KNOWLEDGE NOTE 4-1

CLUSTER 4: Recovery Planning

Infrastructure Rehabilitation
Social infrastructure and public utilities are critical for quick and effective disaster response and recovery. Japan’s rigorous seismic reinforcement of infrastructure has greatly reduced the effort required to restore essential facilities. Identification of priority infrastructure, legislation of financial arrangements for rehabilitation, and establishment of predisaster plans alongside the private sector have enabled prompt emergency response operations and facilitated a quick rehabilitation.

**FINDINGS**

The Great East Japan Earthquake (GEJE) caused tremendous damage to infrastructure and public utilities in the eastern region of Japan. According to the Cabinet Office, damages to public utilities and social infrastructure were estimated to be about ¥1.3 trillion ($16 billion) and ¥2.2 trillion ($27 billion), respectively (KN 6-3).

Since damage to the road network was limited, and rehabilitation work was efficient, (figure 1) the main highways and roads to the affected areas were repaired within one week. Bullet train service was resumed within 49 days of the event. These developments, in turn, facilitated full-scale relief activities in the devastated areas. All of this was a huge improvement compared to the aftermath of the Hanshin-Awaji (Kobe) earthquake in 1995, when it took over one-and-a-half years for highway reconstruction and 82 days for the bullet train line to be repaired.

**Roads.** Some 15 expressway routes and 69 sections of the national highway system, mainly in the Tohoku region, were closed immediately after the earthquake. Many prefectural and municipal roads were also closed. Because they had been retrofitted, bridges on national roads or expressways were not damaged, but 20 bridges on prefectural and municipal roads collapsed or were severely damaged (KN 1-2).

The subsequent tsunami flooded approximately 100 kilometers (km) of national highway, and submerged three expressway interchanges and junctions. The tsunami also washed...
away five national road bridges. Massive amounts of debris brought in by the waves left many of the coastal roads unusable (figure 2).

**Railways.** Railway facilities were also severely damaged, but various earthquake countermeasures, including the seismic reinforcement of railway facilities, prevented most of them from breaking down and causing fatalities. Some 325 km of railway were damaged, mostly by the tsunami. Damage included the displacement or washing away of railroad tracks, power poles, bridges, and stations; the collapsing of earthen embankments; and damage to platforms.

**Airports.** The Sendai Airport, the major airport in the Tohoku region, is located about 1 km from the Pacific coast at an elevation of 4 meters above sea level. The tsunami hit the airport and flooded the runway, the first floor of the terminal building, and the airport access railways (figure 3).

**Ports.** Fourteen international and other major ports and 18 local ports were severely damaged by the tsunami and unable to function. Numerous ports that support the region’s fishing industry were also destroyed. The tsunami and the earthquake together destroyed much of the port infrastructure. Debris from the tsunami washed into the port area, preventing ships from entering.

**Damages to public utilities.** Public utilities were severely damaged by the earthquake and tsunami. About 2.3 million houses were left without water supply after the earthquake, and the sewerage systems were destroyed in the coastal cities and towns in an area spanning some 550 km.
FIGURE 2: **Status of expressways and national highways immediately after the earthquake**

Source: MLIT.

FIGURE 3 (left): **Sendai Airport after the tsunami**
FIGURE 4 (right): **Manhole raised by liquefaction in Urayasu City.**

Source: MLIT and Urayasu City.
Wastewater treatment plants were damaged at 63 locations, 48 of which had to stop operating because of tsunami inundation. The condition of six wastewater treatment plants near the Fukushima Daiichi Nuclear Power Station is still unknown because of access restrictions. In Urayasu city, Chiba, sewerage systems were severely damaged by liquefaction (figure 4).

The number of houses left without electricity reached 8.5 million. Several nuclear and conventional power plants, including the Fukushima Daiichi Nuclear Power Station, went offline after the earthquake, reducing the region’s total power generation and supply capacity. The capacity of the Tokyo Electric Power Company (TEPCO) was reduced by about 40 percent from 50 gigawatts (GW) to about 30 GW, not enough to meet the typical 40 GW peak-time demand for that season.

**INFRASTRUCTURE REHABILITATION PLANNING AND IMPLEMENTATION**

Concerned organizations were able to start rehabilitation work immediately after the earthquake and tsunami, to a large extent subsidized by the national government under the National Government Defrayment Act for Reconstruction of Disaster Stricken Public Facilities (enacted in 1951). This act applies to a variety of transport systems and other infrastruc-

**FIGURE 5: Steps in infrastructure rehabilitation**

Source: MLIT.
ture such as rivers, coastal facilities, sabo facilities, roads, ports and harbors, parks, and sewerage systems. The typical course of rehabilitation project implementation is illustrated in figure 5. In the aftermath of a disaster, local governments report their infrastructure damage to the national government, usually within 10 days of occurrence, with a request for a national subsidy. Upon receipt of the application, the national government conducts a disaster assessment within 2 months of the disaster and approves the subsidy. To ensure quick rehabilitation, local governments can begin implementing their projects immediately after the disaster occurs, even before applying for the subsidy.

The national government subsidizes two-thirds of the project costs, and much of the local government’s share is covered by national tax revenues. Thus, local governments actually cover only 1.7 percent of the costs at most. This local government share decreases as the severity of the disaster increases. In the case of the GEJE, the costs were so large that the local government share was minimal.

To ensure the quick rehabilitation of infrastructure, the national government enters into predisaster agreements with the private sector, ensuring that in the event of a disaster, the needed workforce will be mobilized quickly, without burdensome contracts and paperwork. Such arrangements are made between government field offices and private companies or private sector associations, and they cover such postdisaster activities as construction, engineering consulting, surveying, telecommunications, and broadcasting.

**Roads: Operation Toothcomb.** Transportation infrastructure is critical for delivering relief supplies. After the GEJE, roads were recovered early on to secure an emergency transportation network. Immediately after the earthquake on March 11, the Ministry of Land, Infrastructure, and Transport (MLIT) deployed a strategic initiative to make sure that the entire length of the Tohoku Expressway and National Route 4 was passable to traffic. This major artery runs south to north from Tokyo to Aomori along the inland part of the region, which suffered relatively little damage. Next, 16 routes were opened up, stretching out from various points on this major north-south artery and reaching east to the coastal areas that were worst hit by the tsunami. The plan was called Kushinoha Sakusen, or Operation Toothcomb, because of the shape of the road network (figure 6 and 7). From the next day, the operation began clearing debris from the emergency roads that run eastward from the inland arterial highway—national route 4 (running north-south)—connecting them to the Pacific coast. By March 15, four days after the earthquake, 15 eastward access roads were usable, and by March 18, 97 percent of the national coastal highways were accessible.

Furthermore, 13 days after the earthquake the entire Tohoku Expressway, the main expressway connecting the Tohoku region to central Japan, was open to general traffic.

The quick rehabilitation of roads was possible for a number of reasons:

- The seismic reinforcement of road structures had helped minimize damage.
- There was a clear focus on opening up the 16 eastward routes by concentrating the workforce on them first.
- The authorities used their predisaster agreements to mobilize contractors immediately after the disaster.
FIGURE 6: Operation Toothcomb

Source: MLIT.
Ports and navigation passages. The MLIT requested contractors to begin clearing navigation passages so that disaster relief vessels could enter ports. The operations began in 14 principal ports on March 14, the day after the lifting of the tsunami warnings. This included removing debris as well as ensuring the safe passage of emergency relief vessels (figure 8). By March 15, 4 days after the earthquake, all 14 ports were either entirely or partially usable, and began accepting vessels delivering emergency supplies and fuel. At Sendai’s Shiogama Port in Miyagi Prefecture, the first oil tanker entered 10 days after the earthquake, reducing the fuel shortage in the disaster-affected areas.

Railways. The Tohoku Shinkansen (bullet train) resumed operations between Tokyo and Nasushiobara (the southern section) on March 15, and between Shinaomori and Morioka (the northern section) on March 22. By April 29, the entire Tohoku Shinkansen line was in operation, as were most of the other railways except for those along the coast. The rehabilitation of the coastal railways, especially the Joban Line that runs through an area 20 kilometers from the Fukushima Daiichi Nuclear Power Station, has still not happened.
Many are currently being evaluated for possible rehabilitation along with the reconstruction of the towns and cities. The Sanriku Railway, which runs along the coast, is expected to resume its operation in April 2014.

**Sendai Airport.** The Sendai Airport rehabilitation operation began two days after the earthquake, and by March 15, four days after the earthquake, the airport was being used by rescue and emergency supply rotorcraft. Fixed-wing aircraft were able to use it by the following day, allowing the US Army to bring in emergency supplies. The airport was available for commercial services on April 13.

**Water supply systems.** Although water supply services were resumed for about 90 percent of residents within 1 month of the disaster, the aftershocks on April 7 and 11 temporarily increased the number of households without water (figure 9). The Japan Water Works Association (JWWA) set up emergency headquarters to arrange for relief teams. The Ministry of Health, Labor and Welfare, JWWA, and 400 water utilities nationwide provided assistance to the affected areas by dispatching emergency teams with water supply trucks and machinery. They also helped conduct investigations for the restoration and reconstruction of water works.
FIGURE 9: Water works rehabilitation


Sewage systems. Of the 120 disaster-affected wastewater treatment plants, those with minor damage (95 facilities) were rehabilitated and have recovered their predisaster capacities. Sixteen treatment plants are still inoperable because the tsunami destroyed their infrastructure and equipment. The 13 facilities that are accepting influent sewage have been providing primary treatment only, consisting of settlement and disinfection.

The reconstruction planning for the sewage systems is the responsibility of the local municipalities. However, some 6,575 personnel have been dispatched from national or local municipalities in other regions to support their rehabilitation efforts. Sanitation is a major challenge in a disaster. Higashimatsushima City in Miyagi Prefecture did not have enough toilets for the people staying at evacuation centers. The city installed “manhole” toilets, paid for by a national subsidy system for promoting earthquake proofing of sewage systems across the country. These toilets, which can be easily and quickly installed, were well received, especially by the elderly.

Electricity services. About 90 percent of the power services were recovered within one week of the disaster; however, the aftershocks on April 7 and April 11 temporarily increased the outages (figure 10). Because of its reduced power supply capacity, the TEPCO implemented rolling blackouts in its service areas, including Tokyo, between March 14 and 28.
BOX 1: Rapid rehabilitation of sewerage system in Rikuzentakata City

In Rikuzentakata City in Iwate Prefecture, the wastewater treatment plant was severely damaged by the tsunami. But within its service area 400 houses located on higher ground had survived the tsunami. When water supply services resumed, the sewage generated by these 400 houses had nowhere to go. Following a proposal by a private company, the city decided to introduce a movable membrane bioreactor unit, which was quickly installed and began operating within a month.

Source: MLIT.

FIGURE 10: Electricity rehabilitation

Source: Cabinet Office (based on data from Tokyo Electric Power Company).
LESSONS

- Quick emergency response initiatives, such as Operation Toothcomb, contributed greatly to the prompt rehabilitation of transportation networks and the starting of relief activities.

- Identifying the routes to be recovered first and prioritizing resources and manpower accordingly, was an effective approach to rehabilitating transportation networks.

- Agreements, made with the private sector before the disaster, to provide emergency response operations were effective in quickly mobilizing the needed workforce.

- Experts and equipment dispatched from national and local governments contributed to prompt rehabilitation.

- Rigorous implementation of the seismic reinforcement of infrastructure prevented excessive damage to structures, minimizing the effort required to restore their functions.

- At the time of a disaster, sanitation can be a major challenge. Resumption of water supply services without adequate sanitation led to sanitation and hygiene problems.

RECOMMENDATIONS FOR DEVELOPING COUNTRIES

Effective emergency and rehabilitation operations depend on social infrastructure and public utilities. The following arrangements are required if rehabilitation works are to be started and completed promptly.

Establish financial arrangement mechanisms. Budget-sharing mechanisms between local governments and the central government should be established in advance. Negotiating between governments only after a disaster has occurred will delay rehabilitation work. Such negotiations should cover:

- Procedures for applying for a subsidy to the central government.

- The cost-sharing ratio of rehabilitation works, shared between national and local governments.

- Criteria for which types of disasters—and at what scale—require which mechanisms.

- Establishment of a body of experts and responsible organizations at the central government level.

- Team formulation and procedures for damage assessment.

Arrange predisaster agreements with the private sector. Prearranged agreements with the private sector allow for quick mobilization of the needed rehabilitation workforce.
Government agencies can skip the procurement process and start work immediately. These agreements should include (i) the designated responsibilities of governments and private companies for rehabilitation work, (ii) a government guarantee of payment for the work involved, and (iii) procedures for project requests from the government.

Arrange support teams. Emergency support teams should be established during normal times (KN 3-1). Rehabilitation requires enormous additional resources from local governments, which are already burdened by the aftermath of disaster. Emergency teams from other government agencies can assist those local governments affected by disaster.

Develop disaster-resilient infrastructure. If infrastructure and utilities are planned and developed to mitigate potential disaster damage, the effort and time required for rehabilitation can be minimized. Retrofitting bridges can reduce both damage and rehabilitation efforts (KN 1-2).

Identify key infrastructure. Transportation or communication networks that are critical to emergency operations should be identified before the disaster and given priority during the rehabilitation efforts.

KEY REFERENCES


KNOWLEDGE NOTE 4-2

CLUSTER 4: Recovery Planning

Reconstruction Policy and Planning

The unprecedented damage caused by the Great East Japan Earthquake (GEJE) affected multiple locations, posing severe challenges for local governments. Based on advice from an independent council, the government acted quickly and issued a basic policy and regulation framework within four months, laying the foundation for an inclusive process of recovery and reconstruction. This note documents the interactive process of reconstruction planning, as conducted by various levels of government with the active engagement of affected people, experts, volunteers, and the private sector.

FINDINGS

The GEJE was Japan’s first major multilocation disaster in recent history. With over 200 municipalities affected, it required both a national-level response as well as inclusive and participatory local planning. By adopting early policy and regulatory guidance and releasing several budgetary supplements, the government supported the evolution of effective recovery and reconstruction plans, including coordination at the prefecture and municipal levels. Overall, the policy and planning process involved three stages:

- **Stage I (0 to 4 months):** The government established a disaster headquarters, chaired by the prime minister and an independent reconstruction design council (RDC). Basic guidelines and an act were issued within 4 months, based on the council’s recommendations. The first supplementary budget was passed within 1.5 months of the disaster.

- **Stage II (4 to 11 months):** The provisional reconstruction headquarters was established. Prefectures and municipalities prepared basic recovery plans in close consultation with disaster-affected people. Two other supplementary budgets were adopted to fund the recovery.

- **Stage III (11 months to 10 years):** A reconstruction agency and special zone for reconstruction were formed, and a fourth supplementary budget was passed. The
reconstruction was envisaged to last 10 years, and to be implemented through flexible grants and policies in support of the municipalities.

Although challenges remain—particularly with respect to the role of the new reconstruction agency—the GEJE reconstruction planning process can be seen as a model for other megadisasters. Prior to the GEJE, Japan already had a sound institutional and policy framework for disaster response and mitigation, based on lessons learned from past disasters. Building on this foundation, Japan acted rapidly to establish a reconstruction planning framework based on mutual trust, respect, and collaboration among stakeholders. At the same time, the fact that the GEJE required a new agency and reconstruction act shows that megadisasters, by their very nature, tend to overwhelm existing institutional arrangements. The chronology of policy and planning followed during the GEJE is summarized in figure 1 and explained in further detail below.

**BASIC PRINCIPLES, GUIDELINES, AND LEGAL FRAMEWORK FOR RECONSTRUCTION (MARCH TO JUNE 2011)**

The government set up a headquarters for emergency disaster control less than an hour after the disaster. At the same time, building on lessons learned from the Great Hanshin-Awaji Earthquake in 1995, the government sought to broaden the recovery strategy by setting up an RDC. This advisory panel was composed of a team of highly respected intellectuals, academics, religious figures, and elected officials. Within two months of the disaster, the council issued “Seven Principles for the Reconstruction Framework,” a consultative vision for the reconstruction. By the end of June 2011, a final report was given to the prime minister, which in turn became the basis for the government’s *Basic Guidelines and Basic Act on Reconstruction* (GOJ 2011a and 2011b), issued 3.5 months after the disaster. Thus, the initial process of national consultation set the stage for the entire recovery and reconstruction effort.

The *Basic Guidelines* set in place several innovative policies (box 1). It placed municipalities and residents at the center of the reconstruction; it promoted the concept of multiple defenses and people-oriented measures in disaster reduction (departing from past reliance on defensive structures); and it encouraged land-use planning as a way to balance safety considerations with the need to preserve links between communities and infrastructure.

The recovery and reconstruction period was estimated to last 10 years and cost ¥23 trillion ($290 billion), with the bulk of the effort focused on the first 5 years. The financial resources were to be secured through reconstruction bonds, reduction of public expenditures, increase in nontax revenues, and temporary taxation. As of early February 2012, the government had passed four supplementary budgets, worth a total of ¥21.9 trillion ($274 billion). The budgets were issued over a period of several months, and served to support different stages of recovery and reconstruction.

The *Basic Guidelines* also provided for the establishment of a special zone for reconstruction containing financial and regulatory incentives, and a central one-stop reconstruction agency to respond to, and help coordinate, the needs of local governments (see section on Reconstruction).
FIGURE 1: Chronology of key policy and planning measures after the GEJE

Great East Japan Earthquake

11 March

1 month

2 months

3 months

10 months

11 months

1 year

10 years

Reconstruction Design Council

Seven Principles for Reconstruction
Basic Guidelines for Reconstruction
Basic Reconstruction Act
Reconstruction Headquarters

Prefecture and Municipality Recovery Plans

Law for Special Zone for Reconstruction

Reconstruction Agency and Reconstruction Fund

Reconstruction Grant Projects

Prefecture and
Municipality
Recovery Plans
Prefecture-level planning

Based on the national guidelines, the most affected prefectures and municipalities—Iwate, Miyagi, and Fukushima, with more than 120 affected municipalities among them—developed their own recovery plans. These plans were not intended to be comprehensive, but rather to reach consensus among residents on the vision and key principles to be followed.

BOX 1: Basic guidelines for reconstruction after the GEJE

Key policies

- Recognize the challenges of an aging and declining population by promoting adequate public transportation and support services.

- Promote a strategy of multiple defenses through both soft and hard (structural) measures, putting people at the center of disaster reduction.

- Promote a “new public commons” through social inclusion of a wide range of stakeholders in the reconstruction.

- Make municipalities in disaster areas the main actors accountable for reconstruction, aided by financial and technical support from the central government and prefectures.

- Promote rapid reorganization of land use, to stimulate investment and prevent speculation.

- Prioritize providing stable residences for the affected, through favorable housing loans and low-rent public housing.

- Assist municipalities with reconstruction planning through external experts.

- Promote employment of affected people through recovery and reconstruction investments under the “Japan as One” project.

- Prioritize rehabilitation of key transport and logistics infrastructure and revival of local economic activities.

- Open reconstruction to the world through active international cooperation and lesson sharing.

- Create a special zone for reconstruction to support local projects through flexible procedures and financing.

Source: GOJ 2011a.
the proposed land-use planning (including potential relocation of communities), and the implementation program (figure 2). It was understood that the plans would evolve over time through further consultations with ministries and elected officials, and eventually result in more detailed (and costed) reconstruction plans.

The three most affected prefectures benefited substantially from a partnership arrangement supported by the Union of Kansai Governments (a grouping of prefectural governments in Western Japan), which provided expert personnel to assist with the emergency and relief efforts. This twinning experience, which also proved beneficial after the 2008 Sichuan earthquake, is outlined further in KN 3-4.

To formulate the prefecture recovery plans, task force meetings were held with experts and citizens to collect public comments. In general, prefectural-level plans allowed local stakeholders to make decisions on infrastructure and other issues (such as debris disposal) that required intermunicipal coordination.

Fukushima, for example, faced a special problem due to the nuclear plant accident, which restricted access to contaminated areas and led to the evacuation of large numbers of residents. The Miyagi Prefecture recovery plan, in turn, developed a detailed tsunami
protection plan, including structures resistant to a 100-year tsunami, elevated structures, population relocation to higher altitudes, an accessible evacuation plan, and the promotion of a culture of disaster prevention.

**MUNICIPAL-LEVEL PLANNING**

Planning processes at the municipal level tackled such issues as risk assessment, financing, land tenure and land use, transportation infrastructure, and the role of the government in building consensus and providing relevant information to communities. Recovery plans had a positive tone, reflecting the municipalities’ confidence in the nation’s ability to assist affected people in improving their lives.

Similar to the prefectural recovery planning process, municipalities established recovery planning committees involving experts, residents, and community representatives. Generally, they used surveys and workshops to incorporate residents’ opinions into the plans. For instance, in Minami-sanriku (in Miyagi), a resident’s committee played a key role in proposing “symbolic projects” that were then integrated into the municipal plan (figure 3).

[FIGURE 3: Community involvement in recovery planning in Minami-Sanriku Town (Miyagi Prefecture)]

Source: IRP.
Similarly, Ofunato Municipality (in Iwate), held residents’ workshops and students’ reconstruction meetings involving more than 3,000 residents. In Sendai (in Miyagi), the largest city in the Tohoku region, the mayor herself visited residents’ workshops and talked directly with victims. About 80 workshops were held to share information between residents and the city government, and residents submitted more than 2,000 comments on the draft recovery plan.

The central government supported municipal efforts by deploying two professional private sector consultants per municipality to provide technical services linked to damage assessment and engineering analysis. Experts such as university faculty members, architects, engineers, lawyers, and members of nongovernmental organizations (NGOs) also participated actively and voluntarily in the municipal planning process, according to their field of expertise. Thus, the process of participatory planning was widely supported by governmental and nongovernmental actors across all administrative levels in Japan.

Two issues were particularly challenging in recovery planning: land-use planning and demographic trends.

**LAND-USE PLANNING**

Municipalities used land-use planning as a tool to reach consensus on the strategy for reconstruction. This was based on a tsunami simulation conducted by the prefectoral governments.

The simulation assumed two different levels of a tsunami (figure 4): a maximum-level tsunami such as the GEJE (a 1,000-year event) and a frequently occurring tsunami (a 100-year event). The height of the coastal seawall is usually planned to protect from a frequently occurring tsunami. If a maximum-level tsunami hit the area, water may overtop the seawall and inundate the town. However, because of land-use planning—such as relocation of residential areas, land elevation, and multifaceted protection using forests and/or roads—the water level is projected to be less than 2 meters high in residential areas (making it unlikely for houses to be washed away). Low-lying areas would be reserved for parks, commerce, and industry (figure 5). In case of a maximum-level tsunami, people would have to evacuate, and early warning systems and evacuation routes would become crucial.

In the ria coastal areas of Iwate and the northern part of Miyagi, there was not enough land space available for relocation since steep mountains line the coast. In Minami-sanriku Municipality, for example, many fishing villages that were located adjacent to the coast were severely affected by the tsunami and had to be relocated. However, residents wanted to live close to their original location and to the fishing port to maintain their livelihoods. A policy of separate relocation was therefore proposed, whereby each village would move to a small hillside space close to its original location (see box 2). Residents plan to establish community development associations to facilitate relocation planning.

**POPULATION MOVEMENTS**

According to government statistics, a large number of people moved out of the affected municipalities following the disaster. The gap between out-migrants and in-migrants relative to the total population in 2011 was particularly high for coastal municipalities—9.4
BOX 2: Land use and population relocation strategies

There are generally three land-use strategies to address tsunami events (see upper figure): (i) avoiding risk, (ii) separating risk, and (iii) controlling risk. In the risk avoidance strategy, residential uses are prohibited or restricted in high-risk areas, although nonresidential purposes (for example, recreational) may be allowed. This strategy is being considered in several municipalities in Tohoku, and has been adopted within 20 kilometers (km) of the nuclear power facility in Fukushima. It requires a relocation plan, and identification and planning for the relocated infrastructure and population at the new site.

In a risk separation strategy, some areas are restricted, some are elevated, and others used to divert the tsunami to controlled directions. The controlling risk strategy uses multiple defenses (such as elevated areas/infrastructure, sea walls, and levees). This type of strategy was adopted in the Otsuchi Municipality in Iwate and is proposed for parts of Sendai. It requires knowing the optimal height and location of multiple defenses.

Population relocation can also follow different strategies (lower figure). In a separate relocation plan, each community is relocated separately to a higher location. In a collective relocation, separate (original) communities are relocated to a common (safer) area. A third combination strategy uses variants of the above.

In the wide coastal plains, such as near Sendai, the city government adopted a controlled risk strategy, whereby house rebuilding would be restricted in areas where water levels could rise above 2 meters. The government also intends to raise the height of the roads to act as breakwaters, as well as use vegetative defenses.
FIGURE 4: Tsunami simulations

Source: Ofunato City.

FIGURE 5: Recovery concept of Minami-Sanriku Town
FIGURE 6: Population decrease in disaster areas, and survey of population and businesses in Minami-sanriku (December 2011)

Households
- Planning to leave town: 33%
- Undecided: 24%
- Planning to relocate to higher ground: 20%
- Planning to move in public housing: 23%
- Not affected: 16%

Companies
- Not affected: 16%
- Already recovered: 46%
- Preparing to recover: 23%
- Closed business: 16%
- Went out of town: 23%
- Undecided: 23%
- Don’t know: 33%

Total 3,159 households
Total 552 companies

FIGURE 7: Gap between people moving in and people moving out as a share of population

Source: Statistics Bureau, Ministry of Internal Affairs and Communications, and Minami-sanriku Town
percent in Minami-sanriku, 8.9 percent in Yamamoto, and 8.5 percent in Ostuchi. That gap was also large among young people (less than 15 years old)—up to 14.6 percent in Minami-sanriku and 13.2 percent in Onagawa, further raising concerns about the aging population. In Minami-sanriku, some residents gave up rebuilding altogether due to lack of funds, and planned to either leave town or move to public housing (figure 7).

By contrast, Sendai City experienced a net population inflow (6,633 in 2011). Urbanization in Sendai has therefore accelerated and the population gaps between urban and rural areas are widening. Thus, preexisting trends of aging and declining populations in rural areas and small towns have been exacerbated since the disaster, and must be taken into account in the reconstruction planning.

**RECONSTRUCTION (2012 –2020)**

On February 10, 2012, 11 months after the tsunami, the Japanese cabinet established a national reconstruction agency for a period of 10 years. The agency—headed by the prime minister—aims to promote and coordinate reconstruction policies and measures, and support affected local governments in the Tohoku region (figure 8). It will serve as a “one-stop shop” for local authorities. Although it is based in Tokyo, it includes three regional branches in the most-affected prefectures (Iwate, Miyagi, and Fukushima).

As envisaged under the Basic Guidelines, the government also created a Special Zone for Reconstruction, benefiting 222 municipalities in the disaster-affected zones. These munici-

---

**FIGURE 8: Coordination framework for the reconstruction agency in Japan**

- **Reconstruction Agency** (national level)
  - Planning based on local demands
  - Budget request
  - Earmark budget
  - Implementation plan
  - Distribute budget
  - Coordination, control and supervision

- **Branches** (prefectural level)
  - Receive demands
  - Special Zone for Reconstruction
    - Authorize programs
    - Add special measures
  - Reconstruction grant
    - Budget based on approved plans
  - Coordination

- **Affected municipalities**
  - Formulate reconstruction plan
  - Apply for special zone and reconstruction grant
  - Propose additional special arrangements

---

Reconstruction Policy and Planning
Palities were allowed to submit specific reconstruction plans and apply to the government for funding, as well as a package of special arrangements—such as concessions for land-use planning, creation of new systems related to land use, tax incentives, and special deregulation and facilitated procedures for housing, industry, and services. This strategy supports flexible implementation over time. Reconstruction grants and plans for special measures are submitted to the prime minister, whereas special arrangements for land use are subject to public hearings and inspections.

The process of reaching an agreement on detailed project plans has just begun in most municipalities. In Minami-sanriku, for example, total reconstruction costs are estimated at a few hundred billion yen, a vast sum compared to the annual budget of the town (¥8 billion a year). Two projects are being proposed: a land readjustment project for recovery and a group relocation project (figure 9). An application for a special zone for reconstruction will also be submitted to the central government to relax regulations and attract businesses. Implementation capacity remains a worry, however, as 40 out of the 170 town officials (administrative posts) died or went missing during the disaster.

The creation of the reconstruction agency and the special zone for reconstruction are designed to respond to reconstruction timelines and facilitate a high number of reconstruction projects at increased speed. They represent a major step forward compared to

**FIGURE 9: Land use planning and projects in Minami-Sanriku**

*Source: Minami-Sanriku Town.*
the Great Hanshin-Awaji Earthquake in 1995, where Reconstruction Agency and Special Zone were not put in place, but it remains to be seen how these new systems will be able to coordinate the various recovery plans, turn them into effective projects, and—significantly—overcome a highly sectoral government structure. Already, there are indications that prefectures and municipalities are finding ways to bypass the structures and access funds directly. To succeed, the system must be able to adapt and adjust.

Similarly, it remains to be seen whether the innovative policy of the special zones for reconstruction will be able to help slow or reverse preexisting economic and demographic trends, such as struggling industries and declining and aging rural populations in the affected areas.

**LESSONS**

- To be effective, recovery planning and policies must be based upon local conditions and culture. As such, the highly participatory recovery-planning process followed in Tohoku has proven to be a solid model for megadisaster recovery.

- In disasters of this magnitude, a well-respected and independent advisory council can play a key role in setting the blueprint for the recovery.

- Even though municipalities were responsible for disaster response, they became effectively dysfunctional in the aftermath of the disaster due to the destruction of their offices and the large numbers of dead or missing (a situation that also happened in Haiti). Such destruction is one of the main factors slowing recovery. Furthermore, the implementation of a large number of projects and the outpouring of volunteer support posed a significant burden for smaller municipalities, where financial and human resources are constrained, even at the best of times. This has been one of the principal justifications for the establishment of the reconstruction agency.

- The large scale and diversity of the recovery make information and communication management more challenging and more critical to a successful recovery. Systematic information on victims, for example, was a challenge for many smaller municipalities who lost both records and staff. As a result, prefectures have begun to centralize such information for use by local governments.

- The affected municipalities also benefited from the support of expert consultants contracted by the central government, who had the expertise to quickly carry out damage and needs assessments and provide logistical support. Damage assessments were completed quickly, as the central government relied on private engineering companies who had readily available information on infrastructure replacement costs.

- Similar to the provincial pairing system employed in China after the Great Sichuan Earthquake, and to staff secondments following the Nargis cyclone in Myanmar, twinning arrangements with local governments outside the disaster-affected areas proved very effective for prefectures and municipalities facing a shortage of expertise and manpower.
• While recovery projects may secure the safety of residents’ lives, they will be costly. The population of most disaster-affected areas is sharply decreasing, and it will be a challenge to balance the needs of aging survivors with long-term financial efficiency.

• The design of new residential areas could have been facilitated had a predisaster recovery plan been in place to preselect suitable areas. Taking into consideration the likelihood of large-scale disasters in Japan, enactment of new legislation should be considered to not only facilitate postdisaster response, but also predisaster recovery planning.

RECOMMENDATIONS FOR DEVELOPING COUNTRIES

• Megadisasters in developing countries often involve a multiplicity of humanitarian agencies, donors, and NGOs. As such, it is even more critical to develop, early on, a shared vision for recovery and reconstruction that recognizes local cultural and life values and is perceived as legitimate by key stakeholders. Failure to do so can result in a proliferation of external-driven plans and strategies, as seen recently in Haiti.

• Predisaster planning can help promote a more resilient recovery. This was the case following the 1995 Bangladesh floods, where the response benefited considerably from the level of disaster preparedness introduced after the 1985 floods. In Gujarat, by contrast, a lack of proactive planning despite past disasters hampered recovery efforts following the 2001 earthquake.

• Every megadisaster is different, and the necessity for a dedicated reconstruction agency depends on postdisaster governance and coordination capacity. The Agency for the Rehabilitation and Reconstruction of Aceh and Nias (BRR), established 3.5 months after the tsunami, was generally effective largely due to a strong mandate, national commitment, and external financial support. Concerns about slow recovery, however, led the BRR to take over implementation responsibilities, posing a potential conflict of interest with its oversight function. In later years, the BRR progressively devolved implementation to local governments. Another example of an agency with both coordination and operational functions (albeit not in a developing country) was the Victorian Brushfire Recovery and Reconstruction Authority established after the 2009 brushfires in Australia. Using a successful model based on people, economy, environment, and reconstruction, the authority completed its mandate in 30 months. In other disaster contexts, however, a hybrid model may be more appropriate, where a centralized agency coordinates reconstruction, but implementation capacity continues to be delegated to government agencies.

• In general, recovery planning is most effective when it uses participatory methods and directly integrates the views of experts with those of affected people. Response to numerous megadisasters (for example, the GEJE, 2006 Yogyakarta earthquake, and 2010 Pakistan floods) attest to the merits of this approach. Community members’ participation in planning workshops should be arranged. Also, community leaders should be assigned as members of planning committees. The 2008 Wenchuan earthquake provides an alternative model, where centralized, top-down
planning led to rapid reconstruction. At the same time, there was a weak focus on local capacity building and community preparedness, issues that could hamper future disaster response.

- Governments in developing countries have a very narrow window of opportunity to decide whether to rebuild *in situ* or relocate populations to safer areas. The government of Thailand, for example, considered seriously whether to relocate parts of the capital to higher grounds following the 2011 floods, but this opportunity was quickly lost due to social and political pressures. While moving entire cities has proven historically difficult to achieve, megadisasters can still provide opportunities to improve spatial planning—as demonstrated after the 2011 tsunami in Samoa, when affected coastal communities agreed to relocate further inland.

- Relocation may be needed to preserve public safety, but it often removes people from their sources of livelihood. In a disaster response, both *safety* and *livelihood* have to be well balanced, and nowhere is this delicate balance more difficult than in developing countries. In such countries, affected people are often poor and marginalized, having settled in unsafe areas often because they offer the only land available. When disaster strikes, land speculation and security problems are often rampant; residents quickly rebuild in their original neighborhoods out of fear someone else may move in. As house insurance markets tend to be nonexistent, governments are left with very few instruments to promote relocation: they can resettle people involuntarily (which is seldom successful), or they can promote voluntary relocation by investing in alternative “growth centers” (for example, by building social infrastructure in safer areas). Often, relocating people as close as possible to their original homes and livelihood sources proves to be the most sustainable solution.

- Open and transparent information sharing is a key prerequisite to successful planning. This can be a major constraint in developing countries, where information on key issues such as land tenure and historical exposure tends to be scarce or inaccessible. Since Haiti, development partners working in megadisasters have promoted the use of crowdsourcing and other open data platforms, often with great success. The challenge now is to mainstream such processes effectively into local planning, so that they can provide vulnerable people with a greater voice in mitigating future disasters. The processes should be formulated considering local conditions, since relationships between governments and civil societies vary from country to country.

**KEY REFERENCES**


GFDRR (Global Facility for Disaster Reduction and Recovery). 2010. “Haiti Earthquake
Reconstruction—Knowledge Notes from the DRM Global Expert Team for the Government of Haiti.”


KNOWLEDGE NOTE 4-3
CLUSTER 4: Recovery Planning

Transitional Shelter
Transitional shelter can play a crucial role in housing reconstruction following a megadisaster. Reconstruction of permanent housing cannot move forward until a number of complex issues are settled, such as relocation planning and removal of debris. Even after plans are agreed on and reconstruction begins, it may take several years for permanent housing to be completed. In this context, affected people may need to rely on transitional shelter for extended periods of time, and this will have a significant effect not only on housing, but also on their overall recovery including livelihood rehabilitation.

FINDINGS

The Great Eastern Japan Earthquake (GEJE) led to the total collapse of some 108,000 residential houses. An additional 117,000 houses suffered damage to more than half of their structure (KN 1-2). As a result, more than 450,000 people had to be evacuated to evacuation centers. Within four months of the disaster, 75 percent of the centers had closed, as people were moved gradually to transitional shelters (KN 3-5).

Lessons learned from the Great Hanshin-Awaji (Kobe) Earthquake of 1995 and other disasters led the Japanese government to promote the concept of networked relocation following the GEJE, when an attempt was made to preserve, to the extent possible, existing social networks. The government also offered multiple options for transitional shelter, depending on geography, reconstruction planning, and local preferences. These included temporary housing, mostly prefabricated; government-owned accommodation and public housing; and private rental apartments, which proved popular due to lower prices, higher comfort, and greater versatility. Local governments, volunteers, and nongovernmental organizations (NGOs) provided complementary support, including counseling. As relocation into transitional shelters proceeded, several innovations were introduced, including physical upgrades to improve comfort, wooden housing (easier to convert into permanent use), and multiple-story accommodation. Key challenges have been the lack of sufficient land due to the volume of remaining debris, as well as logistical difficulties in keeping track of disaster survivors to ensure ongoing support. This note discusses the GEJE experience and offers lessons learned with application to developing countries.
JAPANESE FRAMEWORK FOR TRANSITIONAL SHELTER

Prefectural governments are responsible for transitional shelter according to the provisions of the Japanese Disaster Relief Act (1947), with funds allocated from the central government. The prefecture, outside of exceptional cases, can choose the type and form of housing as well as hire private construction companies. Municipal governments coordinate with prefectures for the selection of sites, distribution of affected people, and maintenance of shelters. Affected people are expected to move into permanent accommodation within a period of 2 years (the time normally allowed by Japanese law), and at their own cost, although they receive up to ¥3 million ($37,500) in compensation from the government, depending on the housing damage. Alternatively, they can rent public housing at subsidized rates. The usual flow of the housing reconstruction process is shown in figure 1.

FIGURE 1: The housing recovery process in Japan

Disaster → Evacuation Center → Transitional Shelter → Permanent Housing

Basic Types of Transitional Shelters Used After the GEJE

The government adopted three main programs of transitional shelters in the aftermath of the GEJE (figure 2):

- Newly constructed temporary housing (mostly prefabricated by private contractors)
- Private rental apartments
- Existing public housing and government-owned accommodations (previously built to house government officials)

The type of transitional shelter was influenced by geographic and demographic considerations (figure 3):

- Temporary housing were commonly used in the ria coastal areas north of Sendai (including part of the Miyagi Prefecture and most of the Iwate Prefecture), where most of the resident houses suffered major destruction. This area is characterized by steep and fjord like topography, and both small fishing villages and larger towns located near the ocean; there is little available land near the ocean fit for building.
- Private rental apartments predominated in Sendai City and urban areas in the coastal plains, much of it undamaged.

- The towns in Fukushima Prefecture presented a unique case: due to the radiation hazard residents had to be evacuated for an uncertain length of time. Facing the prospect of having to provide long-term transitional shelter (possibly for many years), the Fukushima Prefecture decided to construct more than 4,000 units of wooden temporary housing, including larger-sized units for larger families. As of March 2012, about 60,000 residents had evacuated the Fukushima Prefecture to other prefectures.
Temporary housing, typically one-story prefabricated row houses built by private companies (29 square meters), is the most common type of transitional shelter used in Japan (figure 4). Typical construction costs have ranged from $5.7 to $6.6 million ($71,000-$80,500 per unit), slightly more than double the price of the 1995 Kobe earthquake. As of early 2012, some 52,000 housing units have been built.

Many prefectures have preexisting agreements with construction companies to build prefabricated temporary housing during emergencies. But even with these agreements in place, it was not possible for construction companies to build all the units needed immedi-
ately, due to shortages of construction materials and workers. Because of such shortages and a lack of coordination across companies, the quality and level of construction of temporary houses varies across the disaster area.

Government policy requires that temporary housing be built on publicly owned land, outside high-risk areas. This posed a significant challenge for much of the disaster area, particularly along the ria coastline north of Sendai, where there was almost no available land—a major reason for the initial delays in the construction of temporary housing. The first residents moved only in April/May, one to two months after the disaster (figure 5).

In many towns, however, a high percentage of temporary housing remained empty, as prospective residents found them inconvenient (too distant from their original villages), uncomfortable, and much smaller than their original houses. The houses were constructed using low-quality, bare-minimum standards, and were not suited to the cold climate of the Tohoku region. Problems included gaps between walls and roofs, drafts, and the absence of noise or temperature insulation, shelves or storage areas, places to sit outside, an awning or enclosure around the front door, and a veranda outside the sliding door (which made it dangerous for the elderly hanging laundry, or small children). Moreover, as allocations were

FIGURE 4: Typical prefabricated temporary houses

Small group of temporary houses near former neighborhood

Temporary houses in Ofunato, Iwate; Onagawa, Miyagi
determined by lottery, residents complained that they did not know their neighbors and lost their community connections. Some people preferred to stay in evacuation shelters as long as possible because food and utilities were provided for (a trend also observed following other megadisasters).

**PRIVATE RENTAL APARTMENTS**

Although not widely used during the Kobe earthquake, privately owned rental housing became the preferred form of transitional shelter after the GEJE, with about 66,000 units used by disaster victims. Rents were paid directly by the government. Such apartments were widely used in the urban areas of Tohoku, including Sendai City.

As also observed in Haiti, private rental units offer many advantages over conventional temporary houses: they are considerably cheaper—about ¥0.7 million-¥1.5 million ($9,000-$18,000) per year per unit or for a two-year average stay, which makes them two to three times less costly than temporary housing. They also allow affected people to move into

---

**FIGURE 5: Number of temporary houses completed**

*Source: MLIT.*
transitional shelters quickly (people started moving in less than a month after the disaster, compared to one to two months for the prefabricated units). In addition, regular apartments are considered more comfortable and livable for residents.

 Nonetheless, private rental apartments are not a viable option for areas that suffer extensive destruction of existing housing stock. In addition, the fact that affected residents are scattered across existing housing units makes it difficult for government and relief workers to track them to provide the necessary information and support. It also makes disaster survivors more prone to losing social connections than when they are grouped together in conventional temporary housing.

**PUBLIC HOUSING AND GOVERNMENT-OWNED ACCOMMODATIONS**

Some disaster survivors moved into public housing managed by government entities, as well as into other government-owned residential facilities. Public housing shares many of the positive features of private rental housing, although it can also lead to residents’ isolation, with limited access to the information and social networks found in the more aggregated temporary housing.

**SUPPORT SYSTEMS**

**COMMUNITY BUILDING AND EMOTIONAL CARE**

Throughout the disaster region, local governments, volunteers, and NGOs started numerous support initiatives to help disaster victims at transitional shelters. These included both physical (provision of furniture, building of additions or improvements, provision of community spaces, buses) and nonphysical support (social events, counseling, health checks, visits, shopping and support for elderly and children).

One example is the Disaster Victims Support Center, started by the town government of Minami-sanriku (Miyagi Prefecture) through the National Government Emergency Employment Fund. The center hired about 100 disaster victims to visit other affected people in temporary shelters, counsel them, and provide support to the most vulnerable. It also established one satellite location in each of the four regions of the town to be closer to the temporary housing residents. This initiative built upon the earlier example of the community centers established in the aftermath of the Kobe earthquake (box 1).

The Japanese Red Cross provided six electric household appliances (televisions, refrigerators, washing machines, cooking pots, microwave ovens, and hot water pots) to those families who moved to new but empty prefabricated houses and apartments. By June 2012 the number of beneficiary families reached over 130,000 throughout Japan, from Okinawa to Hokkaido, including those families displaced by the Fukushima nuclear accident.

**TRANSPORTATION**

One of the key difficulties faced by residents of transitional shelter is the distance from work, schools, hospitals, and shopping. Providing adequate transportation to support these residents is therefore an important challenge.
Livelihood support

Many support groups have started projects to assist residents of transitional shelters in generating side incomes. Examples include the friendship bracelet “Tamaki” produced by wives of fishermen, and hammocks produced by fishermen (both from fishing nets). Other women’s groups have started making and selling products such as key chains, fabric bags, and slippers. The link between transitional shelter and livelihoods has proven important not only to help improve the socioeconomic status of affected people, but also their psychological recovery (see KN 4-5).

LIVELIHOOD SUPPORT

Many support groups have started projects to assist residents of transitional shelters in generating side incomes. Examples include the friendship bracelet “Tamaki” produced by wives of fishermen, and hammocks produced by fishermen (both from fishing nets). Other women’s groups have started making and selling products such as key chains, fabric bags, and slippers. The link between transitional shelter and livelihoods has proven important not only to help improve the socioeconomic status of affected people, but also their psychological recovery (see KN 4-5).

BOX 1: The case of community centers at transitional shelter siters after the Kobe earthquake

A total of 232 community centers were opened as bases to support residents, established by an association of local organizations:

- Volunteers and nonprofit organizations manage the centers.
- Life support advisors visit each house to confirm safety and provide advice.
- Events and gatherings are held by volunteers to promote communication among residents.
- Establishment of community-based organizations is supported.

THE EVOLUTION OF TRANSITIONAL SHELTERS IN THE GEJE

NETWORKED (GROUP) RELOCATION

Given the shortage of publicly available land in disaster-stricken areas, the government allowed some temporary housing units to be built on privately owned land.
Lessons were also learned from Kobe. Many elderly residents had died a solitary death after being separated from their social networks by lottery systems that dispersed them into transitional shelters. In the GEJE, a lottery system was also used during the initial stages of the recovery as the number of temporary houses were much fewer than the number of affected people wanting to move out of the emergency shelters. In Minami-sanriku (Miyagi), for example, some 62 percent of the temporary shelters followed the lottery system.

As more temporary houses became available, municipalities made an effort to support community building and design group housing units that encouraged interaction between neighbors. In Minami-sanriku, therefore, two models of temporary group housing were adopted: large group sites built on public land (schools or athletic facilities) and smaller group sites built on private land. On the larger group sites (built earlier), prospective residents were chosen by lottery, which prioritized senior citizens, families with small children, and other vulnerable residents. Affected people were also given the choice to go to a large group site sooner, or wait a little longer and be relocated collectively into one of the smaller group sites, closer to their former neighborhoods. Smaller group sites were built specifically to support collective group relocation from nearby neighborhoods, to keep affected communities relatively intact.

**PHYSICAL IMPROVEMENTS**

The close network of support to affected people enabled local governments and NGOs to do some improvements to the poor physical condition of the temporary housing units by adding awnings, balconies or verandas, and insulation or soundproof materials, and by providing benches, shelves, and other indoor furniture (figure 6). But problems of basic construction persisted over the entire disaster area, and it was very difficult to improve the situation for all residents.

**FIGURE 6** (left): Improvements to temporary housing—adding insulation to the walls and double-pane windows

**FIGURE 7** (right): Multiple-story temporary housing made with stacked containers
Multiple-story temporary housing made from stacked containers was introduced in Onagawa town to compensate for the scarcity of available land. Stacking the containers to form two- and three-story group temporary housing also helped reduce overall construction time (figure 7).

Wooden temporary housing has been used extensively in Fukushima Prefecture, where long-term, temporary residency is required, as well as in Sumita, Rikuzentakata, and Tono towns. The main advantage is that it can be used for longer periods than the prefabricated houses, and can potentially be converted and/or reused for the construction of permanent housing. It is also more comfortable and warmer, and has the advantages of being disposable. But it is not as standardized as the prefabricated type, and cannot easily be produced in large quantities offsite. In addition, in megadisasters such as Aceh, the extensive use of wood resources has contributed to deforestation of already fragile environments.

TEMPORARY TO PERMANENT HOUSING

In common with other megadisasters (for example, Haiti, Aceh and Yogyakarta in Indonesia, and Chuetsu and Kobe in Japan), it is expected that owner-built transitional shelter will start to emerge. Like wooden temporary housing, it can be reusable and converted to permanent use.

In the 2006 Central Java earthquake in Yogyakarta, the government promoted a “roof first” concept to transitional shelter, allowing residents to incrementally finish the structure. The 2001 Gujarat earthquake in India and the “Katrina Cottages” built following the 2005 Hurricane Katrina (United States) provide further examples where materials and/or semi-permanent structures were provided to residents to gradually rebuild their homes (box 2). This process, however, needs to be carefully monitored to ensure that residents rebuild according to safer standards and do not settle on disputed land.

A relatively unanticipated challenge to the general recovery and reconstruction has been the vast quantity of debris left by the tsunami. Collecting and disposing of such a large amount of debris requires time, large spaces, and resources—impeding other aspects of recovery.

LESSONS

- As discussed in this note, the GEJE experience demonstrates the importance of providing multiple options for transitional shelter. It also shows the importance of allowing local governments and affected communities to have a voice in the location, type, and services provided. This leads to flexible housing solutions that better match the needs of residents. Table 1 summarizes some of the advantages and disadvantages of the various types of transitional shelter, based on the GEJE as well as international experience.

- The design of the transitional shelter was built upon experiences with past disaster recovery in Japan. In Kobe a great deal of temporary housing was constructed far from the city center and former neighborhoods, with residency determined by a lottery system. These conditions exacerbated the feeling of loss for affected
TABLE 1: Transitional shelter options compared

<table>
<thead>
<tr>
<th>Type</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporary housing (prefabricated)</td>
<td>• Standard specifications</td>
<td>• Requires available, safe, and undisputed land</td>
</tr>
<tr>
<td></td>
<td>• Can be built in large quantities offsite</td>
<td>• Slower relocation than rental units (needs to be constructed)</td>
</tr>
<tr>
<td></td>
<td>• Easy to keep track of relocated people</td>
<td>• Low quality and lack of comfort</td>
</tr>
<tr>
<td></td>
<td>• Can be used for collective relocation (preserving social networks)</td>
<td>• Often built in inconvenient locations, far from original homes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• If use is prolonged, risks degrading to a slum</td>
</tr>
<tr>
<td>Temporary housing (owner built)</td>
<td>• Can evolve to permanent housing</td>
<td>• Requires available, safe, and undisputed land</td>
</tr>
<tr>
<td></td>
<td>• Flexibility in location, materials, style</td>
<td>• Principles of building back better (or in nonrisk areas) may not be followed</td>
</tr>
<tr>
<td>Private rental housing</td>
<td>• Cheaper</td>
<td>• May not exist in affected areas</td>
</tr>
<tr>
<td></td>
<td>• Fast relocation (already constructed)</td>
<td>• Relocated people are scattered difficult to keep track and provide services</td>
</tr>
<tr>
<td></td>
<td>• Flexibility and comfort</td>
<td>• Can reinforce social isolation</td>
</tr>
<tr>
<td>Public and government-owned housing</td>
<td>• Cheaper</td>
<td>• Can reinforce social isolation</td>
</tr>
<tr>
<td></td>
<td>• Fast relocation</td>
<td>• More difficult to preserve social networks and provide services than temporary housing</td>
</tr>
</tbody>
</table>

BOX 2: International examples of creative, temporary-to-permanent housing

The “roof first” concept of temporary shelter was adopted in Yogyakarta following the Central Java Earthquake (2006). It prioritized putting a roof over the heads of residents, who could then incrementally finish the structure. For permanent housing recovery, a core house was used to provide a structurally safe permanent shelter as soon as possible for a large number of beneficiaries, who could then expand their housing incrementally over time.

Source: IFRC
people, and there were many cases of “solitary deaths” (kodokushi), where no one even knew that the individual had passed away. The GEJE model tried to prevent this to a certain extent by promoting group relocation and preservation of improved social networks.

- **Community-based organizations** (such as *jichikai*) and **support groups** can play important roles in assisting affected people to understand and resolve issues by themselves during their stay at transitional shelters.

- The design of transitional shelters should be better from the start to promote efficient recovery—for example, by taking into consideration climate conditions and transportation and livelihood needs. It is also important to consider the **special needs of vulnerable groups**—including the elderly, children, and disabled. Transitional shelters need to be accessible to them, and complementary care services planned and provided. To facilitate this, local governments in highly vulnerable areas should **select a suitable construction site for temporary housing and coordinate the works and services needed before a disaster occurs**. Neighborhood groups should also be trained in network relocation.

- A better **information database of disaster survivors** is necessary in order to provide suitable support to the affected population. For example, such data can help in the planning of how many houses to build as affected people move out of the area into surrounding cities, as well as help forecast demographic changes over the long term. This information is also critical for more efficient and economic reconstruction planning.

**RECOMMENDATIONS FOR DEVELOPING COUNTRIES**

- The **timeline** and **costs** of transitional shelter must be considered carefully. In developing countries, affected people often start rebuilding their homes immediately after a disaster, and often according to poor safety standards. As such, transitional shelters may not be needed for long periods (as was the case during the 2010 Pakistan floods), and resources should be shifted toward permanent reconstruction.

- Long periods in transitional shelters may also make it more difficult for beneficiaries to move to permanent housing (such as in the Marmara earthquake, Turkey) and encourage the growth of slums or ghettos.

- In general, megadisasters in developing countries require transitional shelters that are **upgradeable, reusable, and recyclable**, allowing shelter materials to be gradually used for permanent housing. Salvageable materials from debris can often be used to build or complement shelters, and their salvage can be temporary a boost to local livelihoods.

- Owner-built shelters or units built with strong beneficiary participation are often best (for example, 2001 Gujarat, 2006 and 2008 Yogyakarta, and 2010 Haiti) but care must be taken to oversee the quality of the construction or provide incentives for better standards (such as conditional cash transfers). Cash or voucher programs,
such as used in Haiti (2010) and Wenchuan (2008), can promote flexible solutions and allow families to pool resources and rebuild together.

- Transitional shelters must be planned together with strategies supporting daily life (shopping, health care, social life, schools, infrastructure, psychosocial support) as well as livelihoods. To the extent possible, affected people themselves should participate actively in these services, helping rebuild a sense of community and a quick return to normalcy.

- The location of temporary housing is particularly important, especially where land is scarce. Sites with uncertain tenure should be consistently avoided. The preparation of a “land bank”—preselected areas that can be quickly converted to be used as transitional shelters or permanent relocation—should therefore be a critical component of any predisaster contingency plan in highly vulnerable areas. In places where public land is scarce, this may require that the government renegotiate the use of the land with private landowners to prevent subsequent land speculation.

- To the extent possible, the distance between transitional shelters and former homes should be minimized to allow displaced people to maintain social networks and livelihoods, and protect their land and property.

- Community cohesiveness should be ensured by providing timing and site options for temporary shelter. This, however, requires high levels of government capacity and costs, and could slow down shelter transitions. Community members should provide one another mutual help.

- A systematic communication and monitoring strategy is critical to avoid harmful rumors, keep affected people informed, and allow for beneficiary feedback.

- Civil society and the private sector may not be robust and resilient enough to face the disaster, and may not have the necessary relations with their governments in some countries. In these countries, government initiatives are crucial.

**KEY REFERENCES**


IRP Guidance Notes on Recovery: Shelter http://www.recoveryplatform.org/resources/guidance_notes_on_recovery

Shelter Center, Shelter After Disaster http://www.sheltercentre.org/library/shelter-after-disaster

Shelter Center, Transitional Shelter http://www.sheltercentre.org/transitional-shelter


Debris Management

Some 20 million tonnes of waste resulted from the Great East Japan Earthquake (GEJE). The amount of debris in Iwate Prefecture was 11 times greater than in a normal year, and in Miyagi 19 times greater. Appropriate treatment and disposal depends on the type of debris or waste, while recycling should also be considered. Authorities should prepare for disasters by designating temporary storage sites and routes for transporting waste. Japan’s existing debris management plans are being revised to include methods for estimating the amount of disaster waste generated by tsunamis and appropriate measures for dealing with it.

FINDINGS

THE MANY CAUSES OF DISASTER

Disasters have a variety of causes including earthquakes, tsunamis, typhoons, floods, and fires. Over the past decade, several major disasters have destroyed social infrastructure all over the world: Sumatra’s Andaman earthquake in 2004, Hurricane Katrina in 2005, the Great Sichuan Earthquake in 2008, and the earthquakes in New Zealand and Turkey in 2011. Differences in the nature and geographical extent of the environmental effects, and other waste-related problems that may arise, are dictated by many variables including: the cause of the disaster, types of local industry, building densities, and so forth. In other words, big differences exist and it is extremely difficult to generalize.

THE AMOUNT OF DISASTER WASTE AND ITS CLASSIFICATION

The GEJE generated large amounts of disaster waste. Japan’s Environment Ministry estimated 20 million tonnes as on May 21, 2012. This number is very large even when compared with the 15 million tonnes from the Great Hanshin-Awaji (Kobe) Earthquake, the 20 million tonnes from the 2008 Sichuan earthquake, or the 10 million m³ found in Indonesia alone following the 2004 Indian Ocean tsunami (Brown, Milke, and Seville 2011).
Estimates for the Kobe earthquake in 1995, based on the unit waste generation intensity for totally destroyed structures, were 61.9 tonnes/household and 113 tonnes/building. Although there are few reports on the per-unit-floor-space amount, one value reported for the Kobe earthquake was 0.62–0.85 tonnes/square meter ($m^2$), and a contemporary review put it in the range of 0.20–1.44 tonnes/m$^2$ (Takatsuki, Sakai, and Mizutani 1995).

**TSUNAMI SEDIMENT DEPOSITS AND THEIR PROPERTIES**

Tsunami sediment deposits consist mainly of sand, mud, and other bottom material, but their properties and compositions vary widely. Some examples of deposits causing concern are those mixed with the ruins of homes crushed by tsunamis, those containing oils, and those that release offensive odors or dust due to putrefaction or drying. Deposits may also be mixed with substances such as pesticides, acids, alkalis, and other hazardous chemicals from industries in the disaster-stricken areas. Doing nothing about such substances raises public health concerns. The tsunami from this earthquake left heavy deposits. To estimate the amount, we multiplied the tsunami-inundated area by the average thickness of the deposits and a volume-to-weight conversion factor, and obtained a total estimated 11,990,000–19,200,000 m$^3$ and 13,190,000–28,020,000 tonnes for the six disaster-stricken prefectures of Aomori, Iwate, Miyagi, Fukushima, Ibaraki, and Chiba (JSMCWM 2011). The deposit height is between 2.5 and 4 centimeters.

The gist of the chemical analysis results is as follows. Ignition loss (600°C, 3 hours) had a spread of 1.2 percent to 16.3 percent, and there were some samples influenced by the organic matter and oils in the seabed mud. Hexane extracts exceeded 0.1 percent in a number of samples, and on the high end oily mud was at 9.8 percent. While tests for heavy metals did not detect much, lead was detected in many samples in the mg/kg range. Leaching amounts of heavy metals (using a method based on Environment Ministry Notification No. 46) were found in some instances to exceed environmental quality standards for soil contamination from lead, arsenic, fluorine, and boron. In the cases of lead and arsenic, it is conceivable that natural sources were responsible for exceeding leaching standards. Because concentrations of fluorine and boron are high in the seawater of this area, the influence of seawater is a possibility. There were no samples in which the content of persistent organic pollutants (POPs) such as dioxins, PCBs, or pesticides exceeded the standards (for example, for PCBs the standard is the destruction target of 0.5 parts per million [ppm] for PCB treatment, for dioxins it is the environmental quality standard for soil and for sediment in bodies of water, and for other substances it is the established reference guidelines). The levels found were generally the same as the results of environmental monitoring surveys of sediment and soil that were performed in recent years by the Environment Ministry in nearby water and land areas. Because our investigation is based on 62 samples and a limited study, a more detailed study may be carried out in the future, but it is safe to say that at this point no serious contamination in particular has been found.

Essentially, the guidelines for disposing of tsunami deposits call for removing pieces of wood and other materials, detoxifying them, and then using them as fill in landfills or for embankments. In urban areas, where hydraulic excavators are hard to use, removal is performed by people with shovels or other tools. After being gathered, deposits are carried away by heavy machinery, while septic tank pumper trucks can be used for sludge, which has a high water content. After removal, the deposits are put in temporary storage sites; pieces of wood and concrete, which can be used as civil engineering materials, are sepa-
If the deposits contain hazardous substances, they are detoxified by washing and/or physical/chemical treatment, and then either likewise used as material, or taken to a municipal solid waste disposal site if they cannot be effectively used. It was decided that if tsunami deposits contain no pieces of wood or other matter and are not contaminated with hazardous substances, they could be left in place after making arrangements with landowners.

HAZARDOUS WASTE SEPARATION AND DISPOSAL

The types of waste that present dangers, and the methods of handling them, require various cautions, particularly if operations are on-site. There are hazardous wastes such as gas cylinders, building materials containing asbestos, and transformers and capacitors containing PCBs. The Japan Society of Material Cycles and Waste Management (JSMCWM) has prepared a disaster-waste quick reference chart, and it is desirable that personnel performing waste removal should use this (or others like it) to learn about hazardous wastes.

Here is an example from Sendai City of how to treat hazardous waste: such waste, ranging from household cleaners, paints, lead-acid automobile batteries, and emergency power supply systems used by industries, are all being stored separately in a space about the size of a baseball field. Of these types of waste, a decision has been made only about gas cylinders and fire extinguishers—which should be treated by the related industries—while the treatment and disposal of other materials is still undecided. A high level of caution is needed in daily dealings with household hazardous waste, and further detailed measures are required to tackle this issue when establishing plans to deal with disasters.

LESSONS

BASIC FRAMEWORK FOR DEALING WITH DISASTER WASTE

On April 5, 2011, the Science Council of Japan issued the “Urgent Proposal Related to Measures for Earthquake Disaster Waste and Prevention of Environmental Impact.” The proposal’s overall framework was drafted by the JSMCWM, and then issued in collaboration with the Japan Society of Civil Engineers and the Japan Society on Water Environment. The medium- and long-term response was also taken into consideration in formulating a basic policy for the disposal of earthquake waste and the minimizing of environmental impacts. The essential points are given below:

- Waste is to be treated and disposed of quickly, while keeping in mind the securing of public health and the handling of hazardous waste. Priority is to be given to dealing with putrefied organic matter and quickly removing it from cities and streets, or—while taking measures such as spreading lime to delay putrefaction—to determining locations of hazardous wastes such as medical waste, asbestos, and PCBs, and trying to process each waste type in the proper manner.

- Temporary storage sites are to be created (which take the water environment into consideration) and waste is to be uniformly separated. Waste collection locations
are to be decided on immediately, and putrefied materials including sludge-type items, flammable materials, and hazardous wastes should not be mixed. Care is to be taken not to create huge piles, to prevent fires and other such events, and not to cause contamination of water, soil, or groundwater.

- Recycling should be considered, to help put resources to use in recovery and reconstruction. Concrete debris might be recycled in the recovery and rebuilding phases, wood scraps could substitute for fossil fuels in power generation and other applications, and various other types of recycling could be conceived.

- Local employment and wide-area cooperation should be facilitated in disaster-waste recycling. It was determined that in this case what is promoted internationally as “cash for work” could be effective. On dealing with disaster waste in the Tohoku region, even if wastes were to be recycled, the region would not have sufficient treatment and disposal capacity, which raises the possibility of wide-area cooperation. A case can be made for taking a nationwide response: integrating industry, government, academia, and the citizenry.

Figure 1 shows the basic flow involved in operating temporary storage sites and preliminary waste storage sites to facilitate the local management of municipal solid waste. These storage sites play a major part in the smooth removal of debris from disaster areas.
For instance, it was known that since much of the disaster-stricken area in the Tohoku region comprises narrow coastal zones and also because of the urgent need for land for temporary housing and other purposes, it was not easy to secure land for temporary storage sites. In all geographical areas, authorities should prepare for disasters beforehand by designating places for temporary storage sites, traffic routes for waste transport, and other related needs.

In situations such as when a tsunami has scattered individuals’ private possessions and mixed them with disaster waste, removal and processing must proceed while also determining who owns what. At the end of March 2011, the government issued “Guidelines on the Removal and Other Treatment of Collapsed Homes and Other Property after the Tohoku Region Pacific Coast Earthquake” (Ministry of the Environment 2011), which contained the following three points:

- Make sure everyone knows in advance the plans for where operations will be conducted, schedules, and other particulars.
- Before removal, take photographs and make other records of buildings, automobiles, motor scooters, and boats.
- For ancestral tablets, photo albums, and other items that are valuable to owners and other persons, as well as chattels, provide opportunities to return them to the respective owners and other persons.

Valuables such as precious metals and safe boxes should be put into temporary safekeeping. Efforts should be made to contact the owners or relevant parties in the event they are identified, and the valuables should be returned when the owners or relevant parties so request. When the owners or other relevant parties are unknown, the guidelines call for the valuables to be processed as directed by the Lost Property Act.

**SEPARATION AND RECYCLING: THE SENDAI CITY MODEL**

Following is one conceivable classification scheme for the composition of disaster wastes from earthquakes and tsunamis:

- Waste consumer electric appliances and electronics, and various household effects
- Waste wood, concrete rubble, tiles, and so on
- Plants, trees, and other natural items
- Large structures and so on
- Deposits (silt, bottom sediment, and so on)
- Wrecked vehicles and boats
- Hazardous wastes (asbestos, pesticides, PCBs, and so on)
• Evacuation center waste

• Infectious waste, human corpses, and animal carcasses

Depending on the composition of each type, it is necessary to identify and carry out the appropriate treatment and disposal methods, while keeping in mind the possibilities for recycling. Table 1 lists the specific types of waste that fall under the above categories, and their recycling and disposal methods. Although people tend to concern themselves with removing disaster waste quickly, they should from the outset consider how wastes could be recycled to reuse valuable resources and prevent wasting landfill space.

Disaster waste and tsunami deposits generated in Sendai City were estimated to be around 1.35 million tonnes and 1.3 million tonnes, respectively. As of April 2012, these could be treated as follows:

• Concrete, which accounts for about half of the 1.35 million tonnes of disaster waste, can possibly be reused as material for reconstruction.

• Strategies for waste other than tsunami deposits are near completion.

The city had already estimated the amount of disaster waste only three weeks after the March 2011 earthquake, and set up a target of disposing of it within three years. Realizing that it was impossible to treat the waste using only existing facilities, the city decided to set up additional temporary incinerators, which were constructed in the autumn of 2011. Three temporary incinerators (one stoker furnace and two rotary kilns; 480 tonnes/day of total disposal capacity) were installed in three designated temporary storage sites along the coastal area. The following items were separate and recycled: wood lumber (for fuel use), metals, tires, four items designated in the Home Appliance Recycling Law, automobiles, and motorcycles. These items were carried out in turn to each place to be recycled.

Including wastes that are supposed to be landfilled, the amount of waste collected and moved to temporary storage sites is measured by a king-size weighing scale, and in some cases the results are recorded in a manifesto sheet.

**FINANCIAL SUPPORT**

To facilitate disposal of disaster waste, half the cost is covered by government subsidies, and a tax-exemption system is applied to 80 percent of the remaining cost (that is, a local government has to pay only 10 percent of the total cost). Additional measures are being taken this time to reduce the burden on local governments considering the size of the enormous damage caused by the GEJE.
# Debris Management

## Table 1: Classification and treatment of earthquake waste

<table>
<thead>
<tr>
<th>Category</th>
<th>Outline</th>
<th>Type of waste</th>
<th>Recycling and disposal method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste from household goods</td>
<td>Household goods destroyed by earthquake and tsunami</td>
<td>• Valuables and mementoes&lt;br&gt;• Home appliances (TVs, refrigerators, air conditioners, washing machines)&lt;br&gt;• Other home appliances&lt;br&gt;• Tatami mats, mattresses</td>
<td>• Each item stored for return to owner&lt;br&gt;• Home appliance recycling system&lt;br&gt;• Metal recycled after dismantling and crushing; organic material incinerated, inorganic matter disposed of in landfill&lt;br&gt;• Tatami mats, mattresses</td>
</tr>
<tr>
<td>Waste from collapsed houses</td>
<td>Collapsed houses and buildings (including furniture) destroyed by the earthquake and tsunami</td>
<td>• Timber from houses, furniture&lt;br&gt;• Concrete, asphalt, waste tiles&lt;br&gt;• Asbestos-containing building materials&lt;br&gt;• Plasterboard</td>
<td>• Desalted if necessary. Potential usages include: 1) particle board, charcoal, and reuse of material; 2) use as fuel in cement kilns; 3) energy recovery from incineration&lt;br&gt;• Crushed and used as aggregate for roadbed material and in construction&lt;br&gt;• Controlled management: disposed of in landfill, melted&lt;br&gt;• Controlled management: disposed of in landfill</td>
</tr>
<tr>
<td>Wood</td>
<td>Scattered and accumulated garden trees, pine wood, and other trees</td>
<td>• Garden trees, live trees, etc.</td>
<td>• Desalted if necessary. Potential usages include: 1) particle board, charcoal, and reuse of material, papermaking material; 2) use as fuel in cement kilns; 3) energy recovery from incineration</td>
</tr>
<tr>
<td>Bulky waste</td>
<td>Large-sized and unusual waste from factories and infrastructure</td>
<td>• Tanks, power poles, feedstuffs, fertilizer, and fishing nets that each require a specific disposal method</td>
<td>• Crushed and separated and then recycled, incinerated, or disposed of in landfill. Caution is required for hazardous substances such as asbestos.</td>
</tr>
<tr>
<td>Deposits generated by the tsunami</td>
<td>Gravel and mud left in disaster area after the tsunami. Most is bottom sediment from water bodies, but sometimes organic materials and contaminants are included.</td>
<td>• Sediments mixed by the tsunami with the debris of collapsed houses and other debris. Some include oil. Odor and dust could arise on putrefaction and drying. Hazardous chemicals such as acids, alkalis, and pesticides from the disaster area could be included.</td>
<td>• Used as fill for landfill sites or embankments after removing woody debris and detoxifying. Detoxified by washing or incineration when material contains hazardous substances. Non-recyclable items are taken to final disposal site and disposed of as general waste. Where there is no wood debris and no contamination with a hazardous substance, they could be left in place after making arrangements with landowners.</td>
</tr>
<tr>
<td>Vehicles/ships</td>
<td>Automobiles/ships</td>
<td>• Automobiles, motorbikes, tires, ships, etc.</td>
<td>• Automobile recycling system. Tires chipped and used as a supplemental fuel. Ships are dismantled, recycled, and disposed of. Caution required for asbestos materials.</td>
</tr>
<tr>
<td>Hazardous waste</td>
<td>Asbestos, PCBs, etc.</td>
<td>• Batteries, fluorescent lamps, fire extinguishers, gas cylinders, waste oil, waste liquids, transformer oil, etc.</td>
<td>• Controlled management undertaken as necessary for each type of waste.</td>
</tr>
</tbody>
</table>
RECOMMENDATIONS FOR DEVELOPING COUNTRIES

PREPARING A DISASTER WASTE MANAGEMENT PLAN IN ADVANCE

It is essential to make disaster waste disposal plans beforehand to help reduce the need for decision making with insufficient information in the wake of a disaster. Guidelines on measures to manage disaster waste and on measures to treat waste from flooding were established in Japan in 1998 and 2005. Both sets of guidelines require that any plan should specify how to:

- Establish basic policies for waste management.
- Construct and manage the system that deals with waste management.
- Classify disaster waste and secure necessary equipment and temporary storage sites for disaster waste.

In 2010, 72 percent of municipalities across the country (a rather high rate), had disaster waste management plans in place. But they are now being revised to include the following:

- Estimation method for the amount of disaster waste generated by tsunamis, and countermeasures for dealing with the waste.
- Multiple predictions for disasters of different scales.

Accordingly, periodical review of disaster waste management plans is indispensable.

BUILDING COOPERATIVE STRUCTURES WITH VARIOUS ORGANIZATIONS AND INSTITUTIONS

When disasters occur, cooperative ties with various organizations and institutions are key to the smooth management of disaster waste. This is because many problems and administrative needs arise, while the number of appropriate policy experts is limited and the waste disposal sites in the affected areas are often damaged. Above all, much more waste is generated in these circumstances. Developing cooperative relations between local governments in the surrounding affected areas and with communities far from the stricken areas should be considered. Sendai City, for example, which was affected by the GEJE, over the course of a year received 58 staff from 8 organizations to help promote its waste management plans. For waste collection, the city received help from 7,510 staff from 10 organizations, as well as 88 vehicles.

In addition to cooperating with industries and local municipalities, building and making effective use of cooperative relationships with academic organizations, other expert groups, and nonprofit organizations are also recommended.
BOX 1: Preliminary findings of the United Nations Environment Programme’s (UNEP’S) expert mission on Japan’s earthquake waste

- The contingency plans put in place by some prefectures before the earthquake allowed them to respond more quickly to the waste management challenge (for example, in Sendai City, which had contingency plans, three incinerators were already in place processing 460 tonnes of waste a day).

- While Japan has done much to advance global best practices on handling disaster debris, there is still scope for substantial optimization so as to lower the costs of postdisaster debris management and reduce its environmental impacts.

- Commendable emphasis has been placed on waste segregation and recycling. Waste is divided into several categories such as wood, metals, electrical items, tatami mats, fishing nets, vehicles, plastics, and so on. Some segregated materials are already being reused: for instance, tree trunks are being sent to a paper mill, shredded wood is being sent to a cement company for use as fuel in the manufacturing process, and building rubble is being recycled as building material, landfill, or in road construction.

- Maximizing the possibilities for waste recovery and recycling while minimizing the need for transportation are priorities for effective debris management.

- Under Japanese law, the manufacturers of cars and white goods (refrigerators, washing machines, and so on) are responsible for the final disposal of their products. But the volume of disaster debris generated is likely to overwhelm their intake capacity, which may need to be expanded.

- Despite the magnitude of the challenges, and their own personal tragedies, the officials in the various Japanese cities are doing systematic and dedicated work to manage the debris in a time-bound fashion.

- Opportunities exist for learning from best practices in various cities, and a systematic approach to capturing them and disseminating them would be beneficial.

- The national guidelines produced for disaster debris management could be locally adapted, with input from academic experts to reflect local circumstances. This will lead to more environmentally optimal outcomes.

- There is scope for improved monitoring and communication of the waste management activities in the disaster-impacted areas, which will enable everybody to appreciate the challenges faced and the efforts made.

CUSTOMIZING THE REMOVAL PROCESS TO LOCAL CONTEXTS

Each country has its own environmental safeguards, technology, and recycling practices. Utilizing these local practices are crucial in effective debris management.

KEY REFERENCES


KNOWLEDGE NOTE 4-5

CLUSTER 4: Recovery Planning

Livelihood and Job Creation
Livelihood and job creation have long been critical challenges to disaster recovery. Following the Great East Japan Earthquake (GEJE), the Japanese government launched an innovative cash-for-work (CFW) project, hiring more than 31,700 jobless people to work not only on reconstruction, but also on clerical and support work for affected people. This allowed it to reach out to women and the elderly, vulnerable groups that were traditionally excluded from schemes focusing primarily on manual work.

**FINDINGS**

The GEJE caused some 140,000–160,000 people to lose their livelihoods and jobs. By February 2012, in part as a consequence of an innovative emergency job-creation project initiated by the government, 143,820 people had found employment in the three most affected prefectures. Of these, 22 percent (31,700) were jobs directly created by the emergency job-creation project. Despite gaps between sectors, regions, and types of employment available, the government-initiated job-creation policy has generally been effective in sustaining employment in disaster-affected areas.

**RECORD OF LIVELIHOOD AND JOB CREATION IN JAPAN FOLLOWING CATASTROPHIC DISASTERS**

Livelihood and job creation has long been a critical issue in disaster response and recovery, both in Japan as well as worldwide. Fundamentally, it plays three critical roles:

- **Economic.** It serves as a key—and in some cases only—source of income for the population affected by disaster.

- **Social.** It encourages affected people to participate in the recovery process, thus strengthening their social ties.

- **Psychological.** It helps those who lose their jobs regain their self-esteem and look forward to a future.
Historically, job-creation policies benefiting those affected by disasters have not been particularly successful in Japan, despite their recognized importance and long record—even dating back to the 1854 Ansei Nankai earthquake disaster. After the 1923 Kanto earthquake, the Ministry of the Interior encouraged local governments and private firms to hire affected people for disaster response and recovery work; however, this attempt was unsuccessful, as the work provided was mainly manual while affected people aspired to nonmanual, “white collar” labor. The national government instead encouraged jobless people to move to suburban areas of the cities from which they originated.

Livelihood- and job-creation attempts were also unsuccessful following the Great Hanshin-Awaji (Kobe) Earthquake of 1995. As a result of the disaster, some 40,000–100,000 people were left jobless. The national government issued a law in March 1995 forcing public projects in affected areas to reserve up to 40 percent of their workforce for affected people rendered jobless by the earthquake. A year later, however, only 30 people had been hired under the policy. Contractors continued to make employment decisions based on profitability and efficiency, and there were no penalties for noncompliance. As a result, employment for affected people was limited to simple and unskilled public work tasks. During the recovery process, 254 people died in transition shelters without the care of family members or neighbors. Some study reports point out that most of the people who died alone were jobless, suggesting that they were isolated from society and had no contact with others.

**DAMAGE CAUSED BY THE GEJE AND ITS IMPACT ON LIVELIHOODS AND JOBS**

The GEJE could be the most severe of recent disasters in Japan. The Japan Research Institute (JRI) estimates that 140,000–160,000 people lost their livelihoods and jobs in May 2011 due to earthquake and tsunami damage. Moreover, most of the tsunami-hit cities lost the bulk of their infrastructure.

Ishinomaki City, for instance, was one of the largest cities hit by the tsunami (population 160,000). The Ishinomaki fishery port is the third-largest in Japan in terms of total landings. Fishery and seafood processing were the main industries of the city, engaging hundreds of companies and employing several thousand people.

The tsunami washed out nearly the entire central business district of the city. Aside from damage to buildings and facilities, the earthquake lowered soil levels by approximately 1.4 meters, allowing seawater to penetrate the area at full tide. To restart the industry it will be necessary to first elevate the soil, something very few companies can afford to do given the burden of existing loans. Over a year has passed since the earthquake and tsunami, and the national government has included the elevation costs under its third supplementary budget (FY2011). But it will take several years to complete such a large reconstruction project and, therefore, job recovery in Ishinomaki City is expected to be slower than during the 1995 Kobe earthquake.

In Fukushima, the national government designated the area within a 20-kilometer (km) radius of the Fukushima Daiichi Nuclear Power Plant accident as a restricted area, affecting some 78,000 people. Areas with relatively high radiation levels, even outside the 20-km
radius, were designated as Deliberate Evacuation Areas, affecting an additional 10,000 people (most of whom lost their jobs).

Although the national government is planning to remove restrictions in areas with relatively low radiation levels, the recovery of livelihoods and jobs in these areas will be difficult to address. A recent questionnaire of evacuees from these areas conducted by Fukushima University indicates that only 4 percent intend to return to their homes immediately after the lifting of the restrictions. Of the respondents, 25 percent have already decided not to return at all, citing lack of jobs as one of the major reasons. Close to 46 percent of respondents under the age of 35 say they will not return. Since the power plant was the main source of economic activity in the area, there are now very few job opportunities left. Thus, livelihood and job creation will also be critical to recovery in these areas. The survey results further indicate that 16 percent of the respondents say that recovery of the infrastructure will be necessary, while 21 percent argue for a concrete plan for radium decontamination.

**LIVELIHOOD AND JOB CREATION UNDER THE GEJE**

**GOVERNMENT INITIATIVES**

Following the GEJE, the Japanese government’s response involved both cash transfers to the most vulnerable, as well as an emergency job-creation project.

To help secure livelihoods to the most vulnerable people (such as the elderly those handicapped who are not regarded as employable), the government provided cash transfers through the regular social security system based on the Public Assistance Act, amounting to around ¥50,000 to ¥250,000 per month. In addition, the Japanese disaster management system provided up to ¥3 million ($37,500) to households that lost their houses to assist them with reconstruction efforts. Cash was also individually distributed to the most vulnerable people in the form of donations received from all over Japan.

To promote job creation, the Ministry of Health, Labor and Welfare (MHLW) launched the “Japan as One” Work Project immediately after the earthquake. The project had three major policy objectives:

- Steadily create jobs through reconstruction projects.
- Develop a system to match disaster victims with jobs,
- Secure and maintain securing employment among disaster victims.

The first policy objective built upon an earlier emergency job-creation fund created in 2008 after the global financial crisis. Following the GEJE, the government spent ¥50 billion ($625 million) to enlarge the fund, expanding its eligibility to disaster-related job losses.

Examples of activities supported by the project included:

- Evacuation center management and administration, such as food distribution, cleaning, procurement, and the delivery of food and other materials.
• Safety management and life-support services such as patrolling, caring for the elder and disadvantaged, babysitting, supplementary lessons for students, and bus driving.

• Office-work support for local governments such as issuing resident cards, operating the call center, guiding visitors, distributing donations, and monitoring and performing needs assessments at evacuation centers.

• Reconstruction and recovery work such as debris removal, the cleanup of houses of the elderly, parks and public building maintenance, planting of flowers in parks, and public relations activities for sightseeing promotions.

The basic thrust of this policy was very similar to that of a CFW program (see box 1), but it differed substantially from typical CFW programs in developing countries. The range of work created by this project was so diverse that women and elderly could also work, whereas other CFW programs have tended to provide mostly manual labor (for example, infrastructure reconstruction).

One of the constraints faced by the job-creation project was that employers had to comply fully with domestic labor laws. For example, employers had to compel workers to take compensation, employment, and social insurance. Paperwork accompanying employment procedures proved a bottleneck during job creation. Although many of the government agencies, nongovernmental organizations (NGOs), and private contractors were major sources of job opportunities, they were reluctant to hire the jobless since they were otherwise occupied with the emergency response.

**Public-private partnerships** were an effective solution to this problem. The Fukushima Prefecture government, for example, requested private staffing agencies to hire affected people for the work of disaster-response organizations (including municipal governments). This scheme was very effective since the organizations involved did not have the burden of paperwork or personnel management.

**Public-public partnerships** were also used. The CFW activity in Ofunato City was partially undertaken by the Kitakami City government. Kitakami City received emergency job-creation funding from the Iwate Prefecture government, and entrusted a private staffing agency to hire affected people to care for affected peoples in transition shelters in Ofunato City.

For the second policy objective of the “Japan as One” project—matching disaster victims with jobs—the government intended to fully activate and empower public employment exchanges in the affected areas. This was effective to some degree but not enough to manage the significant burden of job matching. This was why (as mentioned above) private staffing agencies played a significant role in job creation.

The third objective—to secure and maintain employment among disaster victims—was supported by two activities. Some ¥727 billion ($9 billion) was distributed as an employment adjustment subsidy to affected industries, as an incentive for them to secure employment. In addition, the government provided ¥294 billion ($3.7 billion) to extend benefit terms of unemployment insurance. This helped protect workers in the formal sectors. Without this assistance, the burden of the job-creation project would have been much higher.
NGOs AND THE PRIVATE SECTOR

Nongovernmental organizations (NGOs) and the private sector also played important roles in the aftermath of the GEJE. The International Volunteer Center Yamagata, for example, launched a CFW project where jobless affected people were hired for debris removal and cleaning activities. Their salaries were financed by donations from all over Japan as well as overseas. The work was eventually expanded to community-support activities. The project ended on March 31, 2012, having hired 112 jobless people. Although it was a typical CFW scheme, it was not as large as programs seen in developing countries.

Another example was the Sanriku-ni Shigoto-wo Project in the Sanriku area, driven by a nonprofit alliance of Iwate Hakuhodo Co. Ltd., Iwate Menkoi TV, and Sendai Television Inc. This project provided livelihoods to fishermen’s wives previously engaged in seafood processing. While affected fishermen had benefited from an emergency job-creation project promoted by the Fishery Agency for debris removal and fishing port clean-up efforts, their wives had been left jobless.

Thirty new shops were opened in the Minamisanriku shopping village, inaugurated on February 25, 2011, for temporary job creation following the disaster (figure 1). The Ministry of Economy, Trade, and Industry through its “Small Medium Enterprise Support, JAPAN Program” facilitated the establishment of this temporary shopping village. Souvenir items produced by local residents, particularly women, were sold in some shops to support livelihoods.

FIGURE 1: Minami-Sanriku shopping village
The project generated a new handicraft made by women: a friendship bracelet called tamaki (“ring”) made of fishing-net materials (figure 2). Approximately 50 percent of the sales went to the women producers. This project was covered extensively by television and the social media, and for several months production could not keep abreast of sales. As of February 29, 2012, 298 producers had received as much as ¥83 million ($1 million), according to the project Web site. The success of this project triggered many other kinds of handicraft production.

The Security Support Fund, operated by Music Securities Inc., was an e-commerce citizen aid initiative that matched prospective investors with small businesses affected by the GEJE to help restart them. Those who needed financial support submitted proposals via the fund’s Web site. In turn, prospective donors could visit the Web site and find projects for their potential investment. Thus, it worked as a microfinance project where prospective donors were matched directly to the recipients.
BOX 1: Livelihood options in humanitarian assistance

International humanitarian assistance has typically used two instruments to promote livelihood recovery after disasters: cash transfer and public works programs (cash for works).

Cash transfers are typically used to provide short-term assistance to the most vulnerable affected people. To be effective, cash grant programs must be well targeted (for example, aimed at the elderly, widows, refugees), be transparent, have sound mechanisms for monitoring and evaluation, and have a clear exit strategy. Typical programs implemented during the 2005 Pakistan earthquake and 2004 Sri Lanka Tsunami involved a transfer of $50 per month per target household for a period of four to six months. Often, cash transfer programs coexist with, or graduate, to become CFW programs.

Cash-for-work (CFW) programs have been common tools for humanitarian assistance. These programs provide cash to affected people in return for their work on various recovery projects, such as debris removal and the repair or reconstruction of damaged infrastructure. They have been used in many disaster situations, including the 2004 Indian Ocean Tsunami, the 2008 Myanmar Cyclone, and the 2010 Haiti earthquake.

CFW programs were developed as an alternative to food-for-work (FFW) programs, in which affected peoples could receive food in return for their disaster-recovery and mitigation work (during droughts and famine). Cash has several advantages over food as a worker incentive: (i) related logistics are less complex and management costs are lower; (ii) workers can choose what they buy, thus empowering them; and (iii) cash has a large market impact when it is spent locally. At the same time, CFW programs must avoid crowding out the normal job market and, like cash transfers, require close monitoring.

This fund has two important features: (i) one unit of investment can be as small as ¥10,500 ($131) and (ii) investors do not expect an economic return from their investment. About half (¥5,000) of the single unit of investment is considered a donation. Most of the investors enjoy communicating through the Web site with the businesses they are supporting. The fund has now grown to ¥700 million ($8.8 million), attracting more than 20,000 investors.

POLICY RESULTS AND OUTSTANDING CHALLENGES

Partially as a result of the government policy, the labor market has recovered rapidly in the affected areas. The number of beneficiaries of employment insurance leapt to 81,179 in June 2011 from 29,931 the previous March. Since June 2011, moreover, job offers have exceeded the number of new applicants, and this gap has been growing (figure 3).

Although the job situation is surely improving in general terms, recovery is not yet complete, and there are gaps in four major areas: (i) differences between job offers and applicants (mentioned above), (ii) gaps among regions, (iii) gaps among sectors, and (iv) gaps in employment patterns.
FIGURE 3: Recovery process of labor markets of the three major affected prefectures

Source: MHLW.

FIGURE 4: New-job-opening ratios of the affected prefectures

Source: MHLW.
In common with other disasters, job opportunities have disproportionately been concentrated in urban areas. Figure 4 illustrates trends in new-job-opening ratios by prefecture. Miyagi Prefecture—where Sendai City, the capital of the Tohoku region, is located—has been attracting more jobs than the other two prefectures. Even within the Miyagi Prefecture, job opportunities are concentrated in the Sendai metropolitan area (a new-job-opening ratio of 1.17 in February 2012), while Ishinomaki and Kesennuma, both of which are located on the coastal areas severely affected by the tsunami, offer relatively scarcer job opportunities (ratios of 0.77 and 0.55, respectively).

Additional gaps are seen among job sectors. With rising reconstruction demand, many new job offers come from construction and related industries, with relatively fewer offers in the manufacturing and distribution industries. Job applicants, on the other hand, appear to be seeking occupations more focused on food processing and clerical work.

A final gap is seen in employment patterns. In spite of an increase in job offers, most involve part-time or short-term employment. The job-opening ratio for full-time, regular workers in Miyagi Prefecture in February 2012 was only 0.49. The situation for those who are looking for regular, full-time work is therefore not as favorable as the general statistics suggest.

Part of the reason why a large proportion of job openings involve so much short-term employment relates to the government-supported emergency job-creation project. Between March 2011 and February 2012, 31,700 workers—or 22 percent of all job offers in the Iwate, Miyage, and Fukushima prefectures—stemmed from the emergency job-creation project (figure 5).
This finding has key two implications. First, the government-initiated job-creation policy has been effective in sustaining the job market in disaster-affected areas. In its absence, unemployment issues would have been far more severe. At the same time, the transition from CFW jobs to regular jobs has been a difficult challenge for the economic recovery process.

CFW programs in developing countries typically assist in the process of economic recovery and even economic growth: this is plausible since disasters in developing countries tend to affect growth rates positively. As such, CFW programs fill an important employment gap immediately following a disaster, after which economic growth creates sufficient permanent jobs to take over.

But economic recovery in developed countries does not necessarily follow this trend: the populations of the three prefectures affected by the GEJE had been declining since before the earthquake. As an economy shrinks, it does not necessarily generate sufficient permanent jobs to take over the role of emergency job-creation programs. Japan could well be facing this problem.

**LESSONS**

- Dedicated emergency job-creation programs, complemented by cash transfers to the most vulnerable, can be effective ways to assist disaster-affected people during a recovery. At the same time, they need to be adjusted progressively to emerging job markets, and avoid cluttering them in the process. More prolonged assistance may be needed when local economies are contracting.

- The livelihood needs of disaster-affected people are diverse, and thus require diverse solutions. The most vulnerable may need cash transfers, whereas those already benefiting from pensions (for example, the elderly) may need primarily an occupation to make them feel needed. Others—such as widows with young children—require regular employment with insurance benefits.

- The experience of the GEJE shows how learning from past disasters has been used effectively to design the emergency job-creation project. Regulatory measures and market forces alone did not succeed in creating jobs following the Kobe disaster. The GEJE helped launch a more proactive government project, which promoted diverse employment and partnerships with NGOs and the private sector, while retaining the means to monitor its overall progress.

- The GEJE job-creation program has been innovative in facilitating public-private and public-public partnerships. In particular, hiring staffing agencies helped reduce the administrative burden, which would otherwise have prevented many employers from engaging the victims of the disaster.

- Matching jobs with the needs of the jobless is a very important but difficult task. Most of the affected areas have seen excess labor demand and labor supply simultaneously, but in different sectors, and urban areas have clearly benefited over rural areas. Interventions such as continuous monitoring of job supply and demand, job retraining, and further integration with municipal plans are necessary to effectively complete the recovery.
• Unemployment insurance can be effective in securing the incomes of those affected. But there are several limitations: (i) unemployment insurance does not cover self-employed workers and those who run private enterprises and (ii) the national government has twice had to extend the beneficiary period of insurance, allowing even those covered for the shortest period to benefit from the program until January 2012. Unemployment insurance therefore needs to be seen as part of a broader livelihood recovery program following a disaster.

RECOMMENDATIONS FOR DEVELOPING COUNTRIES

• To the extent feasible, CFW and employment programs following a disaster should expand the range of work opportunities, from simple manual labor for infrastructure reconstruction to nonmanual work. While in developing countries most of those affected are poor and unskilled, megadisasters such as the Haiti earthquake of 2010 also affected skilled workers. It is important that all be given opportunities to contribute meaningfully to the recovery and reconstruction of their neighborhoods, although priority for external assistance must naturally be given to the poorest and most vulnerable. In particular, the jobs created should be:
  – Appropriate to the workers’ skills and abilities.
  – Help boost the morale and self-esteem of those affected.
  – Build upon the workers’ skills, to help them secure their next occupation.

• The balance between quality and quantity needs to be planned carefully in developing countries, where the primarily goal is often to provide rapid cash relief to the poorest and most vulnerable of the disaster victims. As a rule, the proportion of labor to the total costs of the activity should therefore remain high (for example, 50-80 percent). CFW schemes need also to be designed with a view to providing a smooth transition to long-term jobs, and avoid attracting people back to vulnerable urban areas. As such, prevailing wages should be set just below the market rate for unskilled manual labor, thus ensuring that programs attract only those without other alternative means to earn income, and do not crowd out more permanent job creation.

• In the above context, CFW schemes in developing countries differ from those promoted under the GEJE. Under the GEJE, the beneficiaries of the job-creation project were paid market wages, as there was no possibility of circumventing minimum wage regulations. In addition, as they had the option of claiming unemployment insurance, it was important to set the wages at levels sufficiently attractive to motivate them to work. Statistics in the GEJE prefectures do not show that this approach—at least in Japan—caused wage inflation. Thus, it was not supposed to prevent a transition to normal employment.

• Similar to the experience of Japan, CFW programs in developing countries need to be part of a broader social protection program which can include cash transfers to the most vulnerable, such as was done in the aftermath of the Pakistan earthquake.
or Sri Lanka tsunami. If so, the eligibility, amount, and duration of payments, and cash-delivery mechanisms must follow transparent procedures.

- Periodic evaluations are essential to determine whether livelihood programs are reaching their goals, and allow for corrections among program partners. In the case of Haiti, for example, preliminary evaluations pointed to the need to better target the most vulnerable, while avoiding prolonged aid dependency. A particularly neglected aspect tends to be seasonal competition between CFW and agriculture or fishing occupations, as well as assistance to people who, while not direct victims of the disaster, may be under traditional obligations of sheltering family members, with consequent strains on food supplies.

- Job-creation programs in Japan tend to be smaller than those in developing countries—most hire fewer than 100 people each. Although this model is not necessarily an efficient way to maximizing employment, it helps integrate CFW programs with long-term job opportunities, as employers are directly responsible for supervising and caring for employees.

- The case of the Securite Supporting Fund in Japan proves the effectiveness of e-commerce in directly linking affected people with potential benefactors. This has also been observed in other recent megadisasters (for example, the Pakistan and Bangkok floods), where the social media increasingly played an important role in disaster recovery (see also KN 4-2).

- While CFW programs are effective schemes for the short term, the transition from CFW jobs to regular jobs is a difficult challenge. Job opportunities for construction works will complete within a few years. Government support for creating regular jobs is essential in devastated areas—such as arranging jobs, building factories, rehabilitating facilities of irrigation and fishery harbors, and resolving double debt (KN 6-4).

**KEY REFERENCES**


Recovery Research Institute. 2011. “Questionnaire Survey for Evacuees from Futaba 8 Municipalities” (in Japanese). http://fsl-fukushima-u.jimdo.com/app/download/5674929767/4f8d78e2d453ea202dcdcaf2a227a5f5f9ed7ad2b40418/24.2.14H23%E5%8F%8C%E8%91%89%EF%BC%98%E7%94%BA%E6%9D%91%E8%AA%BF%E6%9F%BB%E5%9F%BA%E7%A4%8E%E9%9B%86%E8%A8%88_ver2.pdf?t=1329268540.