Strengthening the Regional Resiliency of Industrialized Suburban Cities through BCP Consolidation: Case Study Based on the Niigataken Chuetsu Earthquake†

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Abstract

In Japan, business continuity plan/management (BCP/BCM) is recognized as a very significant issue as in other advanced countries, because of the great earthquake disasters in 2004 and 2007 in Niigata Prefecture that caused disruptions of many small and medium sized production companies as well as forcing all Japanese automobile manufacturers to cease production for several days. However, according to some reports the BCP establishment rate in Japan is still low. This study focuses on Ojiya City, which was seriously affected by the Niigataken Chuetsu Earthquake in 2004. The production industries have a concentrated presence in Ojiya City, making it an excellent case study for clarifying the disincentives to BC planning at small and medium sized enterprises (SMEs) as well as demonstrating a new concept for increasing regional resilience, because it represents areas of potential resource consolidation for cooperation within the industrial community, the regional civic community and other remote regions. As a result, several key elements are proposed that may support “regional BCP” that may consequently lead to true “regional resiliency.”

JEL Classification: L29, R00, Z00

Keywords: Business Continuity Plan, Disaster Recovery, Resiliency, Industrial Agglomerated Region

1. Introduction

The concept of reducing damage levels and enabling rapid recovery from natural disasters or lowering the event probabilities of technological disasters and accidents is called “disaster prevention,” “disaster mitigation,” “risk management (RM),” or “disaster recovery (DR).” Japan has been prone to many natural disasters—earthquakes, typhoons, and heavy snows—due to its geographical location and meteorological conditions. For example, Japan has experienced no fewer than seven earthquakes that have caused great suffering and then named individually by Japan Meteorological Agency since 2000. Seismic activity predictions warn of an ocean-trench earthquake, known as a Tokai or Tonankai earthquake, outbreak in the near future, which would cause extreme damage to cities on the Pacific coastline, including the Tokyo metropolitan area. Under such circumstances, Japan’s disaster countermeasures are considered amongst the most advanced in the world. Some concrete measures taken against natural disasters in Japan include the quake-proof design of buildings, durability in heavy snowfall conditions, adopting efficient technology to prevent losses from fire or other accidents and prevent the escalation of events, and insurance coverage to mitigate economic losses. These measures can be applied preventively before an incident, during the incident, and in its immediate aftermath. However, such traditional disaster mitigation or disaster recovery strategies cannot treat the long-term effects following a disastrous event. Today’s complex and networked society pre-

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vents any single organization, including local governments and private companies, from continuing operation without cooperative plans involving others. Therefore, the continuity strategy to maintain an organization’s critical functions during a state of emergency, which is to resume full activity as soon as possible and then to survive long-term, has been recognized as fundamental (e.g. Sheffi [16], Oke and Gopalakrishnan [13], Zsidisin et. al. [19], Craighead et al. [41]). That is, the importance of an organization’s resilience has been a topic of growing interest for some years, and especially so after the 9/11/2001 terrorist attack. After 9/11, some financial and information service organizations implemented thorough continuity strategies that include alternate business sites located appropriate distances away from the attack site, the mirroring or replication of important business data to multiple separate devices, redundant communication paths, employees’ disaster training, and the like, recovered their business quickly after the event (Berman [1]). The business continuity plan (BCP) is the recommended approach for achieving such resilience. Now various activities have been carried out to promote BC planning at private companies and other organizations through the formulation of BCP guidelines by governments or by national standards agencies worldwide (British Standard Institute [2], Cabinet Office, Government of Japan [5], National Fire Protection Association [12]), and the technical committee of the International Organization for Standardization (ISO) has recommended international BCP standards, all business people are increasingly aware of the importance of BC planning.

However, we do not observe a widespread movement to implement BCP in individual corporations, much less integrated regional plans. The Japanese government’s 2008 white paper on disaster management reports that only 12% of non-large private companies have implemented their BCPs and less than 20% of even large companies have implemented theirs (Cabinet Office, Government of Japan [3]). The report also revealed that more than 60% of small and medium sized enterprises (SMEs) do not even know the term or the concept of BCP. The Niigataken Chuetsu Earthquake in 2004 was an inland earthquake whose epicenter was at the town of Kawaguchi, Honshu, a mountainous region of Japan’s main island. Ojiya City, near Kawaguchi, is a heavily industrialized area with more than 300 small and medium sized companies manufacturing ironware, precision machines and equipment, electric and electronic parts, and processed foods; thus, their earthquake-related damages and losses were enormous. In 2007, the Niigataken Chuetsu-oki Earthquake occurred offshore from Kashiwazaki City, which faces the Sea of Japan near Ojiya City. Moreover, located nearby are one of the largest nuclear power plants in the world that runs seven reactors with over one million kilowatt declared power individually, other production enterprises, similar to those in Ojiya, comprising of more than 460 small and medium companies producing ironware, mechanical parts, information and communication device parts, and processed foods. Despite the very low percentage of preparedness among the SME business continuity, nearly every company seems to have recovered and is functioning well today.

What contributed to their seemingly natural business continuity? The Chuetsu-oki Earthquake forced one large factory that produces essential automobile parts in Kashiwazaki to cease production, which in turn caused all the automobile companies and some parts suppliers to stop their production lines temporarily because of the disruption in supply chain (Sato [14]). Immediately after this collapse, nearly every automobile company that were customers of the damaged parts supplier sent much of their own workforces to Kashiwazaki to support the recovery activities of the damaged factories, which total more than 800 personnel on peak days. As a result, the auto-parts manufacturer resumed production rapidly and began operating at nearly the usual volume one week after the event. The author had also confirmed that five days after the tremor, some production machinery manufacturers outside of the disaster area helped their user companies reinstall, raise, adjust, and test the accuracy of affected equipment (Kourakata [9]). Did such support networks among enterprises beyond the regional border or across the industry make a large contribution to the affected manufacturers’ rapid recovery from the disruption?

If so, we have some very intriguing issues to explore that relate to how these seemingly ad-hoc intercorporate networks performed during the catastrophe. Is a more rapid and appropriate mutual aid system available? Are public sector entities, including local autonomous bodies, able to supply efficient backup to private enterprises in the affected area? This research targets Ojiya City with the goals of discovering factors that may strengthen the SME community’s resilience in the industrialized suburban city and proposes a
new framework for regional BCPs that can be implemented when regional natural disasters occur. Finally, based on this investigation, we attempt to reveal the barriers to SMEs’ BC planning and propose a new perspective from some tactics for establishing an extensively networked BCP that is not constrained by existing standards or guidelines.

2. Recent Disasters and Their Impacts

2.1 Profile of the Region Studied

This study focuses on Ojiya City in the central area of Niigata Prefecture, located in the central region of the Japanese main island, Honshu, 300 km from center of Tokyo, with the Sea of Japan approximately 25 km from its densely-inhabited district (DID). As shown in Table 1, Ojiya is an inland suburban city with a 155.12 km² city area and a population of 39,956 at the end of 2005. In one direction, it lies near the sea coast and experiences heavy snows, often more than three meters high. In the other direction, Ojiya borders the mountains that separate the Pacific side of Honshu from the side facing the Sea of Japan and feels the effects of seasonal winds. Ojiya has rich history and was previously known for traditional high quality fabric production and agricultural products. The current era of industrial activities, including ironware, electric and electronic parts, and processed foods, began in the sudden but brief oil-rush around 1890. Building upon those early industries, Ojiya saw the emergence of machinery manufacturers in response to the national policy of expanding the mechanical industry during World War II, this was also when the first industrialized rice biscuit production in Japan began there. The neighboring coastal city of Kashiwazaki is on direct route to the sea from Ojiya, and so interaction between these cities has flourished. The longest river in Japan, the Shinano,

<table>
<thead>
<tr>
<th>Name of city</th>
<th>Niigata Pref.</th>
<th>Ojiya</th>
<th>Kashiwazaki</th>
<th>Tsubame</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area [km²]</td>
<td>12,583.48</td>
<td>155.12</td>
<td>442.70</td>
<td>110.88</td>
</tr>
<tr>
<td>Population</td>
<td>2,431,459</td>
<td>39,956</td>
<td>94,648</td>
<td>43,255</td>
</tr>
</tbody>
</table>

Drawn by the author on the basis of 2005 population census and 2006 Establishment and Enterprise Census of Japan.
passes through middle of the city and continues to Niigata, the capital of Niigata Prefecture. Thus, its location has made Ojiya a strategic hub for traffic and logistics since ancient times ([6]). Today, 7,547 employees work in its manufacturing industries, totaling 40% of all the 18,704 workers in the city; thus, we can assert that Ojiya is a typical industrialized rural city. Table 1 and Figure 1 also shows that Ojiya’s economy depends heavily on more manufacturing industries than other cities, including Tsubame, which is known as a center of the metalworks industry.

2.2 The Niigataken Chuetsu and Niigataken Chuetsu-oki Earthquakes

As mentioned previously, Niigata Prefecture was struck by two big earthquakes within four years. Hereafter, we will call the Niigataken Chuetsu earthquake of 2004 and Niigataken Chuetsu-oki earthquake of 2007 the Chuetsu quake and the Oki quake, respectively.

The Chuetsu quake occurred early on a Saturday evening, when nearly all workplaces were closed for an official holiday; even holiday-operating factories had ended their working hours. The Oki quake struck at midmorning on a Monday, but since it was a national holiday, many companies in the disaster area were closed. The industrial concentration district in Ojiya stands very close to the epicenter of the Chuetsu quake. The geographic relationship between the cities and epicenters of the main tremors of the two quakes and the density of manufacturing factories are shown in Figure 2. The Oki quake’s epicenter is slightly further from the factory zone in Kashiwazaki, but the seismic intensity was high there. The author and colleagues investigated the damages and recovery processes after both quakes and then confirmed a great number of damage reports to industrial machinery in factories and structural failures of factory and office buildings. Among the various types of damage to production equipment, general-purpose lathes and unusual special assembly machines seemed to be more likely to collapse than machining centers and grinding machines. The finding resulted from the former having a relatively high center of gravity in narrow installation areas, and the latter being heavier, with a low center of gravity and installed on wider bases. Among the many precision metal working firms, we found reports of serious damage to expensive or rare measuring devices, such as a three-coordinate measuring machine, an absolute length measuring machine, and the like. Besides the collapse or breakage of level blocks weighing more than several hundreds kilograms, there

![Figure 1 Composition of gross yearly product by industrial sector of Japan and the focused regions. Drawn by the author on the basis of 2005 population census and 2006 Establishment and Enterprise Census of Japan, and Annual Report on National Accounts of 2006.](image-url)
were innumerable reports of damaged or destroyed ceiling panels, window frames, racks, and shelves. The fact that both quakes caused only few deaths amid these severe conditions was mere luck, and demonstrates the importance of being prepared against such natural disasters to mitigate damage on a usual workday.

Having made those observations about public facilities, we must also consider the collapse of expressways and the long-term traffic constraints after each disaster. The Shinkansen (a high-speed “bullet train” connecting Tokyo and Niigata) related damages after the Chuetsu quake included derailments, breakage of bridge columns, concrete walls collapsing, and temporary ceasing of operations. These conditions had caused great inconvenience to local residents and to every business and government agency in Niigata Prefecture. Electricity, water service, and city gas service were restored within a period ranging from a few days to three weeks after the attack (according to some materials available publicly, the nuclear electric power plant in Kashiwazaki, which shut down all the reactors immediately after the Oki quake, does not operate commercially still on 1 December 2009 due to incompleteness of restoring damaged facilities caused by the quake and following procedures of checks, safety evaluations, and the inspection by the national government).

3. Business Continuity

The British Standard BS25999-1:2006 defines BCP as the “documented collection of procedures and information that is developed, compiled and maintained in readiness for use in an incident to enable an organization to continue to deliver its critical activities at an acceptable pre-defined level.” Put simply, BCP is a documented plan for maintaining critical activity at a required level and to recover in the shortest time acceptable.
to stakeholders like private companies or public institutions after any incident that disrupts business operations, thus keeping an organization functioning. Conventional ideas of disaster mitigation and recovery planning or risk management assume specific categories of disasters or accidents, and then plan countermeasures against (or recovery measures for) their occurrence. In contrast, BCP does not consider specific incidents but focuses on an organization’s processes. The complete functioning an organization consists of a series of business processes. The purpose of BCP is to analyze the impact to business operations from the disruption of these processes, taking countermeasures in advance to prevent bottlenecks that may affect business continuity, to maintain critical activities of the organization at levels acceptable to all the stakeholders, and to facilitate the earliest possible recovery to the usual level of operations. For example, the financial services corporations that buy and sell securities or stocks via communications terminals can be seriously damaged by customer transaction record data loss if a disaster causes terminal server or network failures; even a brief blackout can severely damage these businesses if data is lost. Therefore, like these firms’ BCP relies heavily on real-time data mirroring or backup at distant sites (presumed to be unaffected by local disasters), multiplex communication lines, and emergency power generators sufficient for any disastrous incident in order to ensure extremely rapid recovery defined in their BCP’s “recovery time objective (RTO)” – several hours at the most after the event.

The region we focus on in this study has a concentration of many small and medium sized manufacturing establishments, producing parts, units, modules, etc., as components of final products fabricated by downstream customers or as capital goods. These establishments are in turn downstream from vendors of intermediate goods. Thus, many companies comprise a highly complex supply chain. Procuring a particular part from several suppliers is a suitable business continuity tactic in the event of a business collapse, but such measures raise management and procurement costs. Doubling the production line is even more expensive. Because of the complexity of BCP strategies, identifying common best practices for enterprise BCP is a very difficult high-level management judgment call, which sometimes needs helps by appropriate consultants and/or software programs.

4. Methodology

For gathering diverse concrete measures adopted by individual companies in Ojiya during and after the Chuetsu quake to return to normal operations, this research chose the case study approach (Yin [18]). By this method, we can expect to obtain a variety of the companies’ actions, such as recovery procedures, assistance obtained from entities outside of the company, identification of unavailable facilities or institutions prioritized for public sector support despite strong private-sector needs, and even detrimental facts. The mail-in
survey method, which may be appropriate for gathering common information, was considered but found to be inappropriate for identifying the “microscopic” and precise actions taken by the individual respondents that are so essential to this study, and we did not want to risk the typically low percentage of response to mail-in surveys that would compromise the effectiveness of the research. The principal reason why the case study method is suitable for the study is as follows.

The industrial structure and relationship among the Ojiya manufacturing companies forms a hierarchy as shown in Figure 3: several core firms, each surrounded by some smaller subcontractors, with the subcontractor groups slightly overlapping each other. Thus, the case study method applied to these “core” companies as multiple cases provides deeper and wider data about each organization in the region than would other methods.

Five independently funded cases were chosen from 68 member companies of the Iron and Electronics Industry Association of Ojiya. All these cases are over medium sized enterprises having more than 100 to 150 employees, however, we would get detailed information not only about themselves but also their small and micro sized subcontractors. The outlines of the enterprises investigated are listed in Tables 2–1 and 2–2 and their names are anonymized. Prior to beginning data collection, the author participated in a board meeting of the Association and explained the objective, method, and proposed schedule of the research, and then obtained the board members’ understanding and cooperation. In the case study, companies received a document that proposed several categories of questions to ensure a smooth investigation. After that, the author visited each company between October 2008 and February 2009 and interviewed one or several respondents at once. Questions sent before the interview were about the business outline including supply chain information, risk and disaster management system, damage situation, and disaster recovery actions done and aid received from outside of the company, such as the Chuetsu quake, however, respondents were not restricted within these items but allowed to talk freely about the disaster related matters, i.e. semi-structured interviews were held. Each respondent was a manager or a president with detailed knowledge of their business.

Table 2–1 Profiles of investigated manufacturers and informants

<table>
<thead>
<tr>
<th>Company H</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Founded year</strong> : 1944</td>
<td></td>
</tr>
<tr>
<td><strong>Capital</strong> : ¥1,020 million</td>
<td></td>
</tr>
<tr>
<td><strong>Employee number</strong> : 197</td>
<td></td>
</tr>
<tr>
<td><strong>Annual sales</strong> : ¥3,300 million</td>
<td></td>
</tr>
<tr>
<td><strong>Main products</strong> : measuring equipment, precision machinery, bearings</td>
<td></td>
</tr>
<tr>
<td><strong>Main customers</strong> : bearing maker, optical device manufacturer, car maker and parts suppliers</td>
<td></td>
</tr>
<tr>
<td><strong>Characteristics of business</strong> : prominent lapping technique, many built-to-order goods, relatively long delivery time</td>
<td></td>
</tr>
<tr>
<td><strong>Establishments</strong> : 1 Ojiya plant; 5 branches in Japan and 1 in China</td>
<td></td>
</tr>
<tr>
<td><strong>Informant</strong> : manager of general affair dept.</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Company J</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Founded year</strong> : 1947</td>
<td></td>
</tr>
<tr>
<td><strong>Capital</strong> : ¥90 million</td>
<td></td>
</tr>
<tr>
<td><strong>Employee number</strong> : 214 and 2 part timers</td>
<td></td>
</tr>
<tr>
<td><strong>Annual sales</strong> : ¥4,900 million</td>
<td></td>
</tr>
<tr>
<td><strong>Main products</strong> : machine element, precision machinery</td>
<td></td>
</tr>
<tr>
<td><strong>Main customers</strong> : tool maker, industrial machine builder, car maker and parts suppliers</td>
<td></td>
</tr>
<tr>
<td><strong>Characteristics of business</strong> : high market share of machine element, customer-specific machinery, relatively long delivery time</td>
<td></td>
</tr>
<tr>
<td><strong>Establishments</strong> : 1 Ojiya and 1 Kawaguchi plants; 3 branches in Japan and 1 in USA</td>
<td></td>
</tr>
<tr>
<td><strong>Informant</strong> : manager of production dept. and manager of general affair dept.</td>
<td></td>
</tr>
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situation and its exact activities during disaster period. Each interview lasted two to three hours and was entirely recorded with the interviewee’s permission for later analysis. The information obtained was summarized, and individual sentences or words were categorized into six classifications together with information gathered from the Company Directory in Niigata Prefecture, brochures, the Internet, and some materials presented by interviewees. The categories were: “business outline,” “direct damage by the quake,” “indirect middle and long term effects,” “management framework and procedures for disaster recovery from collapse and any efforts at the time of the incident” and “those taken after the incident,” and “time-series episodes related to the disaster until restoration was almost completed.” Each category was subcategorized into some inter-case common items and integrated in a matrix. Compiled data was sent back once to each interviewee for correction. Unique or characteristic events specific to individual cases, including other information obtained through informal interviews or conversations, were examined and analyzed carefully, one by one. After one full cycle of the analysis process, a brief report was presented at the yearly meeting of the association for the purpose of checking the validity of the compiled data and to obtain additional interviews.
with other organizations as references: a large processed food company (a major industrial category in Ojiya), an industrial mechanical parts manufacturer, a governmental financial institution, a local banking corporation, and a local government.

5. Analyses and Results

5.1 Hypothesized Factors Contributing to Successful Recovery

Although one of the case-study companies has more than 500 employees, others are SMEs. Therefore, at the outset of this research, the author anticipated the following issues that were investigated in each enterprise. The enterprise:

a. does not accumulate enough internal funds and had difficulties in expending or procuring funds for disaster recovery activities.

b. has only one or two factories, and is therefore unable to back up manufacturing operations between multiple sites.

c. could not recover quickly without external support, because human resources are insufficient and many employees were also residents who suffered damages or personal harm.

d. produces capital or intermediate goods and has steady, large-scale customer companies; thus, the customers’ support contributed to its early and successful recovery.

e. exists in the environment described above, and so the close relationship between itself and customer companies became an important factor in the disastrous situation.

f. experienced difficulties in the procurement of intermediate goods from their local subcontractors, because their business sites were also damaged heavily, and they are too small to recover by themselves.

g. needed to request consignment production from other companies in the same trade, if a long time period was necessary for recovery from serious damage, i.e., an OEM agreement for an emergency would be necessary for its survival.

The adequacy of these hypotheses will be validated through the analyses described in following sections.

5.2 Description of Damages

In the workshops, we frequently observed fallen and displaced manufacturing machines, plumbing, wiring for electricity and communication, shelves for jigs, and goods in process and in stock. Some equipment fixed to the floor with anchor bolts remained steady; however, there were rather severe damages, like fractured bolts or deformed machine bodies caused by extreme seismic acceleration. (Machine fixation using anchor bolts to the ground is still controversial; however, we do not treat such technical problems in this paper.) The heat treatment process for metal caused small fires in some companies.

Regarding buildings and facilities annexed, there were also a high number of walls and ceiling panels that collapsed, broken windows and glass falling out, water damage caused by broken piping for air conditioners, disconnections of communication lines, and lighting fixtures and air-conditioning apparatuses fallen down. While a lot of fixtures and pieces of furniture fell over at almost every establishment, many factory buildings avoided fatal damage, except for one investigated company whose buildings collapsed and became unusable thereafter. Ojiya has a great deal of snow in the winter season, and so many buildings are constructed to withstand heavy snow coverage; such a high level of durability probably helped to resist the quake.

In spite of these serious situations, few casualties occurred, probably because of simple luck in the timing of the event early on a Saturday evening. Many people would definitely have been injured or killed had the quake struck during office hours on a weekday. On the other hand, the day being a holiday caused other diffi-

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1 Maximum accelerations of 1,750 Gal at Tokamachi City and 1,502 gal at Ojiya City were recorded. 100 Gal = 1 m/s².
culties. Managers at companies’ head offices experienced difficulty in communicating with their employees. As discussed in later sections, employees who were also community residents moved to evacuation locations where both conventional and cellular phone service were compromised because of physical disruption or congestion of the lines; therefore neither phone calling nor visiting employees’ houses could confirm their safety.

5.3 Recovery from Disruptions

Figure 4 shows an averaged situation of recovery of the studied cases in a time sequence parallel with the resumption of important services such as electricity, telephone, water service, and gas. Circles and triangles in the figure correspond, respectively, to the cases that gained the earliest and the latest resumptions of these utilities. All business activities depend on these elements of public infrastructure; therefore, business recovery is also affected to some degree by the resumption of these utilities. With several exceptions, utilities such as telecommunication lines, electricity, water service, and gas became available at the earliest on approximately days one, three, four, and seven after the incident, respectively. Among these, telecommunication lines and electric power, which almost all communication, information, and manufacturing equipment needed to resume work, returned quickly to transmit information to the stakeholders, activate order-receiving systems, and operate machinery. Even within the same disaster area, some places could not use them for a somewhat longer period. Very few establishments prepared for emergencies by having electric generators, but some procured generators through corporate networks to restart their businesses.

The investigated establishments had had only fire evacuation drills during the previous year, lists of emergency “bring-out” goods, or no plans at all. Despite this, they resumed manufacturing very quickly and successfully. We observed a few examples that supporting workforces were not necessarily a major factor for recovery; these companies have internal capabilities to maintain and improve, or even fabricate, manufacturing equipment themselves, and their employees were multiskilled workers, so the employees’ dedicated efforts supported a successful and speedy recovery. Of course, even such establishments are unable to either finish final accuracy checks of all the equipment or restore buildings and their annexed structures alone. Rapid assistance from many organizations, like industrial machine manufacturers and general contractors from outside the disaster area, contributed greatly for an early recovery. Particularly for small sized firms who lack sufficient resources to recover, such assistance was very effective. In fact, the presidents of some small and medium sized companies in Ojiya reported that the voluntary support provided by industrial

![Figure 4: An averaged recovery situation of establishments and lifelines in Ojiya after the Niigataken Chuetsu Earthquake. Circles and triangles in upper part correspond to timings of the fastest and the latest recovery “cases” respectively.](image)
machinery manufacturers or the dispatching of skilled workers to re-install equipment with the necessary tools were extremely helpful.

Figure 4 also shows that production activities stopped for approximately one week at each workshop after the event, although nearly every company resumed some of its shipping function within a couple of days after the event. Upon analysis, the one week period was within the “maximum tolerable period of disruption” often cited by BCP best practices, and the rate of continued business operations surpassed similar “critical activities” benchmarks during the emergency period. The reasons for the acceptability of a one week period of disabled manufacturing may include the goods not being in urgent demand because they are capital goods, their times to delivery being naturally relatively long, the performance of the goods being affected by time-consuming integration between customers and suppliers or there being no—or only slight—competition for even intermediate commodity manufacturers. The core competences of many establishments in the disaster area are high-mix and low-volume manufacturing and immediate shipment of the customer’s order; consequently, their sales networks consist of branches or agencies, and critical amount of goods are available even during a short stoppage of production. On the other hand, almost none of them copied important business data at remote locations or had an emergency power source, oversights that would hamper their ability to respond to customers’ requests efficiently.

Company M’s factory buildings suffered such heavy damage that it could not recover manufacturing for a long time, even though it has other factories in China, whose manufacturing processes integrate with the workplace in Ojiya. It lost a large portion of its trade with a US company to which it had supplied intermediate products, while it maintained relationships with Japanese customers by establishing temporary or continuous OEM agreements with other companies in the same industry in Japan, through an industrial association. Today, company M continues business operations at a new scaled-down site, and some of its products are supplied to the customers by OE manufacturers. The interviewees in this study nearly all agreed on the impossibility of OEM contingency agreements, but company M’s case revealed the importance of examining mutual supply systems in advance, considering the product’s properties and quantity, and the customer’s needs.

Although we found that damage to factory buildings were slight, we did observe some exceptions where buildings collapsed completely, including company M. Some of them could move their business bases to their own vacant factories, but a few small companies could not. While these small or micro-subcontracting enterprises could not reconstruct their business sites by themselves, one major contractor provided temporary workspace in its factory for them, rebuilt damaged facilities, and finally enabled them to move into renewed sites. Others could relocate their workshops to unused buildings owned by other companies, on the basis of “availability information” from regional industrial associations.

We have very helpful information from the experience of the 1995 Great Hanshin Earthquake. There, many micro-scaled factories related to the chemical shoes industry that had enormous damages, however, administrative organizations—i.e., local government, foundations, industry-academia networks, etc.,—facilitated these companies’ resumption of business by creating temporary industrial parks, building new factory units, and similar projects (Seki and Otsuka (Eds.) [15]). On the other hand, we have never heard, at least from interviewees and available materials, of such support by governmental and other agencies during the incidents we studied. One respondent said that he had proposed to the local government expending public money from existing recovery funds, to build temporary factories. We certainly know that some experts argue against spending public money for private property; however, flexible and quick countermeasures should be taken when natural disaster strikes a wider area, especially when an industrialized region suffers widespread damage.

Financing may become the most important issue in recovering business activity after a disastrous event. Although nearly all the investigated organizations could budget for recovery on their own, some of them had to depend on public financial support or loans from banking institutions. Although several companies could get public financing and/or support, such as an interest subsidy, they reported that the insufficient support system, the complexity of the disaster loan system, and limitations in using government financial
institutions made it difficult to raise enough funds. Improvements in the system for providing public financial support for damaged enterprises should be taken, because the recovery of employer companies, even if privately funded, directly leads to securing employees' incomes, and thus to the revival of the regional economy.

5.4 Other Significant Facts Affecting Recovery

While the recovery of facilities, buildings, and lifelines are naturally important, the most important consideration for any organization is simultaneously securing all stakeholders’ safety. Companies are, of course, required to safeguard employees’ lives first. Many companies, as noted, had had fire evacuation drills during working hours and took measures to reduce the risk of the occurrence of such accidents; however, they never prepared for the eventualty of a disaster occurring during a holiday, with few or no persons in the building. After the Chuetsu quake, because of this communication oversight, employers had trouble confirming employees’ safety. As is the case in many industrial suburban cities, the local community overlaps with the industrial community in the investigated region; i.e., a large segment of local residents are also employees of local businesses. For people living within a relatively small area, their safety can be confirmed by voluntary access to their workplaces by foot or bicycle if the traffic system or communication lines are disrupted, or through word of mouth within the local community. This approach, however, depends entirely on circumstances and luck. Some companies studied reported that their emergency communication network based on the use of conventional land-line telephones did not work satisfactorily. As an employers’ managers have to confirm the safety of all persons related to the company’s activities, particularly those residing within a specified distance from the work site, the use of a cellular phone “disaster message board service” for emergencies is recommended, on the premise that cellular network data communication is more robust than voice communication. Verification of employee safety and company operational information is important not only to satisfy regulatory requirements, but also to ensure an accurate public perception of the scope of the disaster.

The effects of rumors are sometimes overlooked but can cause fatal results for businesses. Newspapers and TV reports describe the seriousness of the direct damage, but because of this, they may give viewers and readers unfoundedly alarming impressions of the event, including information about the surrounding area. Their reports spike immediately after a disaster, followed by rapid decrease, which we call the “long tail effect” of the press. Large-scale enterprises may be able to communicate and deliver their own correct information via the appropriate media, but many SMEs cannot. In any case, not all the news stories are necessarily correct. A certain national newspaper reported a few days after the Chuetsu quake that the manufacturing companies in Ojiya were in catastrophic circumstances, although some of them had already begun production activities. Individual organizations should carefully estimate the risks related to communication plans, although communications have many vulnerabilities in the face of natural disasters like a large-scale earthquake affecting a wide area, including the physical elements of the cellular and Internet data networks. Under such circumstances, a region-wide or trans-regional approach to manage information delivery to the outside and also within the community would contribute to the reconstruction efforts and the ongoing stability of the region, because customers exist across a broader area.

5.5 Partnerships within Wider Areas

Although earthquakes and floods affect broader areas, more smaller scale damages than many people imagine occur at locations within 30 minutes or a one hour drive by car away from the epicenter or wash-out. On the other hand, industrialization frequently spreads beyond the impacted area, like Ojiya and its surrounding cities. Some businesses near the epicenter had a considerable effect upon other companies in adjacent regions to which they temporarily or permanently outsourced processes that were difficult to resume in a short time. Constructing databases and information utility networks that any damaged organization can access for relevant information for prompt outsourcing or other purposes would be a very effective counter-measure. One respondent at a medium-sized production factory with about 80 employees said, “approximately one week will be enough to move, install and adjust equipment and to begin factory operation at the alternate site.” As a reference point, so the crucial nature of this issue can be understood, the fastest recov-
As mentioned in section 5.3, the reinstallation of fallen or moved machinery needs specific heavy equipment. In ordinary circumstances, not many specialized companies need to be located in or around the industrial region, but such limited resources cannot deliver sufficient services in the occurrence of a mass disruption. Similarly to rare machine tools, such equipment for installing industrial machinery is in short supply. To achieve rapid recovery, therefore, even with voluntary assistance, an information network among comparable regions would play a crucial role in obtaining hard-to-find equipment.

5.6 Propositions for a Regional BC Framework

We can extract some key points for “regional BCP” in industrialized cities where many SMEs in similar industries need to ensure continuity of the affected businesses and thus secure residents’ incomes. To that end, we offer the following propositions. Needless to say, each suggestion must be taken not after the event, but planned in a disciplined process, with all stakeholders’ acceptance of its strategy, objectives, and expected outcomes.

Proposition A: Economical support should be supplied with simple procedures.

The restoration of damaged buildings and facilities is expensive, but many small and micro-sized companies do not have enough money available, nor can disaster insurance completely cover it in all cases. Public financing support, decreasing the interest rate for loans, or low-interest disaster loans may also support recovery from disaster. Japan does, in fact, have systems for such financing and Niigata Chuetsu Offshore Earthquake Foundation provides even direct cash subsidy for individual SME’s disaster recovery. But many people find the procedures too complicated or the application form too difficult, and sometimes the strict financing criteria prevents processing of the applications. The disaster loan system provided by the Small Business Administration (SBA) of the US may serve as a useful model. The SBA maintains a one-stop service for disaster loans, with a simple application form available online as well as at the SBA office. We urge our government agencies or legislative institutions to improve the convenience of our financial support system as soon as possible.

Proposition B: Preparation or the rapid availability of alternate sites is critical for heavily damaged businesses to continue operating.

It is clear that the multithreading of business processes or preparing alternate sites facilitates a company’s rapid recovery after disastrous events. However, very few SMEs can adopt this tactic because many of them operate at only one workplace. Micro-sized subcontractors are not always able to depend on spare space at their parent companies. The example mentioned in section 5.3, i.e., subcontractors being given temporary workspace in their core company’s factory, should be recognized as an exception. Under catastrophic circumstances like natural disasters, all community members in the affected region are damaged, so sharing efforts and resources for recovery with other organizations is difficult for even the relatively larger businesses. Still, there may be vacant factories and public or private spaces temporarily and rapidly available for business operations. Some type of social system like a database or information network for sharing and disseminating information about usable vacant spaces in the case of a catastrophic event can be useful in many ways. It could be accessed by not only individual businesses or single communities but also by business and civic entities within a broader region that, consolidating their information, would help all SMEs (and small civic organizations) to develop, test, and implement valid contingency plans. Needless to say, just implementation does not assure the effectiveness of the plans unless repeated exercising, checking, and redeveloping procedures (PDCA cycle) with appropriate interval time; they say at least once annually. The information contained in such databases should not be limited to only real estate, but should include all types of resources, some of which may alter as time, thus periodically testing all the aspects of the plans including consistency and applicability of data accumulated is absolutely necessary to maintain enterprises’ prepared-
ness. Such information management would be fundamental to the following propositions.

**Proposition C**: Efficient allocation of resources supplied from outside the affected area enables more rapid recovery.

Generally speaking, SMEs do not have enough resources, including their workforce. When a disaster strikes, recovering without external support is difficult. Because natural disasters like the Chuetsu quake disrupt the entire community, it is pointless to depend on only local networks for mutual support. When the Chuetsu quake occurred, many construction companies and industrial machine manufacturers outside of the area sent supporting workers with special skills and necessary tools voluntarily on the basis of their customer information, and their dedicated behavior accelerated the recovery of damaged companies. A few days after the Oki quake, the same situation occurred. Through the news media, we know that hundreds of supporting workers from car construction companies contributed to the rapid resumption of production of a certain automobile parts supplier. However, the author did not find in the cases of Ojiya and Kashiwazaki any such efficient distribution of supporting workers across the damaged area. Who needs support, what kind of support is needed, when and where? Observers of the Chuetsu and Oki quakes reported that voluntary supporting workers helped companies with whom they had no regular business relationship. If that is true, one may expect even greater effectiveness through such voluntary actions if a “headquarters” existed to provide targeted requests for assistance. This central information management function may be established through enhancing coalitions, communications, and networking activities, for instance, among regions’ respective industrial parks, local company associations, trading groups, and the members of chambers of commerce and industry. Mature inter-industry and inter-regional relationships would establish a mutual aid system through a disaster countermeasure office coordinated by the government during the emergency. We must remember the probability, however, that inappropriate dependence on a gift economy and torrential resource inflow through market economy negatively affect the economical situation of the affected region in the aftermath of the disaster because of outflow of residents’ jobs and incomes (Nagamatsu [10], Nagamatsu [11]).

Here we note that Propositions A, B, and C describe three major elements requiring management for coordinating BCPs—Man, Material, and Money.

**Proposition D**: Contracts for alternate production facilities between separate regions having similar industrial makeup may become critical for business continuity.

For manufacturing companies, if a long-term production stoppage is anticipated, longer than the maximum tolerable period of disruption, the manager or the president must take any measures necessary to ensure continuity along the supply chain. Inappropriate or no countermeasures lead to the organization’s collapse, and those trans-regional OEM agreements with other companies in preparation for such circumstances will be an effective strategy for SMEs’ business continuity to ensure the resilience of their supply chains. The information about which factory can quickly supply essential capital goods damaged by the disaster will provide an important resource listing. Exactly such issues as those mentioned previously belong to organization-related concerns, and every organization should research and formulate their plans individually. However, the actual damage caused by disasters or accidents frequently exceeds the estimation, and such unexpected damage can cause a bottleneck in the recovery process. In a region with a concentration of comparable firms, producing similar goods and utilizing analogous technologies, there is a good possibility that the damaged region can procure the facilities to avert the bottleneck with items like jigs, gauges, dies, or even the full production machinery. Actually, in the Oki quake, a certain company, X, did procure some important mechanical parts from a manufacturer, Y, in Ojiya with which X does not usually have a business relationship. A notable fact in this case is that X did not place an order with Y directly, but via X’s customer company, Z, five days after the Oki quake. Z might have begun immediately after the event searching for a manufacturer with the necessary quality of production, but no fewer than four days were lost as a result of Z’s delay. Some type of system that coordinates damaged companies’ needs with the available resources might hasten their recovery activities. There is no need to confine the participating areas within one local region, which is different from Proposition B’s focus on local sites. If the convenience of transportation and logistics are assured, emergency network systems for mutual utilization of the necessary resources not only
within a region, but also in other areas, including relatively remote locations, also play a vital role as an intrinsic part of the integrated BCP for an entire industrialized suburban city.

6. Conclusions

In this paper we analyzed various activities related to the disaster recovery of business enterprises affected by the Chuetsu quake in 2004 in Ojiya City, which is an industrialized suburban city. Several key conclusions were drawn as to what should be included in the regional BCP, and finally several propositions were presented. These proposals might be implemented by a third party outside of the region; however, truly efficient planning of BC can be accomplished only through purposeful activities by the community members, because networks, customs, culture, and so forth vary diversely. The stakeholders who most need an effective BCP must be those who drive the research, testing, maintenance and, in the case of a disaster, implementation of the company and regional plans.

Even though nearly all private companies in Ojiya did not have their own BCP nor disaster recovery plan, at least before the Chuetsu quake, they achieved surprisingly rapid business resumption. We note in this investigation that some components of BCPs were put into effect by these businesses. That is, they acted on the basic strategies of “human life first” and “cause no trouble to customers,” intended to resume business after the disruptions to the normal level within the maximum tolerable period of disruption, and simultaneously continued critical operations like shipping goods in stock (even using manual tracking, without their IT system), selling, and communicating with stakeholders via agencies or branches. Some of them participated in a big industrial exhibition, the Japan International Machine Tool Fair (JIMTOF), which has been held every two years in Tokyo and in 2004 began on the first of November, only nine days after the incident, even though complete discovery had not yet been attained. We consider this action to be a targeted risk communication. Another phenomenon demonstrated the relationship between the business and civic communities: the culture of mutual trust and mutual aid among the residents of this snowy region resulted in behavior that was both humane and rational because many of the residents were also employees of the affected companies. From the residents’ perspective, the success of local corporations is an essential element of civic life, supporting daily living through the resident employees’ incomes. Another pattern in the regional tapestry of trust is the fact that employees devoted themselves to their employers’ recovery activities while they left their damaged houses unrepaired; such behavior can only result from strong mutual trust between employees and employers. In this demonstration of “enlightened self-interest,” employees trusted in their companies’ ability to recover, as their employer’s success would directly lead to the reconstruction of their own lives and then to the recovery of family and community well-being.

As a side issue, we found that a large segment of all the Japanese private companies that face high risk from some type of natural disaster and accidents, including the companies that experienced both the Chuetsu and Oki quakes, neither have nor intend to draw up a BCP (GIAC [7]). Many managers say they do not have enough money to adopt disaster countermeasures (Thomas [17]). Doubling the number of file servers, multiplexing dedicated lines, preparing backup facilities, using commercially available services for confirmation of the employees’ safety, and so on would be costly, sometimes exceeding an acceptable fiscal budget. Ironically, the factors of sheer luck, of a perhaps unique culture of corporate/community trust, and of both humane and rational behavior within their industries and supply chain stakeholders combined to support business continuity with nearly no planning whatsoever. These unique factors in this region may make it an exception to the very rules for which it represents a general need.

Despite the Ojiya manufacturers’ fortunate experience and the lessons they have taken from it, we have shown other effective ways to strengthen the resiliency of any organization with low-cost but effective strategies: agreements with other organizations for alternate production sites and reciprocal support during emergencies, cultivating confidential relationships with employees and the local community, among others. The author believes that is an answer—to begin with these simple plans and add organization-suitable measures step by step. Such an approach can be taken by any organization, even micro-enterprises, and public support can further enhance an appropriate BC framework.
In Ojiya, a series of lucky circumstances prevented the loss of human life within the corporate facilities that were damaged: the day of the main tremor was a holiday, so there were few casualties among employees, including their families, good weather continued at least several days after the event, there was no major fire disaster (only a few small ones), and the economic situation was recovering from the recession after the collapse of the IT economic bubble. Even with these elements of good fortune, conquering the difficulties caused by the Chuetsu quake was a very precious experience for the citizens of Ojiya, not only for each business but also for the industrialized city as a civic entity.

This paper describes the knowledge obtained from this limited set of experiences analyzed through the case study method applied to enterprises damaged by one or two specific earthquakes. There remain several issues for further study: other countries’ public financing systems for disaster, cases where non-manufacturing industries are regionally concentrated, and the real possibilities of implementing an integrated multi-regional business continuity framework among relatively distant but industrially similar areas, and others. Also interrelationship among respective recovery actions by multiple industrial sectors and/or some kinds of communities should be investigated by an economical point of view for evaluating the efficacy of countermeasures taken. However, the author believes that the four propositions and the related analytical results presented here will be helpful to encourage resiliency planning for entire industrialized regions.

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