

the office. At these municipalities, as well, providing support to the affected people at various post-disaster stages was difficult without the use of information and communication technologies (ICT). It became more evident than ever that post-disaster expectations toward ICT divisions change as time passes.

(4)Difference existed in the preparation levels for earthquake and tsunami

Excluding destruction caused by the tsunami and damage to communication cables, most of the ICT divisions did not suffer any physical damage to equipment as a direct result of the earthquake, such as due to the collapse of buildings. We assume this is because in the past ten years many municipal government office buildings had implemented quake-proofing measures, including earthquake-resistance tests and reinforcement of structures.

In prefectures close to the seacoast, however, some government offices with servers and other data storage facilities located on the lower floors of the building lost a considerable amount of digital data, and we assume there was no standard policy in place regarding tsunami countermeasures.

(5)Private sector played a major role in the recovery process outside of contracts

Although most of the agreements entered into with subcontractors of information processing systems included no clauses regarding action to be taken in the event of a disaster, they proactively undertook different operations that were beyond the scope of their contracts, thus contributing greatly to recovery efforts. Some companies even had backup files stored at their facilities that enabled lost digital data to be recovered.

(6) Critical issues exist in the handling of digital data at government offices

The importance of creating backup files has been emphasized from the perspective of business continuity planning by ICT divisions as well. In reality, however, the management of application software and electronic data was mostly entrusted to individual business divisions and not only were there no standard guidelines regarding data backup, in some government offices the relevant ICT division was not aware of what kind of data was being stored and the storage methods being used.

This is also indicative of issues in the system. For example, in government offices where external storage of data was prohibited to prevent leakage of personal information, it was impossible to recover valuable information that was lost in the tsunami.

Unlike damage to hardware and application software that can be fixed, restoration of lost electronic data is difficult, hampering the entire recovery process. It is necessary to raise awareness of digital data as a prime asset that must be protected in the event of a disaster.

(7) Critical importance of ensuring stable power supply and uninterrupted lines of communication to key infrastructure

Although the intensity of damage suffered by each organization was different, most municipalities stressed the importance of ensuring stable power supply even during a disaster. This need was further highlighted by the fact that in many instances ICT services could not be provided to residents because of disrupted power supply, despite no damage to equipment.

Further, with regard to telecommunications lines linking branch offices and other local offices, many municipalities with independently installed cables had to investigate damages themselves, therefore it took them a significant amount of time to restore communication. This brings to light the limitations municipalities face in laying and maintaining telecommunication lines on their own and underlines the need for establishing relevant infrastructure that is not restricted by the administrative framework of the local municipality.

(8) Little utilization of the Disaster Victims Support System[1]

Disaster Victims Support System, a government endorsed comprehensive post disaster support system which was developed after 1995 Hanshin Awaji Earthquake that killed thousands, was not utilized as expected. Instead, municipal governments opted to use simpler software such as Microsoft Excel or quickly modifying original software to suit requirements. The reason for the less than expected use of the package was lack of time to learn how to operate the software package in the disaster situation. It is notable that much ICT resources were spent in the most critical moments developing systems that meet the demands of the diverse local situations.

(9) Keen interest exist in adopting cloud computing as future preparation

With regard to the use of cloud computing as one measure to protect digital files in the future, employees of ICT divisions showed keen interest in the technology especially as a means of backing up data. Many of them, however, expressed concern over security issues.

Opinions are divided as to the use of the Local Government Wide Area Network (LGWAN)[2] between those who favor its utilization for data backup and others who consider it impractical to use the system at its current connection speed. To

[1] A system developed by Nishinomiya City, Hyogo Prefecture after the Great Hanshin earthquake, designed to provide comprehensive support to municipal governments in the event of an earthquake, typhoon or other natural disaster. In 2005, the system program was registered in the Local Authorities Systems Development Center (LASDEC) program library for municipal government operations and is provided free of charge to municipal governments throughout Japan.

[2] The Local Government Wide Area Network (LGWAN) is an administration-focused mutual network of local public bodies that was established in order to facilitate highly efficient data utilization through streamlined exchange and sharing of data. LGWAN is reciprocally linked to the central government ministries' Kasumigaseki WAN for information exchange with national administrative organs. LGWAN is highly secure and uses ASP to make available a variety of administrative applications.

deal with this issue, measures were taken in the Third LGWAN Maintenance Plan to increase the connection speed of the backbone line. It is anticipated that prefectural governments will be able to access the LGWAN faster when the improved backbone line becomes operational in April 2012.

Despite the keen interest shown by ICT divisions in the shared use of computer networks, including cloud computing, issues such as standardization of data formats still remain and it is necessary to adopt a top-down approach towards implementing consistent measures for standardization.

2. Survey conducted

Visits were made to 13 municipal governments and 3 prefectural governments. Survey participants were interviewed for approximately two hours. Much effort was put in to collect comparable factual data among the locations.

The survey topics may be broadly divided into the following:

1) The role of the ICT division;
2) Damage caused to the ICT division on March 11 and the steps taken toward recovery; and
3) Thinking on future action after experiencing the disaster and recovery thereafter

With regards to 2), participants were asked questions about the damage caused and the recovery measures that were taken with regard to four information processing systems (basic resident registration, family registration, tax and social security), power supply and transmission lines related infrastructure, computer hardware, and facilities.

Table 1: Municipalities surveyed and survey date

Municipality

Municipalities surveyed		Departments visited*	Survey date
Iwate Prefecture	Miyako City	Administration Planning Dep., Planning Div., Information Processing Promotion Office	December 16 (Fri), 2011
	Rikuzentakata City	Planning Dep. Collaboration Promotion Office., Administration Dep., Administration Div. (telephone interviews)	November 29 (Tue), 2011
	Kamaishi City	Administration Planning Dep., Public Affairs Division, Information Processing Promotion Section	December 15 (Thu), 2011
	Otsuchi Town	Disaster Recovery Bureau, Recovery Measures Promotion Office and Disaster Recovery Bureau, Information Processing Promotion Office Note: The survey also covered employees from the Finances and Planning Division, Yahaba Town, Iwate Prefecture, who were sent for relief work.	December 15 (Thu), 2011, January 19 (Thu) and January 20 (Fri), 2012
Miyagi Prefecture	Sendai City	Administration Planning Bureau, Information Policy Department, Information Policy Division	December 22 (Thu), 2011
	Ishinomaki City	Planning Department, Information Policy Division	November 25 (Fri), 2011
	Kesennuma City	Planning Department, Planning Policy Division, Information Processing Promotion Office	November 29 (Tue), 2011
	Higashimatsushima City	Disaster Recovery Policy Department, Recovery Policy Division, Information Processing Promotion Unit	November 25 (Fri), 2011
	Minamisanriku Town	Disaster Recovery Planning Division, Information Processing Promotion Section	January 20 (Fri), 2012
Fukushima Prefecture	Iwaki City	Administration Department, Information Policy Division	December 22 (Thu), 2011
	Minamisoma City	Administration Planning Department, Information Policy Division	December 13 (Tue), 2011
	Futaba Town	Saitama Branch, Residents Lifestyle Improvement Division and Administration Division	January 12 (Thu), 2012
	Namie Town	Nihonmatsu Office Administration Unit	December 9 (Fri), 2011

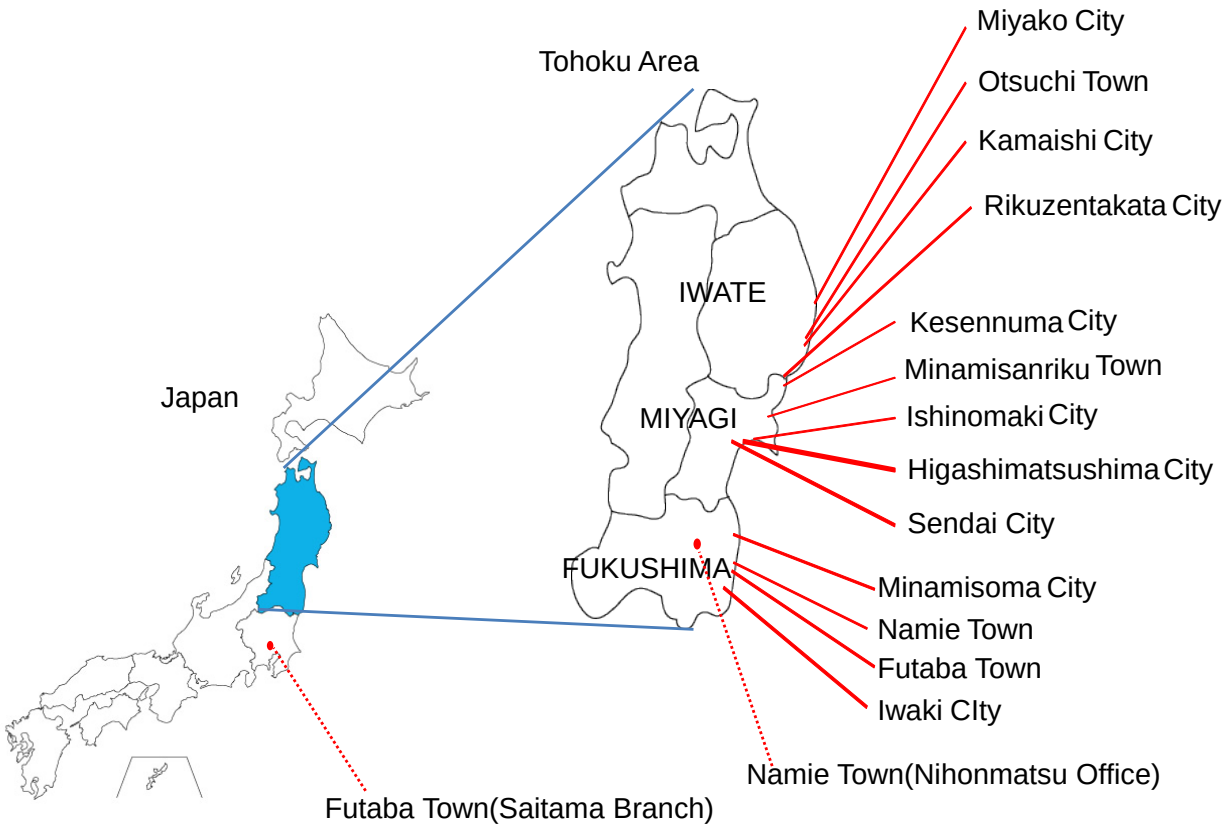
* Names of organizations are as at the time of the survey

Prefecture

Municipalities surveyed	Departments visited*	Survey date
Iwate Prefecture	Regional Policies Department, Regional Development and Promotion Office, Regional Information Processing In-charge Regional Policies Department, Municipality Division Administrative Department, Legal Affairs Division, Administrative Information Processing In-charge	February 16 (Thu), 2012
Miyagi Prefecture	Disaster Recovery and Planning Department, Information Policy Division	February 20 (Mon), 2012
Fukushima Prefecture	Planning Department, Information Systems Division	February 20 (Mon), 2012

* Names of organizations are as at the time of the survey

Figure 1: Municipalities visited



3. Overview of events that took place in the ICT divisions of municipal governments affected by the Great East Japan Earthquake

In general, regional disaster response plans drawn up by each municipality specify the scope of action to be taken by the relevant organization during a disaster, such as setting up disaster response headquarters and confirming the safety of residents. Some plans also clarify the role of each operational division in the event of a disaster.

With regard to ICT divisions, however, none of the 13 municipalities surveyed had drawn up action plans that included business continuity planning, and responses by the respective ICT divisions at the time of the disaster were mainly based on their own discretion. After the disaster response headquarters were started up, many of the municipalities dispatched personnel for tasks such as operating evacuation centers and transporting goods under instructions from those headquarters. Further, although several of the regional disaster response plans stipulated that the role of the ICT divisions during a disaster would be information services for the residents; this was not possible because key communication means were disrupted.

The following is a typical timeline of responses, created based on activities conducted by employees of ICT divisions at the municipalities that were surveyed, in the months that immediately followed the disaster on March 11.

1) Immediately after disaster struck, checked the condition of the servers and other equipment in the server room.
2) Confirmed resident whereabouts, and helped with transporting goods and other tasks related to the operation of evacuation centers.
3) After power supply was resumed, worked on restoring information processing systems, networks and other related equipment within the facility.
4) Studied the introduction of and developed information processing systems that can be used for disaster response activities.
5) Worked to restore public data networks in the region.

Subcontractors of information processing systems and employees from other prefectural governments contributed immensely to realizing (3), (4) and (5) above. Private businesses, other than subcontractors of information processing systems, also supported relief efforts significantly through the provision of office automation and other equipment necessary to conduct work.

Five of the municipalities surveyed had to relocate all government functions, making it difficult to conduct an integrated assessment of recovery processes. In this section, however, we have tried to describe in an organized manner the damage caused and steps taken towards recovery in five areas vital to maintaining ICT environments:

power supply, telecommunications infrastructure, information processing systems (digital data and servers), business relations with subcontractors of information processing systems, and facilities (including computer hardware).

In order to provide an overview of the status of devastation at the municipalities surveyed, prior to analysis of the situation in each area, we have summarized in the table 2 below information regarding the damage to each municipal government office building, relocation of resident service counters, damage to the relevant ICT division employees, loss of digital data/use of backup data, and earthquake resistance reinforcement measures taken over the past ten years.

From this information, it is apparent that the definitive effects of the tsunami, and not the earthquake, made it impossible to continue operations at all 13 municipal government office buildings. It is our thinking that the quake resistance testing and proofing measures implemented by many of the municipalities over the period of the past ten years paid off.

Table 2: Damages suffered by the municipal government offices surveyed and relocation of resident service counters

(As of January 2012)

Municipalities surveyed		Damage to the government office building	Relocation of resident service functions	Damage to the ICT division employees	Loss of digital data/ use of backup data*	Earthquake resistance reinforcement measures taken over the past ten years
Iwate Prefecture	Miyako City	First floor submerged	No	No damage	No loss/backup data not used	Not implemented Diagnosed as requiring reinforcement
	Rikuzentakata City	Totally submerged (3-storied building)	Yes	Damaged	Data lost/recovered from server hard disk drive and data stored at information processing systems subcontractors' facilities	Implemented in fiscal 2002
	Kamaishi City	Buildings 1 – 4 partially submerged	Yes	No damage	No loss/backup data not used	Not implemented Diagnosed as requiring reinforcement
	Otsuchi Town	Totally submerged (2-storied building	Yes	Damaged	Data lost/recovered from server hard disk drive and data stored at information processing systems subcontractors' facilities	Not implemented
Miyagi Prefecture	Sendai City	No flooding	No	No damage	No loss/backup data not used	Implemented in fiscal 2009
	Ishinomaki City	No flooding	No	No damage	No loss/some backup data used	Earthquake resistance test completed
	Kesennuma City	First floor of branch office submerged	Yes Partially damaged	No damage	No loss/backup data not used	Not implemented

	Higashimatsushima City	No flooding	No	No damage	No loss/backup data not used	Implemented in fiscal 2004
	Minamisanriku Town	3-storied building washed away	Yes	Damaged	Data lost/recovered from data stored at information processing systems subcontractors' facilities	Details not available
Fukushima Prefecture	Iwaki City	First story floor partially destroyed	No	No damage	No loss/backup data not used	Not implemented Plans currently being drafted for earthquake proofing
	Minamisoma City	No flooding	No	No damage	No loss/backup data not used	Implemented in fiscal 2006
	Futaba Town	No flooding	Yes	No damage	No loss/backup data used	Not implemented
	Namie Town	No flooding	Yes	No damage	No loss/backup data used	15-year old building

*Data on the system network under the ICT division supervision

As of January 2012, governments of five municipalities, Rikuzentakata City, Otsuchi Town, Minamisanriku Town, Futaba Town and Namie Town, were operating at makeshift offices. Three of the government offices had to be relocated because the original buildings were submerged by the tsunami floodwaters, and two due to the nuclear accident at the Fukushima Daiichi nuclear power station (hereinafter referred to as the 'nuclear accident') operated by Tokyo Electric Power Company. In Kamaishi City, only resident service counters were moved to another location within city limits because Building 1 of the municipal government office, where resident service functions were earlier carried out, was destroyed by the tsunami and power supply in the area could not be restored immediately. Further, due to land subsidence and heaps of rubble in the vicinity, the area was deemed unsafe.

In Rikuzentakata City, Otsuchi Town and Minamisanriku Town, temporary office buildings were constructed close to the original locations and operations resumed there between March and April. In Futaba Town and Namie Town, the offices had to be relocated twice before operations were resumed at the current location (as of January 2012) and plans call for further moves or transfers to yet unspecified locations. (see Table 3).

Table 3: Relocation of resident service counters

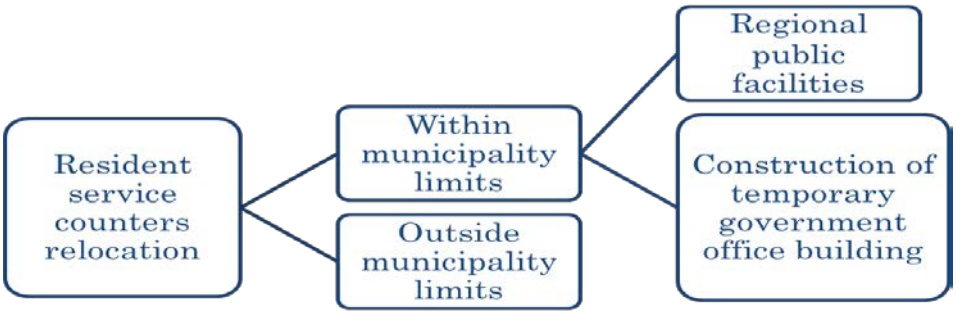
(As of February 2012)

Municipalities surveyed		Damage to the government office building	Relocation of resident service counters
Iwate Prefecture	Rikuzentakata City	Submerged	Makeshift office set up in a prefabricated house on March 19 and services resumed on May 16. Following Buildings 1 and 2, temporary office Building 3 completed on July 18, and Building 4 under construction as of February 2012.
	Kamaishi City	Buildings 1 - 4 partially submerged	Operations resumed at the Kamaishi City Education Center on April 1, and from April 18 at Sea Plaza Kamaishi (near JR Kamaishi Stn.) following relocation.

	Otsuchi Town	Submerged	Services resumed on April 13 at the Central Community Hall, and were moved to a temporary office at the Otsuchi Elementary School ground from April 25, which is currently being expanded.
Miyagi Prefectu	Minamisanriku Town	Washed away by the tsunami	Temporary office established on March 22. A total of 16 buildings completed by October.
Fukushima Prefecture	Futaba Town	No damage	Evacuated to Kawamata Town, Fukushima Prefecture, on March 12; moved to Saitama Super Arena (Saitama City, Saitama Prefecture) on the 19 of the same month; and then again on the 31 to the now defunct Saitama Prefectural Kisai High School (Kazo City, Saitama Prefecture), where operations were resumed.
	Namie Town	No damage	Evacuated to the Namie Town, Tsushima branch office on March 12, relocated on the 15 to Towa Area, Nihonmatsu City of Fukushima Prefecture. From May 23, operations were resumed at an office within the Fukushima Gender Equality Centre in Nihonmatsu City.

Shown below is a diagrammatic representation of resident service counters relocation at the above six municipalities.

Figure 2: Diagrammatic representation of resident service counters relocation



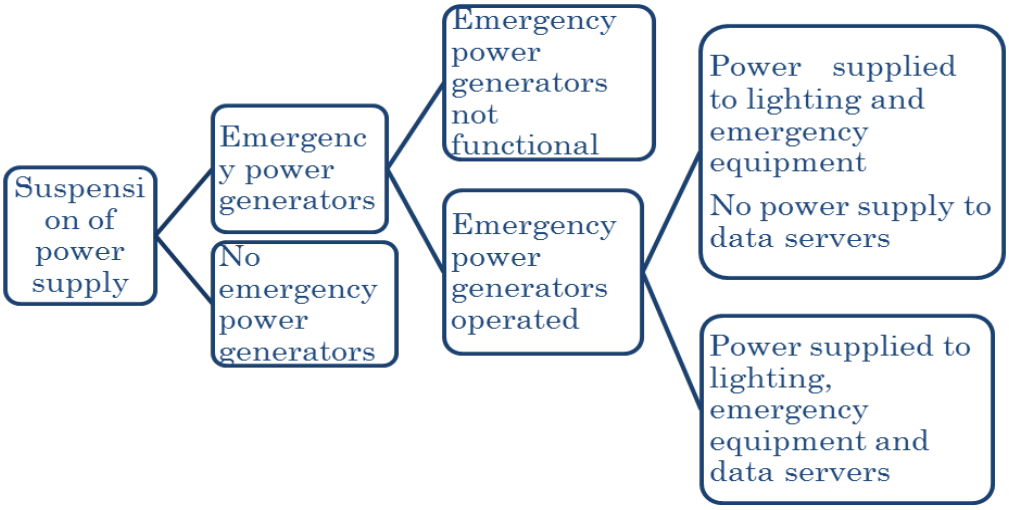
The following sections provide a summary of the damage caused and steps taken towards recovery in five areas vital to maintaining ICT work environments: power supply, telecommunications infrastructure, information processing systems (digital data and servers), business relations with subcontractors of information processing systems, and facilities (including hardware).

4. Power supply

Broadly speaking, potential problems that ICT divisions face in the wake of a disaster are 1) relocation of the server room, the operations room and other facilities, 2) suspension of power supply, 3) disruption of telecommunications lines or damage to information processing systems. Suspension of power supply affected business continuity the most at the 13 municipalities that were surveyed.

Excluding Iwaki City, Minamisoma City and Futaba Town, power supply was suspended at ten of the 13 municipal government office buildings after the earthquake struck on March 11. Figure 3 below illustrates the responses by the ICT divisions of these ten municipalities, whether emergency power generators operated and for what purposes they were used.

Figure 3: Responses by ICT divisions to the suspension of power supply



Emergency power generators were used to supply power to server rooms in Sendai City and Ishinomaki City. Besides the server room, however, in the Sendai City government office and the local ward office, power was supplied only to lighting fixtures. As there was no power supply to the computer terminals and other equipment required to recommence operations and little prospect of power being resumed soon, the servers were shut down temporarily after data backup was completed. In Ishinomaki City, power was supplied to lighting fixtures within the server room, but not to the mainframe computer.

In Kesennuma City and Minamisanriku Town, emergency power generators were used to operate the servers (including temporary servers) for approximately two days from March 15 and about a month from March 22 respectively, before normal power supply was resumed. In Kesennuma, restrictions were placed on system operation

times and access made possible to vital information on residents that was necessary to confirm their whereabouts and safety. At the temporary office in Minamisanriku, laptops were used as servers and all systems were operated using power from emergency power generators until commercial power supply was made available from late May.

The Otsuchi Town Central Community Hall, where the emergency response headquarters was located, is equipped with emergency power generators. Temporary server 1 was installed here and operated for some time using power from the emergency power generators. After about a week power supply was switched to a ground power unit, following which commercial power supply was resumed and temporary server 2 was installed, enabling the provision of various resident services such as *inkan* registration and certification and issue of resident cards. Beginning April 25, operations were moved to a temporary office building with commercial power supply utilizing feeder panels installed at the neighboring Otsuchi Elementary School (see Table 4).

Table 4: Status of power supply at the municipal government office buildings immediately after the March 11 disaster and power resumption timing

Municipalities surveyed		Suspension of power supply	Status of power supply at the municipal government office buildings (including use of emergency power generators)	Power resumption timing
Iwate Prefecture	Miyako City	Yes	Power supply to lighting fixtures using compact emergency power generator	March 26
	Rikuzentakata City	Yes	Power supply to lighting fixtures using emergency power generator	March 14 (only areas where emergency response headquarters were set up)
	Kamaishi City	Yes	Emergency power generator installed at Building 1 after the disaster to supply power to lighting fixtures.	Mid July (March 20 to server room and peripherals)
	Otsuchi Town	Yes	Power supply using emergency power generator; about a week after the disaster switched to a ground power unit (both at the Central Community Hall, where the emergency response headquarters was located)	March end (to the Central Community Hall) April 25 (to the temporary office)
Miyagi Prefecture	Sendai City	Yes	Power supply to lighting fixtures and emergency equipment using emergency power generator (emergency power generator used at the Information Systems Center where the server room is located, but since there were no prospects for early resumption of power, use was discontinued on the night of March 11)	March 12 (March 13 to the Information Systems Center)
	Ishinomaki City	Yes	Power supply to server room and lighting fixtures using emergency power generator	March 26
	Kesennuma City	Yes	Power supply to the emergency response headquarters and computing systems from March 15 using emergency power generator leased by a local electrical utility	March 17

	Higashimatsushima City	Yes	Power supply to the emergency response headquarters only using emergency power generator	March 15
	Minamisanriku Town	Yes	Power supply to the emergency response headquarters and temporary office using emergency power generator	May end (temporary office)
Fukushima Prefecture	Iwaki City	No	-	-
	Minamisoma City	No	-	-
	Futaba Town	No	-	-
	Namie Town	Yes	Details not known	March 12

Immediately after the disaster, the Miyako City municipal main office moved its servers to the Niisato office that is situated further inland and is better equipped with larger emergency power generators that can support server operation. From March 14, normal power supply was resumed in the Niisato area and the servers could be operated without utilizing the large emergency power generators.

5. Telecommunications infrastructure

In this section we analyze telecommunications infrastructure in the disaster areas from the perspective of intra- and inter-regional means of communication. Communication networks within the municipal government office buildings and public networks within the region are referred to as ‘intra-regional communication means’, while ‘inter-regional communication means’ indicate landline telephones, mobile phones, internet and satellite phones. ‘Public networks within the region’ refer to communication networks that link users to facilities providing government services and to the municipal government office buildings.

5.1 Telecommunications infrastructure--intra-regional communication means

Communication networks at 11 of the 13 municipal government office buildings surveyed were disrupted immediately after the earthquake and tsunami due to power failures and damage to communication cables.

At the Miyako City, Kamaishi City, Sendai City, Kesennuma City, Higashimatsushima City and Namie Town government office buildings, communication networks returned to normal as soon as power supply was restored. Damaged communication cables disrupted networks in the Sendai City, Ishinomaki City and Iwaki City government office buildings. In Sendai City, which experienced both power failure and damage to cables, restoration of public networks was delayed even after government office networks became operational. Communication networks were newly installed within the temporary offices of the Rikuzentakata City, Otsuchi Town and Minamisanriku Town municipalities in conjunction with relocation (see Table 5).

The raised access floor of the server room in the Ishinomaki City government office building was flooded by the tsunami, submerging all power sources and communication cables in the floodwater. However, due to lack of fuel and related logistics issues, replacement of the cables could not be done before April. As a result, the ICT division was compelled to continue using the wet cables, despite fears of short circuits and interrupted communications.

With regard to public networks within the region, communications have yet to be restored in some areas. Reasons for this delay include cables washed away by the tsunami, collapse of utility poles, destruction of cables due to land subsidence and other damage, and uncertain plans regarding future use of land in the devastated areas.

In Ishinomaki City and Higashimatsushima City, that have their own optical fiber network, employees of the ICT divisions are visiting different areas to assess the damage and restore networks wherever possible with support from the National government—a time-consuming process. In Minamisanriku Town, surveys are still underway to gauge the destruction to the town's self-operated optical fiber network.

Table 5: Damage to intra-regional communication means and date of restoration

(As of January 2012)

Municipalities surveyed		Damage suffered		Date of restoration	
		Government office building networks	Public networks within the region	Government office building networks	Public networks within the region
Iwate Prefecture	Miyako City	×	Partially disrupted	March 26	June
	Rikuzentakata City	×	No sites that offer government services	Switching to new networks on July 23	September and later
	Kamaishi City	×	× (Networks linking Buildings 1 - 5)	Mid July	Mid July
	Otsuchi Town	×	- (1)	Late April	-
Miyagi Prefecture	Sendai City	Disrupted due to power failure and partial destruction of cables		March 16	
	Ishinomaki City	×	Cables partially washed away	March 26 (Cable replacement on April 30)	May to October (Partial disconnection continues)
	Kesennuma City	×	Cables partially washed away	March 17	April to September end
	Higashimatsushima City	×	Cables partially washed away	March 15	Not restored where cables were washed away
	Minamisanriku Town	×	Cables partially washed away	By April end	May 25(new installation)
Fukushima Prefecture	Iwaki City	×	Cables partially destroyed	March 12	December (not restored in some areas)
	Minamisoma City	○	○	-	-
	Futaba Town	○	(No sites that offer government services)	-	-
	Namie Town	×	Details not known	March 12	Details not known

×: network not operational; ○: network operational

(1) Otsuchi Town has a branch office, but it is not linked to the network.

5.2 Telecommunications infrastructure--inter-regional communication means

In many of the prefectures affected by the disaster, all means of communication with the outside were lost due to power failure, resulting in 1- 2 weeks of isolation. The only communication means during this time was by satellite telephone, distributed mainly to emergency response headquarters. Satellite phones, however, are rarely used in daily life and comments regarding their usage included statements such as, “ We don’t know how to use a satellite phone,” “We don’t have contact numbers,” ”(The phone number was not made public), but there was a leak of information and we received numerous general enquiries at that number, hindering usage during emergencies.” Other problems associated with its usage were poor connectivity due to telephone congestion control as all affected prefectures began using the telephone at once, and short battery life that prevented frequent use.

Suspension of power made it impossible to get external information via television and radio, and as a result some areas did not have any access to information. With no proper means of acquiring information and all communication with the outside cut off, many of the municipalities could not even send out requests for help.

In Higashimatsushima City, Iwaki City, Minamisoma City and Futaba Town, Internet services were disrupted due to connectivity problems other than power failure.

Landlines, mobile phones and the Internet were operational in Minamisoma City on March 11, however, all these services were disrupted for a week from the 12th, isolating the city from the rest of the world (see Table 6).

Table 6: Status of inter-regional communication means and timing of restoration, and use of satellite mobile phones

Municipalities surveyed		Status of usage *1 (March 11)			Timing of restoration			Use of satellite mobile phones*3
		Landlines	Mobile phones*2	The Internet	Landlines	Mobile phones	The Internet	
Iwate Prefecture	Miyako City	×	Δ (1)	×	From April	-	March 26	○
	Rikuzentakata City	×	×	×	Details unknown	From March 18	From July at the temporary office	○
	Kamaishi City	×	×	×	From March 18	Around March 18	March 20	○
	Otsuchi Town	×	×	×	April 25	Around March 20	Around May 25	○
Miyagi Prefecture	Sendai City	○	Δ (2)	×	-	Around March 14	March 13	○
	Ishinomaki City	×	×	×	Around March 26	Around March 26	Around March 26	○
	Kesennuma City	×	Δ (3)	×	March 21	From mid-March	March 17	○
	Higashimatsushima City	×	×	×	From March 17	By March end	March 17	○
	Minamisanriku Town	×	×	×	From late March	From April	March end	No arrangements
Fukushima Prefecture	Iwaki City	○	○	×	-	-	March 12	○
	Minamisoma City	○ (From March 12 ×)	○ (From March12 ×)	○ (From March 12 ×)	Around March 19	Around March 19	Around March 19	Poor connectivity
	Futaba Town	○	Δ (4)	×	-	Around March 18	4:30 p.m. on March 11	No arrangements
	Namie Town	×	×	×	Details unknown	Details unknown	late May	○

*1: Could not be used: ×, Could be used: ○, Could be used with some restrictions: Δ

*2: Information on the status of usage of mobile phones is as stated by the survey respondents. The status of usage of mobile phones immediately after the disaster and the timing of restoration varies by telecommunications service provider and area.

*3: The user was not always the ICT division.

(1) Mobile phones could be used between only a few telecommunications service providers.

(2) Varies by telecommunications service provider and area.

(3) Could be used until around 10 p.m. on March 11.

(4) Could be used only to send and receive e-mails, not to make phone calls

Satellite mobile phones were not distributed to Miyako City and Namie Town on March 11, but were provided later as part of relief supplies. Namie Town received satellite mobile phones from Fukushima Prefecture when the town office was relocated to the Tsushima branch office, also in the same town. Rikuzentakata City had equipped its government offices with satellite mobile phones, but the instruments at the main government office building were destroyed by the tsunami. Of all the satellite mobile phones distributed among the 11 district headquarters, only two units at the district headquarters along the mountains remained operational.

Futaba Town received an offer from a private business for the leasing of satellite mobile phones, but could not accept the offer as the offices had to be relocated several times.

6. Information processing systems

In this section we analyze the data backup measures of information processing systems operated and managed by the ICT divisions of the municipalities surveyed, the status of data usage after the disaster, the relation between systems recovery and re-commencement of resident service counters, and information processing systems that are required to conduct disaster response operations. We focused on four information processing systems, namely, The Basic Resident Registration, Family Registration, Tax, and Social Security systems. At two of the 13 municipalities surveyed, the ICT divisions were responsible for operation and management of the family registration system -- Otsuchi Town and Namie Town. The information processing systems listed in Table 7 are operated and managed by the ICT divisions of each municipal governments.

6.1 Data backup measures

The data backup measures at each of the municipalities are centered on three elements: place of storage (within the main government office building/outside the main government office building (within the town or city/outside the town or city)), method of storage, and frequency of backup.

As of March 11, three of the 13 municipalities surveyed (Kamaishi, Ishinomaki and Iwaki) had data stored outside the main government office building (within the town or city) and two (Sendai and Namie) at remote locations outside the town or city.

Most government offices used tapes to backup data and the tapes were stored in the server room. Ishinomaki City, Minamisanriku Town and Namie Town had backed up data on the server hard disk drive.

The frequency of data backup varied by municipality, however, all 13 municipalities

surveyed backed up files on a daily to weekly basis.

With regards to data backup and recovery regulations, most municipalities had no organization-wide standards for data backup. Each ICT division determined the place of storage and backup frequency of files in information processing systems that were managed and operated by them. Business divisions in charge of management and operation of application software established individual procedures for system operation and data backup. The ICT division of the Sendai City government office, however, had an information security policy and has established procedures for implementing security measures related to information processing systems under their supervision, as well as unified standards for data backup. For systems managed by individual business divisions, operating guidelines were drawn up by division, which also specified data backup and recovery procedures.

Table 7: Data backup measures

(As of March 11, 2011)

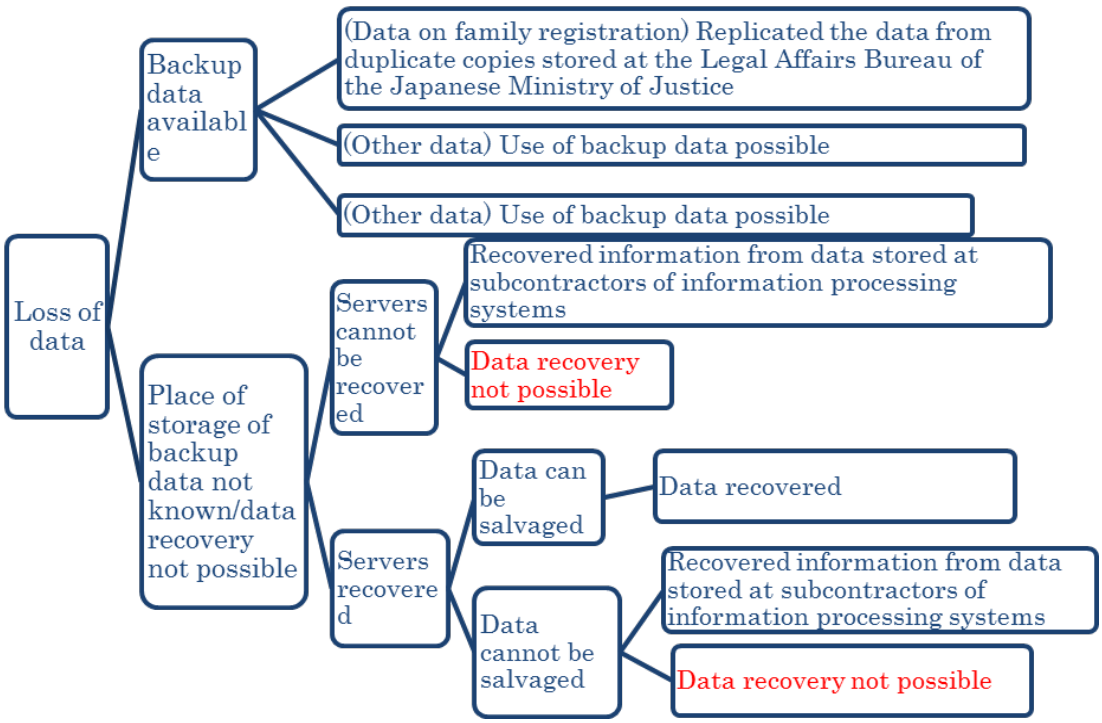
Municipalities surveyed		Information processing system	Backup frequency	Storage method	Place of storage*	
					Within the government office building	Outside the government office building
Iwate Prefecture	Miyako City	Residents' information system (Basic Resident Registration Network, Tax and Social Security systems)	Daily	Tapes	○	-
	Rikuzentakata City	The Basic Resident Registration Network System (including Social Security) and Tax systems	Daily	Tapes	○	-
	Kamaishi City	Basic Resident Registration Network	Daily	External storage media	○	×
	Otsuchi Town	Basic Resident Registration Network, Family Registration, Tax and Social Security systems	Daily	Tapes	○	-
Miyagi Prefecture	Sendai City	Basic Resident Registration Network, Tax and Social Security systems Note: Operated by a local information processing systems center (specified as the government office)	Daily (within the government office building) Once a month (outside the city)	Tapes	○	○ (outside the city)
	Ishinomaki City	Basic Resident Registration Network and Tax systems	Weekly (within the government office building) Once a month (at an external location)	Server hard disk drive (within the government office building) Tapes (at an external location)	○	○ (within the city)

	Kesennuma City	Residents' information system (Basic Resident Registration Network, Social Security systems and tax)	Daily	Tapes	○	-
	Higashimatsushima City	Basic Resident Registration Network, Tax and Social Security systems	Weekly	Tapes	○	-
	Minamisanriku Town	Basic Resident Registration Network, Tax and Social Security systems	1 – 2 times a week	Tapes and server hard disk drive	○	-
Fukushima Prefecture	Iwaki City	Basic Resident Registration Network system	Daily	Tapes	○	○ (within the city)
	Minamisoma City	Basic Resident Registration Network, Tax, Social Security and Family Registration systems (all managed by business divisions)	Daily	Tapes	○	-
	Futaba Town	Residents' information system (including Tax, and Social Security)	Daily	Tapes	○	-
	Namie Town	Basic Resident Registration Network, Tax, and Social Security systems	Daily	Server hard disk drive and tele-transmission	○	○ (outside the town)

*○: stored, -:not stored

The Rikuzentakata City, Otsuchi Town and Minamisanriku Town government office buildings were completely devastated by the tsunami and the data servers were either submerged in or washed away by the floodwaters. None of the three municipalities had backup data stored at locations outside the government office buildings, and for a while it seemed that all digital data had been lost. Based on the events that took place at the three municipalities, the instances of the loss of data to recovery can be classified as shown in Figure 4 below.

Figure 4: Instances of data loss and recovery



Municipalities that belong to each instance are as follows:

<u>Backup data</u>

- Replication of family registration[3] digital data from duplicate copies stored at the Legal Affairs Bureau…Rikuzentakata City, Otsuchi Town and Minamisanriku Town
- Use of backup data possible…None applicable
- Recovery of backup data not possible…Rikuzentakata City

<u>Place of storage of backup data not known</u>

- Servers cannot be recovered…Minamisanriku Town
- Recovered the submerged data servers and salvaged files from the server hard disk drive…Rikuzentakata City, Otsuchi Town

  (Rikuzentakata City, Otsuchi Town and Minamisanriku Town utilized the backup data stored at subcontractors of information processing systems until files were recovered.)

While waiting for data from the server hard disk drive to be recovered, Rikuzentakata City commenced the creation of a temporary system based on the Basic

[3] In Japan there are two primary citizen registration database, one recording current residence and the other registering family connections.

Resident Registration Network information (hereafter called ‘Juki Network data’) as of the end of February, stored at subcontractors of information processing systems. Similarly, a temporary finance and accounting system was created using finance and accounting information (hereafter called ‘financial data’) as of January 23, stored at the same subcontractor of information processing systems. Only Juki Network data, Social Security information (hereafter called ‘Social Security data’) and data related to tax returns were later recovered from the server hard disk drive. Information from the Family Registration system (hereafter called ‘Family Registration data’) was replicated from copies stored at the Legal Affairs Bureau of the Japanese Ministry of Justice. All other data was lost.

Similarly, in Otsuchi Town temporary systems were created using Juki Network data and data related to tax returns (hereafter called Tax data) as of March 1, stored at subcontractors of information processing systems. Juki Network data and Tax data were later recovered from the server hard disk drive, but Social Security data could not be restored. The server on which Family Registration data was stored could not be salvaged, and digital files of information up to February 2011 were recreated from copies stored at the Legal Affairs Bureau and from applications received after the disaster.

In Minamisanriku Town, the servers were all washed away and could not be retrieved. In addition, all backup data stored at the main government office building was also washed away and for a while it seemed that all resident information had been lost. By chance, however, it was later found out that the subcontractor of information processing systems had backup data from the core systems of the Juki Network, tax, employee salaries, accounts, caregiving, and national insurance, stored at their facilities, with information updated up to March 4. This was the only backup data that could be recovered and was used to create a provisional system after relocation to the temporary office building. All other file servers, excluding that for the core systems, had no backup done at external locations, resulting in a complete loss of data. Family Registration data was recreated from copies of digital files stored at the Legal Affairs Bureau.

Although no data was lost, Ishinomaki City, Futaba Town and Namie Town used backup data at some resident service counters after the disaster. Certificates of residence (with the ‘Family relationship’ column left blank) issued by Ishinomaki City on March 28 utilized backup data as of March 11 on resident information. The Futaba Town government office that was relocated to the Saitama Super Arena used resident information backup data stored at an information processing systems subcontractor to issue Disaster-victim Certificates. Backup data stored at the Futaba Town government office building was retrieved when functions were temporarily moved back to the town. When the Namie Town government office was relocated to the Towa Area of Nihonmatsu City, a simply configured data server was installed using backup data

stored at a data storage center outside the town, following which the temporary office building and the center were linked by a computer network.

Table 8: Usage of backup data

Municipalities surveyed		Status of data loss (Data in the information processing systems listed in Table 7)*1	Usage of backup data*2	Place of storage of backup data used	
				Within/without the government office building	Information processing systems subcontractor
Iwate Prefecture	Miyako City	-	-	-	-
	Rikuzentakata City	○ (Recovered from the server hard disk drive)	Backup data stored at information processing systems subcontractor used	Data recovery measures not taken	○
	Kamaishi City	-	-	-	-
	Otsuchi Town	○ (Recovered from the server hard disk drive)	○ (Backup tapes could not be retrieved)	Not retrieved	○
Miyagi Prefecture	Sendai City	-	-	-	-
	Ishinomaki City	-	○	○	-
	Kesennuma City	-	-	-	-
	Higashimatsushima City	-	-	-	-
	Minamisanriku Town	○ (Servers washed away)	○ (Backup tapes could not be retrieved)	Not retrieved	○
Fukushima Prefecture	Iwaki City	-	-	-	-
	Minamisoma City	-	-	-	-
	Futaba Town	-	○	○	○
	Namie Town	-	○	○	-

*1: ○: Lost, -: Not lost

*2: ○: Used, -: Not used

**: Family Registration data lost at Rikuzentakata City, Otsuchi Town and Minamisanriku Town was recreated using duplicate files stored at the Legal Affairs Bureau.

As a post-disaster measure, Rikuzentakata City eliminated the use of tapes for storing data and as a general rule for the entire office, switched to the use of server hard disk drives. Individual system configurations, however, necessitate the use of unique data backup methods.

After moving to the temporary government office building, Otsuchi Town installed standby data servers in the server room for the Juki Network, Family Registration, Tax and Social Security systems and is currently duplicating all information. Further, remote backup of the Juki Network system via LGWAN was commenced in December 2011.

In their temporary office buildings, Minamisanriku Town and Futaba Town linked their systems to those of information processing systems subcontractors via computer networks that are currently being used to conduct business. Data backup locations outside the towns are also being used (excluding Family Registration data, which is being backed up within the respective temporary office buildings).

In the summer of 2011, employees of the Ishinomaki City government office independently developed a system that enables daily data backup on the server hard disk drive, and operation of the system by the ICT division has begun.

6.2 Damages to and recoveries of information processing systems managed and operated by ICT divisions

Table 9 shows the location of the server room in each municipal government office at the time the disaster struck

Table 9: Server room location

(As of March 11, 2011)

Municipalities surveyed		Server room location
Iwate Prefecture	Miyako City	Second floor of seven-storied government office building
	Rikuzentakata City	First floor of three-storied (four in some sections) government office building
	Kamaishi City	Not disclosed
	Otsuchi Town	Second floor of two-storied government office building
Miyagi Prefecture	Sendai City	External location (information processing systems center within the city)
	Ishinomaki City	First floor of seven -storied government office building and second floor of branch office
	Kesennuma City	Second floor of three-storied government office building and third floor of three-storied Densan Center situated close to the office building
	Higashimatsushima City	Second floor of three-storied government office building
	Minamisanriku Town	Second floor of three-storied Disaster Prevention office adjoining the government office building
Fukushima Prefecture	Iwaki City	Seventh and eighth floors of eight-storied government office building
	Minamisoma City	Third floor of four-storied government office building
	Futaba Town	Second floor of four storied government office building
	Namie Town	Second floor of four storied government office building

The Kamaishi City and Sendai City municipalities had installed server rooms at locations besides the government office that housed the ICT divisions. The information processing Systems Center in Sendai City was like a branch office with ICT division employees stationed there permanently.

Iwaki City moved its data servers to an external, and safer, location in September 2011.

Rikuzentakata City installed data servers within the temporary government office building; Otsuchi Town in the Central Community Hall; and Minamisanriku Town in the data storage center of an information processing systems subcontractor.

Minamisanriku Town operates its Family Registration data server within the temporary government office building.

Futaba Town initially operated temporary systems within the Saitama branch office, and later moved its data servers to the data storage center of an information processing systems subcontractor. Namie Town had used a data storage center even before the disaster, and after relocating to the Towa Area, Nihonmatsu City office used a computer network to link systems to the data center.

Looking next at the dates when power supply was resumed, operation of information processing systems was recommenced and resident service counters were reopened, it can be seen that, most municipalities prioritized the operation of information processing systems as soon as power supply was resumed, followed by the reopening of resident service counters for the issue of certificates and other documents. (see Table 10).

Table 10: Dates when power supply was resumed, operation of information processing systems was recommenced and resident service counters were reopened

Municipalities surveyed		Power supply resumed	Operation of information processing systems recommenced	Resident service counters reopened
Iwate Prefecture	Miyako City	March 26	March 14	March 14
	Rikuzentakata City	March 14 (only areas where disaster response headquarters were set up)	March 23 (provisional)	Beginning March 23
	Kamaishi City	Mid July (data server and peripherals March 20)	April 1 (moved to another facility)	April 1
	Otsuchi Town	April 25 (at the temporary government office building)	March 29 (temporary server 1), April 13 (temporary server 2)Power supply to both servers from ground power units)	April 13
Miyagi Prefecture	Sendai City	March 12 (March 13 to the Information Systems Processing Center)	Online services were resumed on March 17	March 14
	Ishinomaki City	March 26	March 26	Partially reopened on March 28 All counters reopened on April 11
	Kesennuma City	March 17	March 15 (power supply from emergency power generators), all systems resumed from 17	From March 22
	Higashimatsushima City	March 15	March 16	From mid April
	Minamisanriku Town	Late May (at the temporary government office building)	March 28 (power supply from emergency power generators)	Partially reopened on March 28 Other counters reopened beginning April 29

Fukushima Prefecture	Iwaki City	-	Operation not disrupted	March 14
	Minamisoma City	-	Operation not disrupted	March 14
	Futaba Town	-	April 18 (at the Saitama branch)	April 18
	Namie Town	March 12	April 4 (a simply configured data server was set up in Towa Area of Nihonmatsu City) Late April (at a data storage center in Iwaki City)	Beginning mid April

On March 29, Otsuchi Town transferred backup data to temporary server No. 1 that was used to access residents' information. Temporary server No. 2 was installed on April 13 and the issue of certificates and other documents was recommenced.

In Sendai City, applications on paper continued to be accepted for services for which paper ledger could be used. Certificates of residence with the 'Family relationship' column left blank were issued by Ishinomaki City on March 28, the last working day of the fiscal year, utilizing backup data. Power was supplied to the mainframe computer between March 26 and April 11 and information input on March 11 and thereafter was transferred to the mainframe computer. In Kesennuma City, emergency power generators were used to supply power to operate servers and enable access to residents' information only from March 15 to 17, when normal power supply was resumed. As Higashimatsushima City prioritized disaster response measures and recommenced operation of information processing systems, and resident service counters, and these were carried out later than other municipalities.

Miyako City first moved its servers to the Niisato office situated further inland and functions such as issuing certificates were conducted here. As computer networks within the municipal government office buildings and public networks within the region were not yet operational at this time, applications received at the main government office building and at branch offices were transported to the Niisato office the same day and processed for delivery the following day. Family Registration data utilized as personal identification information for applications received on weekends was installed on three laptops and used without linking to a computer network.

6.3 Disaster response measures and information processing systems

The response measures summarized below require a large number of people working at the disaster site to carry out numerous activities, including creating lists of survivor names and other information, manning resident service counters to issue Disaster-victim Certificates required to avail of disaster relief and other support systems, distribution of relief money, accepting applications for temporary housing, and tearing down damaged buildings and clearing debris.

The disaster response measures taken by the ICT divisions of 13 municipalities

surveyed can be primarily divided into the following:

1) Documenting evacuee names and other information (on paper)
2) Documenting evacuee names and other information (on the computer)
3) Restoring operation of information processing systems
   -Upgrade of existing systems
   -Development and introduction of new systems
4) Verifying information in various lists with previously documented residents' information
5) Issuing of Disaster-victim Certificates

1) and 2) are extremely labor-intensive tasks and most of the municipalities made significant efforts to complete this unexpected post-disaster duty that employees also found demanding.

Information processing systems that were restored or newly introduced and the timing of measures taken differ by municipality. The system types may, however, be broadly divided into the following two types:

-Systems based on residents' information that link to all government functions
-Individual systems for each function (issue of Disaster-victim Certificates, distribution of relief funds, etc.)

The Disaster Victims Support System is one example of an existing system that is based on residents' information and links to all government functions. Survey respondents were also asked questions about the introduction of this system. Although none of the municipalities had installed the system before March 11, 2011, Miyako City, Ishinomaki City, Kesennuma City, Minamisanriku Town and Iwaki City, have introduced it since and selectively use only those features of the system that are required for their individual operations. Miyako City utilizes the system to manage distribution of relief funds; Ishinomaki City for the issue of Disaster-victim Certificates; Kesennuma City for the management of debris removal; and Minamisanriku Town to manage distribution of relief funds and occupancy of temporary housing facilities.

Table 11 below lists the date of issue of Disaster-victim Certificates by each municipality and the information processing systems that were introduced. Issuing of certificates as part of regular duties was resumed on the same day that resident service counters were reopened at each municipality.

Table 11: Dates when resident service counters were reopened, Disaster-victim Certificates were issued and status of development and introduction of information processing systems

(As of January 2012)

Municipalities surveyed		Reopening of resident service counters	Issue of Disaster-victim Certificates	Status of development and introduction of information processing systems ( )indicates the system operation start date
Iwate Prefecture	Miyako City	March 14 (Niisato office) March 27 (main office building)	Around March 20	Disaster Victims Support System (mid-May) Disaster Victim's Information Registration and Retrieval System (December 22)(1)
	Rikuzentakata City	Beginning March 23	April 27	Not introduced
	Kamaishi City	April 1	Beginning early April	Developed an original Disaster Victim's Information Registration and Retrieval System (April 18)
	Otsuchi Town	April 13	April 27	System for the issue of Disaster-victim Certificates (National Research Institute for Earth Science and Disaster Prevention) (April 27) Disaster Victim's Information Registration and Retrieval System (around May)(1)
Miyagi Prefecture	Sendai City	No disruption	Beginning around March 23	Disaster Victim's Information Registration and Retrieval System (upgrade of existing system, after Golden Week holidays)
	Ishinomaki City	Partially on March 28 All counters reopened on April 11	Beginning from Golden Week holidays	Disaster Victims Support System (Beginning from Golden Week holidays)
	Kesennuma City	From March 22	April 18	Disaster Victims Support System (April - May) Developed original Disaster -victim Certificates database and Disaster Health Information Management System (Beginning mid April)
	Higashimatsushima City	From mid-April	April 4	Developed original Disaster Victim's Information Registration and Retrieval System (April 18)
	Minamisanriku Town	Partially on March 30 All counters reopened beginning April 29	Early May	System for the issue of Disaster-victim Certificates (provided by subcontractor of information processing systems) (late March) Disaster Victims Support System (November)
Fukushima Prefecture	Iwaki City	March 14	April 4	Developed original Disaster Victim's Information Registration and Retrieval System (late May) Disaster Victims Support System (November end)
	Minamisoma City	March 14	Beginning April 25	Developed original Disaster Victim's Information Registration and Retrieval System (April)
	Futaba Town	April 18	June 22	Introduced an information processing systems managed by a call-center type system (around March 20)
	Namie Town	Beginning mid-April	March 22	Developed original Disaster Victim's Information Registration and Retrieval System (March 23)

(1) A system created and provided through collaboration between industry, government and academia, under the guidance of Haruo Hayashi, Professor at the Disaster Prevention Research Institute, Kyoto University. Iwate Prefecture takes the initiative in constructing the system and providing operational support to municipalities whose administrative functions have weakened due to the effects of a disaster.

Most municipalities commenced issuing Disaster-victim Certificates beginning in April.

Higashimatsushima City began operations related to issuing Disaster-victim Certificates simultaneously with start of system development. Initially management of applications received and certificates issued was done on paper, and data entries were made after system development was completed. In Namie Town, applications were initially processed on paper, but as this proved to be a time consuming and burdensome job, operation of the system was begun from the very next day after development was completed. After the disaster, Kamaishi City applied for the product key required to install the Disaster Victims Support system, but had to abandon the plan due to system architecture and data loading problems.

Following the disaster, many municipalities considered introduction of the Disaster Victims Support system, but were forced to defer introduction for the following reasons:

-Installation on data server was not successful
-Data processing is required, making use of the system cumbersome
-A drop in performance was expected when handling large volumes of data
-Studying the system and customizing could not be completed in time for issue of the certificates
-Operational differences with the developer (Nishinomiya City) regarding the format of the Disaster-victim Certificate and other issues
-Information upload regarding disaster victims was already completed using a different application software

All of the problems mentioned in the above comments could have been avoided if preparations had been made in normal times to configure the system beforehand and train personnel to be able to upload resident information immediately in the event of a disaster.

On the other hand, as many post-disaster tasks cannot be foreseen, it is often difficult to determine beforehand what information upload will be required (and what will not) during a disaster. The following are examples of items that cannot be confirmed earlier and require some form of technical support to upgrade the system as may be needed after a disaster.

-No record of relocation history of evacuees
-Information on temporary housing choices of evacuees cannot be uploaded
-Information on management of relief goods cannot be updated
-No feature to record transactions at resident service counters

The operation of information systems to deal with disaster response measures, including the Disaster Victims Support system, requires more than just installing the system on a server. As explained above, emergency preparedness measures must be taken to enable uploading of resident information immediately after a disaster, and training to ensure business continuity and provide support to victims must be implemented beforehand.

In addition, not just considering introduction of system for disaster response measures, steps must also be taken to ensure speedy coordination between systems to enable extraction of information from the existing resident information system and conversion to the new format.

7. Business relations with subcontractors of information processing systems

Although some of the 13 municipalities surveyed had specified clauses in their contracts regarding measures that must be taken by subcontractors of information processing systems in the event of a system failure, none of the contracts included action anticipating natural disasters.

In this survey, we asked participants about their business relations with subcontractors of information processing systems and the kind of assistance they received during the recovery process. The contents of responses received (although fragmented) regarding the role played by subcontractors of information processing systems have been summarized below. We can see that they worked together with employees of ICT divisions on almost all operations related to system recovery and also contributed significantly to municipalities that had to relocate their offices, particularly through the provision of ICT equipment. In addition, they also played a major role in helping municipalities recover lost data by transferring backup files stored at their facilities as part of the subcontracting agreement.

The main forms of support received by each municipality are summarized in Table 12 below.

Table 12: Main forms of support provided by subcontractors of information processing systems

(As of January 2012)

Municipalities surveyed		Main forms of support received (limited to the forms of support identified through this survey)
Iwate Prefecture	Miyako City	Worked together with ICT division employees to relocate data servers
	Rikuzentakata City	Provided backup data, helped recover data server hard disk drives a week after submerging and salvage data
	Kamaishi City	Laying of cables by telecommunications carrier
	Otsuchi Town	Helped recover data server hard disk drives, restore data and configure systems, and

		provided equipment
Miyagi Prefecture	Sendai City	Checked the condition of data servers and other equipment at the information processing systems center
	Ishinomaki City	Verified system damage and upgraded the Disaster Victims Support system
	Kesennuma City	Conducted inspections of data servers
	Higashimatsushima City	Supervised the export of Juki Network data to configure the Disaster Victim's Information Registration and Retrieval System
	Minamisanriku Town	Provided backup data, configured systems and provided equipment
Fukushima Prefecture	Iwaki City	Checked the safety features of the data server room
	Minamisoma City	Provided equipment
	Futaba Town	Provided backup data and computer terminals, and helped introduce the call center-type system
	Namie Town	Helped configure simple data servers after relocation and provided computer terminals

ICT divisions, even in normal times, play an important role in supporting the business foundations of the entire office and their working relations with other divisions greatly influences the business relationship with subcontractors of information processing systems. Responses to survey questions regarding the information processing systems operated and managed by ICT divisions show that at most municipal government offices, each business division individually manages the operation of exclusive application software, including the signing of agreements with subcontractors of information processing systems. This may be one crucial issue that must be dealt with when considering the future role of ICT divisions at municipal governments.

At most of the 13 municipalities surveyed, the relevant division in charge of family registration matters oversaw the operation of the Family Registration system.

8. Facilities (including computer hardware)

This section provides a summary of the damage to facilities, such as server rooms (including ventilation facilities) and offices (including computer hardware), as well as the available ICT personnel at the time.

The power failure following the disaster cut off server room ventilation systems at most of the municipal government offices. This did not pose a major problem as outside temperatures were not high, and only a few municipalities mentioned this issue during the survey. In Minamisanriku Town, however, where the intensity of damage to the government office building necessitated a move to a temporary location, a server room could not be set up within the temporary government office building. Coupled with concerns regarding the system operational environment when temperatures rose in summer, this led to the decision to install servers (excluding the Family Registration data server) at a data storage center outside the town. Futaba Town could not install a server room within the (now defunct) Saitama Prefectural Kisai High School because it was not certain how long they could continue operations there, and hence switched to

the use of servers at a data storage center.

Rikuzentakata City, Otsuchi Town, Minamisanriku Town, Futaba Town and Namie Town had to set up new offices for their ICT divisions after moving to the temporary office building.

In addition to subcontractors of information processing systems, other private businesses also provided tremendous support in recovering and restoring ICT equipment damaged by the tsunami. It is no exaggeration to say that recovery efforts would have been delayed without support from the outside.

With regard to ICT personnel, there was a notable lack of skilled engineers particularly in Rikuzentakata City, Otsuchi Town and Minamisanriku Town, who could develop and maintain ICT operational environments at the temporary government office buildings. ICT division employees from Nagoya City, Hachimantai City and Yahaba Town were sent on long-term assignments to Rikuzentakata City and Otsuchi Town; in Minamisanriku Town, however, the ICT division received only short-term support and when responding to survey questions expressed the need for extended support. Systems must be put in place to provide personnel support in accordance with the needs of the affected municipalities.

Table 13 summarizes the actions taken by survey respondents during the days immediately after the disaster on March 11.

Table 13: Actions taken by ICT division employees during the days immediately after the disaster on March 11

Municipalities surveyed		Actions taken by ICT division employees during the days immediately after the disaster on March 11
Iwate Prefecture	Miyako City	Inspections of server rooms, securing food supplies, etc.
	Rikuzentakata City	After taking refuge on the roof of the government office building for a night, procured and distributed food supplies, blankets and other items, and helped confirm residents' whereabouts
	Kamaishi City	Photographing disaster scenes as part of activities specified under the regional disaster response plan, waiting for power supply to resume
	Otsuchi Town	On a business trip to Morioka, returned on March 12 and helped with the operation of evacuation centers
Miyagi Prefecture	Sendai City	Inspections of server rooms, helped with the operation of evacuation centers and transport of relief goods, network restoration efforts, etc.
	Ishinomaki City	Inspections of server rooms, could not get out because roads around the building were inundated
	Kesennuma City	Inspections of server rooms, helped with the operation of evacuation centers and with preparing the emergency power generators for use
	Higashimatsushima City	Inspections of server rooms, preparing computer terminals for use by the disaster response headquarters
	Minamisanriku Town	Inspections of server rooms, after taking refuge on the roof of the government office building for a night helped with the operation of evacuation centers
Fukushima Prefecture	Iwaki City	Inspections of server rooms, network restoration efforts
	Minamisoma City	Inspections of server rooms, helped with consolidating information on resident whereabouts, created a website as part of activities specified under the regional disaster response plan
	Futaba Town	Inspections of server rooms, evacuated to Kawamata Town on March 12
	Namie Town	Inspections of server rooms, evacuated to the Tsushima branch office on March 12

Kamaishi City had installed its server room in a building other than the Government Office Building 1 where the ICT division office was located. Immediately after the disaster, the area around Building 1 was covered with debris making it impossible to go outside and check the condition of the servers. Moreover, the server room door was fitted with a digital lock that could not be opened until power supply to the building was resumed around March 20 (the conventional door lock was lost during the devastation).

9. Lessons learned: Future measures that must be implemented by ICT divisions of municipal governments

One of the key findings of this survey is the fact that at the time the disaster struck none of the municipalities surveyed had action plans that included business continuity planning (BCP) for their relevant ICT divisions. Disaster response measures taken by the municipalities were typically left to the discretion of the people in charge of each division, and we could not confirm what action was taken by ICT division supervisors in the areas where ICT division employees became victims to ensure business continuity. Although subcontractors of information processing systems and other private businesses contributed significantly to the recovery process, there were no shared disaster response procedures.

Secondly, the management of application software and electronic data was mostly entrusted to individual business divisions and not only were there no standard guidelines regarding data backup, in some government offices the relevant ICT division was not aware of what kind of data was being stored and the storage methods being used. The most important factor impeding recovery was the loss of data.

Based on these and other findings from our survey, we have outlined future measures that must be implemented by ICT divisions of municipal governments in the following two areas, i.e., **1) Creation of business continuity plans, and 2) Collaboration between diverse entities**

9.1 Creation of business continuity plans

In order to put to good use the findings of this survey towards drafting effective business continuity plans, the types of risks observed at the 13 municipal government office buildings following the earthquake and tsunami and the situations that arose subsequently are described here.

- Collapse of government office buildings
- Damage to the server, ventilation systems and other equipment
- Loss of electronic data
- Suspension of power supply
- Damage to telecommunications cables and equipment (disruption of communications)
- Destruction of office automated systems
- Difficulty in getting employees and other personnel to the government office building
- Inability to enter the server room

- Relocation of the server room
- Relocation of administrative functions

Further, in areas affected by the nuclear accident, access to the government offices is difficult for local and outside personnel despite no damage to the buildings themselves, and relocation of data servers outside the region, and of administrative functions is increasingly apparent.

Post-disaster risks could potentially give rise to diverse situations. In particular, a power failure will upset the operation of information processing systems and disrupt communication with the outside. Hence measures to ensure uninterrupted power supply are of utmost importance. During the survey as well, most of the municipal governments emphasized the need for stable power supply. The time taken for commercial power supply to be resumed at the 13 government office buildings varied greatly by municipality, ranging from one day to several months. Although it may be close to impossible to anticipate the time required for power supply to be restored, measures must be implemented to clarify beforehand the tasks that must be carried out during a power failure and to create systems that will ensure uninterrupted power supply to essential ICT equipment. Initiatives must also be taken to prepare for other responses such as the relocation of some administrative functions, in the event of prolonged power outages.

The issues faced by ICT division employees who could not enter the server room for inspections immediately after the disaster included 1) the server room was located in a different building from the ICT division office; 2) the server room door was fitted with a digital lock that could not be opened until power supply to the building was resumed; 3) the conventional door key was lost in the confusion following the earthquake; and 4) floodwater levels remained high and the area was scattered with debris making it impossible to leave the building immediately after the disaster. Municipalities with servers installed at locations away from the ICT division office must investigate safe emergency routes to the server room and the means to enter the room even during a power failure.

The next table lists the response measures necessary to deal with these risks, as indicated by the municipalities surveyed. From the perspective of business continuity planning, provision must be made beforehand to ensure smooth implementation of the measures listed below.

Table 14: risks observed and response measures taken by the municipalities surveyed by types of disasters

Types of disasters	Risks observed	Response measures taken by the municipalities surveyed
Earthquake Tsunami	-Collapse of government office buildings -Damage to the server, ventilation systems and other equipment -Loss of electronic data -Suspension of power supply -Damage to telecommunications cables and equipment (disruption of communications) -Destruction of office automated systems (including account processing of balance of leased equipment payment) -Difficulty in getting employees and other personnel to the disaster response headquarters -Inability to enter the server room -Relocation of the server room -Relocation of administrative functions	-Implement quake-proofing measures and reinforce structures to enhance quake resistance -Ensure thorough awareness of response procedures and establish communication channels to secure replacements for damaged devices immediately -Establish data backup standards (including the use of cloud computing) -Install emergency power generators (and secure fuel supply)and set up ground power units -Install infrastructure for multiple telecommunications systems (satellite, wireless, cellular, etc.), prepare for the use of satellite telephones, and expand communication networks -Establish communication channels to secure replacements for damaged devices immediately and the personnel to install them -Establish emergency communication systems to contact employees, subcontractors and others -Establish programs to receive personnel support from other municipalities -Identify safe emergency routes to server rooms to enable inspections even during power outages -Establish communication channels to secure replacements for damaged devices immediately and investigate methods to recommence operation of the Family Registration system -Determine alternative locations in the event that the main government office building and branch offices cannot be used
Nuclear accident	-Difficulty in getting employees and other personnel to the government office building -Relocation of server room -Relocation of administrative functions	-Measures to secure ICT and other equipment when subcontractors have no access to the area -Determine alternative locations and methods to operate information processing systems at those locations, secure ICT devices and equipment necessary to resume work, and investigate methods to operate the Family Registration system -Determine alternative locations, conclude disaster response agreements with relevant municipal governments, and secure ICT devices and equipment necessary to resume work

Organizing the risks observed by disaster type, we can see that response measures differ for each assumed disaster type--earthquake and tsunami, and nuclear accident.

Further analysis of the recovery stages at the 13 municipalities surveyed reveals that, after the disaster, reopening resident service counters was given less priority compared to tasks such as confirming the whereabouts and safety of residents and setting up and operating evacuation centers, and that these tasks accounted for a significant portion of the work done by ICT division employees during this time.

Their Business Continuity Plans include setting up information processing systems, such as the Disaster Victims Support System, to implement disaster responses; coordinating activities with other divisions; and conducting training on operating information processing systems, including for employees of other divisions. The BCP Guidelines draws awareness to the relationship with information processing systems to implement disaster responses, including the Disaster Victims Support System, and

notes that supplementary considerations must be emphasized.

The following is a list of disaster responses identified through the survey. Municipalities that relocated administrative functions due to the nuclear accident conducted responses at the alternative location.

- Establishing and operating evacuation centers
- Transport and management of relief goods
- Support of evacuees, and documenting evacuee information
- Confirming the whereabouts and safety of residents
- Issue of Disaster-victim Certificates

The receipt and management, transportation to the evacuation centers and other locations, and distribution of the enormous volume of relief goods that poured into the affected areas from all over Japan, was time-consuming and required the intensive efforts of a large number of employees. Such tasks could usually be completed by assigning numerous people to the job, however, in municipalities with a small population size and small number of government employees, there was a wide gap between the number of people required to handle the huge volumes of relief aid items and the actual number of people who were available to help, resulting in a strenuous workload for the employees. Further, in municipalities where power supply had not yet resumed and telecommunications networks were not operational, information and communication technologies could not be used for various jobs related to the setting up of evacuation centers and creation of evacuee lists, etc., thus delaying responses. Information had to be communicated manually and employees physically carried paper documents to wherever required, indicating a major disruption of the technologically advanced ICT division office environment.

As part of business continuity planning, due consideration must be given to action that can be taken beforehand and relevant training conducted to ensure smooth implementation of the disaster response measures described above. Based on responses from the municipalities surveyed, some of the action items that can be implemented beforehand are listed below.

- Establishing and operating evacuation centers: selection of candidate sites, identifying optimal routes for evacuation and transport of goods, ensuring means of obtaining and sharing information, securing personnel, etc.
- Transport and management of relief goods: establishing structures to receive and manage relief goods, determining locations to receive goods, creating a system to verify the needs of people affected by the disaster against relief goods received, securing personnel, etc.

- Support of evacuees, and creating evacuee lists: securing personnel to aid in relief operations, making preparations to acquire replacements of ICT devices, re-install systems, etc.
- Confirming the whereabouts and safety of residents: determining procedures for confirming the whereabouts and safety of residents, securing personnel, etc.
- Issue of Disaster-victim Certificates: making preparations to acquire replacements of ICT devices and to re-install systems, establishing information networks, determining locations for the issue of certificates, securing personnel, etc.

The initiatives that must be taken to ensure smooth implementation of disaster responses are varied, ranging from installing ICT devices and other information processing systems to securing materials for setting up evacuation centers and obtaining food as well as other relief goods, and many issues, including securing adequate personnel to manage and implement these measures, need to be addressed. Mechanisms must also be put in place to match personnel and logistical needs with provided supports. In addition, infrastructure that supports networking between diverse entities is required to provide assistance to evacuees, confirm the whereabouts and safety of residents and conduct other related tasks.

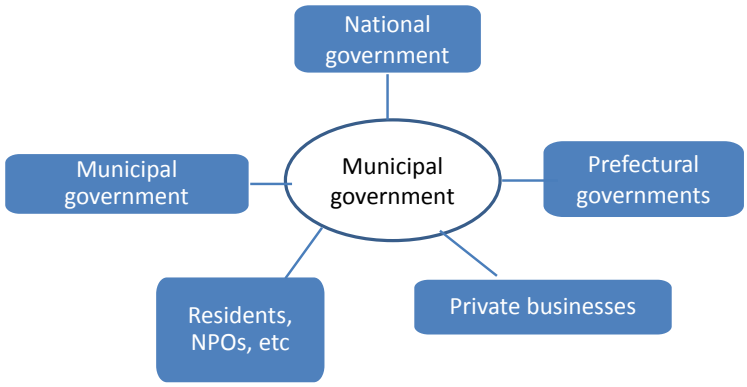
In contrast to issues that can be resolved by installing information processing systems, resident service counters, such as those for the issue of Disaster-victim Certificates, often receive a large number of applications at the same time and personnel support must be provided to deal with the workload. In some municipalities, there were days when over 500 residents queued up at the temporary disaster response counters, and municipal government employees worked tirelessly to cope.

9.2 Collaboration between diverse entities

9.2.1 Diverse entities that have working relations with municipal governments

A study of the recovery processes at the ICT divisions of the 13 municipalities surveyed reveals the diverse entities that were involved and the vital roles played by each one of them. When considering the future role anticipated of ICT divisions of municipal governments, it is evident that implementing measures to handle all potential risks by the municipalities alone is impractical from the perspective of cost. Collaboration between the municipal governments and diverse entities is extremely crucial.
(see Figure 5)

Figure 5: Diverse entities that have working relations with municipal governments

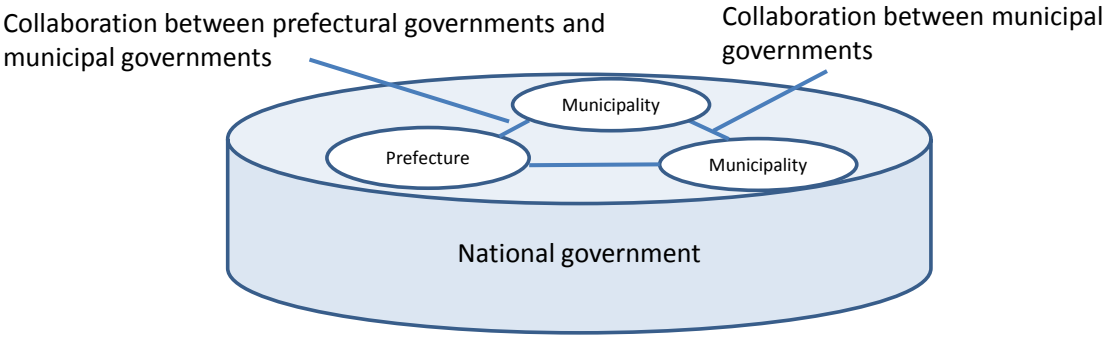


In this survey, we assume the numerous external entities that have business relations with the municipal government to be the National government, prefectural governments, other municipal governments, and private businesses such as subcontractors of information processing systems and telecommunications services, as well as local residents, NPOs and other organizations. Business relations with local residents, NGOs and other organizations are not within the scope of this survey and will not be discussed here.

It is improbable that the municipal government will always form the hub as shown in the conceptual diagram above. Based on the objective of the action being taken, it is necessary to determine the focal entity and create corresponding frameworks. Each entity must, at all times, have structures in place to ensure information sharing and uninterrupted means of communication.

With regard to collaboration between these entities, we suggest that, to begin with, they develop the concept that the National government must provide assistance in terms of funds, establishing systems and improving infrastructure. (see Figure 6)

Figure 6: Conceptual diagram on collaboration between the numerous entities



In this section, we review the role of the National government as shown in the figure

above and study the creation of frameworks for mutual assistance between municipalities.

9.2.2 The role of the national government

Numerous requests of the National government were made in this survey, including regarding applications for and uses of subsidies; the development of telecommunications infrastructure in natural disasters; and the establishment of various frameworks. The action items that the national government must undertake, from the viewpoint of supporting municipalities, have been described in this section.

(1) Financial assistance to carry out measures expected of local municipalities

Supplementary national government budgets were set aside by the municipalities surveyed for restoration of ICT operational environments, however, financial assistance is absolutely necessary for the preventive measures that ICT divisions must take as part of lessons learned from the 3/11disaster. In addition to expenses for installing information processing systems to implement disaster responses, municipalities will bear other long-term operational costs such as for telecommunications infrastructure, emergency power generators, data backup, etc. Some kind of financial aid will be required for these operational costs as well. Although several financing projects have already been initiated within the national government budget for the establishment of quake-resistant telecommunications infrastructure[4], support for installation costs alone will not suffice and supporting projects must be provided from a long-term perspective.

(2) Assistance to establish systems

Based on the Japanese Act on the Protection of Personal Information, each municipality has ordinances and other regulations to protect personal information. However, opinions vary by municipality regarding items that are not covered by the law, and thinking on whether information on evacuees should be provided to third parties or not also differed. In the survey, some municipalities indicated the need for common policies regarding the provision of personal information to third parties when extensive devastation occurs, as was seen on March 11.

The Study Group on Maintaining Communications Capabilities during Major Natural Disasters and other Emergency Situations set up by the Japanese Ministry of Internal Affairs and Communications concludes in its final report that there is the

“need for new examinations on the treatment of personal information during large-scale disasters.” The committee also recommends that “municipal governments should proceed with studies of finding the right balance between the necessity of providing information on people’s safety and other critical information during large-scale disasters and other emergencies and the demands of personal information protection and, where necessary, municipal governments should revise their personal information protection ordinances (such as defining exception clauses concerning the treatment of personal information in emergencies).

Taking into consideration the wishes of the municipalities surveyed, however, it is difficult for each municipal government to individually implement measures towards defining exception clauses concerning the treatment of personal information in emergencies, and hence the National government must take action such as drawing up common guidelines for all municipal governments.

With regards to the types of digital data handled by municipalities as well, different ministries process different information--for example, the ministries responsible for the Juki system and for the Family Registration system vary--and no standard policies for systems operation in the event of a disaster were created either. Standard rules must be established for all digital data handled by each municipality in the aftermath of a disaster, until normal systems operations are resumed.

Development of personnel is also an important form of systems-related support. No matter what prior arrangements are made, in some cases, it is the decisions taken by personnel at the disaster site that are most crucial. Given that similar disasters could occur anywhere in Japan, it is extremely important that the National government take measures to develop people capable of making key decisions at disaster sites.

(3) Improving electricity and telecommunication infrastructure

Incentives, including financial assistance, must be provided by the prefectural or National government to municipalities that independently take measures as part of their business continuity plans to install and operate emergency power generators. However, with regards to establishing infrastructure for commercial electricity supply and telecommunications that cannot be handled by municipal governments at either the municipality or prefectural levels, the National government must make proposals and take nationwide action towards ensuring redundancy.[5]

The municipalities surveyed showed keen interest in cloud computing technologies, especially as a means of data backup. In order for municipality and prefectural governments to set up private clouds as data backup sites with due consideration to security and protection of data, the National government must draw up relevant guidelines and regulations.

(4) Standardization

The shared use of information processing systems by municipalities necessitates enormous effort by each municipality, such as a review of business processes and transfer of data related to current business processes, hampering the introduction of such systems. Many of the municipalities surveyed expressed their wish for the National government to propose measures towards the shared use of information processing systems and unified methods for data transfer.

One important post-disaster task at the municipalities surveyed was the organizing and documenting of evacuee information. Survey respondents pointed out that private businesses could not speedily help with this task since the document format, the contents of information recorded and other details varied by municipality. Proactive measures by the National government are necessary to create standard document formats with consistency in items of information.

9.2.3 Creation of frameworks for mutual assistance between municipalities

The creation of frameworks for mutual assistance between municipalities may be advantageous in the event that the disaster exceeds levels assumed by the business continuity plan or disaster responses do not proceed as planned.

Specifically, although municipalities conclude agreements with each other for cooperation in the aftermath of a disaster, there are few instances in Japan of dedicated agreements between ICT divisions for this purpose and the concept must be expanded in the future.

In Rikuzentakata City and Otsuchi Town, employees from other municipal governments contributed immensely to restoring the ICT operational environments. It, however, takes a significant amount of time to acquaint oneself with systems and network environments in the disaster area and also requires appropriate technical skills. Given that personnel support is essential for relief work, how to match personnel to suitable jobs is a topic for future discussion, along with areas of support that the prefectural government must play a lead role in.

Currently, material support is considered to be within the scope of regular disaster response cooperative agreements, while personnel support to ICT divisions is not. Hence, a sense of shared awareness must first be developed among relevant authorities of the importance of personnel support.

Further, as part of disaster preparedness measures should there be need to relocate government office functions, candidate sites for relocation must be determined in advance and disaster response cooperative agreements signed with the relevant municipal governments in order to enable speedy acceptance of equipment and other

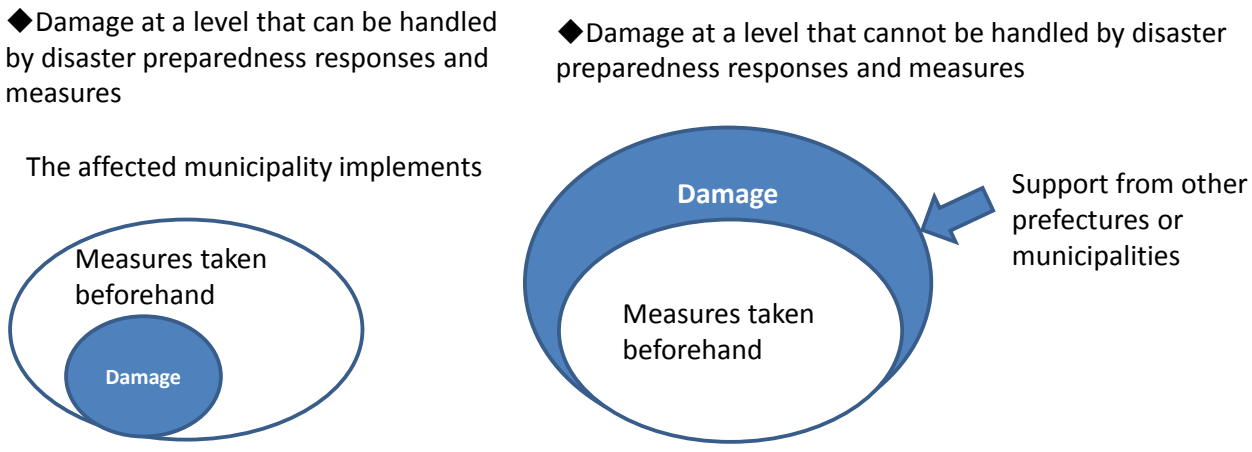
items necessary to conduct work.

Increased collaboration between ICT divisions of municipalities during peaceful times, with a view to improving relations and promoting the use of information processing systems, may also be effective in providing and accepting mutual support in a timely manner.

To enhance the effectiveness of support provided, survey participants suggested the creation of frameworks for mutual support between municipalities that have similar population sizes or utilize the same type of information processing systems. They also stressed the importance of collaboration with municipalities that are geographically apart to reduce the likelihood of both municipalities being struck by disaster at the same time, and of signing agreements with more than one municipality.

Figure 7 is a schematic representation of frameworks for mutual assistance between municipalities. Assuming cases in which prefectural governments support municipalities and those in which municipalities support each other during disasters that exceed levels estimated in prior preparedness plans, identifying what will be the most effective form of support is a topic for future consideration. Although not in the scope of this survey, initiatives conducted from the perspective of collaboration with administrative organizations and residents are also important.

Figure 7: Frameworks for mutual assistance between municipalities.



10. Conclusion

Based on the results of this survey, we studied the ideal state of future action by ICT divisions of municipal governments through specific measures and proposals. Our studies indicate that future measures can be divided into disaster preparedness and prior training that will certainly help cope with post-disaster risks and flexible post-disaster responses to eliminate disparities between needs that are likely to arise in a wide variety of areas and actual support received.

Many of the disaster preparedness measures can be resolved by drafting business continuity plans. These must be prioritized in order of importance and tackled one by one, keeping in mind the diverse needs of the disaster victims.

Among the measures that can be taken beforehand, office-wide discussions are necessary for the creation of data backup standards even before the drafting of business continuity plans and plans that include the creation of data backup standards must be drawn up. Further, the roles of the numerous entities that have business relations with the municipal government must be specified and measures taken to improve collaboration at all times.

With regard to flexible post-disaster responses, the development of on-site personnel is most important and reflects thoroughly implemented daily work practices that will stand in good stead during a disaster.

The scale of the Great East Japan Earthquake and tsunami was such that could not be anticipated in any business continuity plan, even if such plans had been prepared.

However, as the proverb ‘Forewarned is forearmed’ goes, it is important to draft business continuity plans that draw on this experience, deepen understanding and awareness altogether through thorough daily work practices so that the effects are reflected appropriately during an emergency.

Reference

This report is an abridged and revised (to suit foreign readers) version of a much larger report written in Japanese that contain detailed report of each municipality. The original report is as follows:

財団法人地方自治情報センター、慶應義塾大学 SFC 研究所、「東日本大震災における地方公共団体情報部門の被災時の取組みと今後の対応のあり方に関する調査研究報告書」平成 24 年 3 月.
https://www.lasdec.or.jp/cms/resources/content/26859/all.pdf