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Improvement and Dissemination of BCM based on the Lessons of the Great East Japan Earthquake

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Abstract

For the resilience of Japanese economy, business continuity management (BCM) of industries is indispensable. Japanese industries have sequentially faced the serious concern of disruption of important business since the Great Hanshin-Awaji Earthquake in 1995. Since 2015, Japanese government issued several guidelines of BCM for enterprises and public organizations. Among the disasters which occurred afterwards, the Great East Japan Earthquake (GEJE) in 2011 was the most serious incident for business continuity. Japanese industries and government should utilize the lessons of the GEJE and execute effective countermeasures, including improvement and maintenance of BCM. The revision of BCM guidelines by the governmental organizations were appreciated as a part of the efforts. “Supply chain management” and “substitute strategy” seems to be most important aspects to revise existing BCM of companies. As for the small and medium-sized companies, dissemination of BCM is necessary especially for those which compose important supply chains. However, it is not an easy task until now.

The author performed hearing surveys in damaged companies of the GEJE which achieved early restoration. Regardless of whether those companies had business continuity plans (BCP) or not, top management was required to recognize the allowable time of customers, have an image of alternative site and take quick actions to restore their business. On the other hand, BCP documents was effective only if the employees mastered them well, and the simpler BCP documents seems to be better for long-term management. Therefore the author believes top management’ recognition of the critical element of BCM and personnel training/exercises of BCP to employees should be more emphasized.

Keywords: business continuity management (BCM), the Great East Japan Earthquake (GEJE), supply chain management, the Great Hanshin-Awaji Earthquake

1. Introduction

Earthquakes and other major disasters cause direct damage on human being, building and infrastructure and also indirect damage on society and economy. Economic damage frequently spreads nationwide and worldwide through supply chains. Japanese industries have sequentially faced the serious concern of business disruption by way of supply chains since the Great Hanshin-Awaji Earthquake in 1995.

In 2011, the Great East Japan Earthquake (GEJE) caused indirect damage to many companies by the resultant halt of supply of parts, materials and services by damaged companies, as well as shortages of electricity and fuel which occurred in widely in eastern Japan. Some companies with their business continuity plans (BCP) successfully restored their important business quickly, but there were a number of companies with their BCP failed to continue their business because they suffered more than their damage assumption in the BCPs.

As there is considerable concern over major earthquakes in Japan such as the Nankai Trough Earthquakes and the Tokyo Inland Earthquakes, Japanese enterprises and organizations should learn the lessons of the GEJE and take effective measures including disseminating and revising BCPs or business continuity management (BCM), in addition to structural measures such as anti-seismic reinforcement.

2. Background Information

2.1 Back Ground of Diffusion of BCM

BCM is a management strategy for corporations and public organization to facilitate the rapid recovery of critical operations with minimum interruption in the aftermath of a disaster or an accident. BCM includes development, execution, exercising and review of BCPs.

In the wake of the computer millennium bug problem of the beginning of 2000 and the terrorist attack on September 11 in New York in 2001, the importance of BCM and BCP came to attract attention worldwide including Japan. USA and UK have taken the lead in widespread adoption of BCM, and cases of Japanese companies that are requested by overseas trading partners to furnish their BCP were on the rise. In addition, because it is necessary to tackle the issue of business continuity throughout the supply chain, major domestic companies are beginning to demand BCPs from their suppliers.

However, the problems that companies' damage by disasters caused disruption of their supply chain was recognized even in Japan before the computer millennium bug problem of 2000. The Great Hanshin-Awaji Earthquake of 1997 caused considerable damage to, for example, Kobe Steel, Ltd., in the city of Kobe, such as the shutdown of its shaft furnaces. This prevented Kobe Steel from supplying the wire rod for automobile engine valve coils which only it produced, raising great concern from domestic manufacturers and Western car companies alike. The US Department of Commerce even raised this issue with the Japanese government, seeking its efforts at resolution. Kobe Steel made public its method of producing valve coil wire rods, and permitted other Japanese steel companies to make alternative supplies available [1]. The experience of this earthquake made companies and the government renew recognition of the importance of corporate disaster management measures. Structural measures such as anti-seismic reinforcement were execute more widely, but BCM/BCP was not focused yet in Japan.

Afterwards, the terrorist attack on September 11 was the opportunity for Japanese companies and the government to know the effectivity of BCM/BCP to continue important business. The good practices of damaged companies that recovered soon by their BCPs and severe result of failing business continuity facing a management crisis without useful BCPs moved Japanese industry association and governments to introduce BCM.

Japanese government published the first Business Continuity guidelines in 2005, and other several guidelines followed it. They stressed the importance for all companies including small and medium-scale enterprises (SMEs) to come to grips with BCM. Furthermore, the government positions BCM/BCP as a key

pillar of corporate disaster management in their policy for national countermeasures in the event of a large-scale earthquake.

2.2 What is Business Continuity?

Fig. 1 shows a concept of Business Continuity explained in the latest "Business Continuity Guidelines" of Japanese government [2]. If a company has no countermeasures to continue its critical operation, the operation degree of the critical operations turns to be zero % by a disaster or an accident, and gradually recovers. However, such a late recovery seems to cause 1) losing customers to other companies, 2) decline in market share, 3) serious social inconvenience and 4) negative impact on a company's reputation due to the interruption of critical operations. Therefore, the company should recognize the "permissible limit of recovery time", and should recover the operation degree before the limit. Additionally, even shortly after a disaster or an accident, the company should keep the operational degree above the permissible level.

The interested parties of a company, including clients, require that after damage is incurred, the companies do not suspend critical operations, or if they are suspended, they resume operations as soon as possible. For the damaged company, it means the company has to fulfill responsibility of supply, and this responsibility is a key word of BCM.

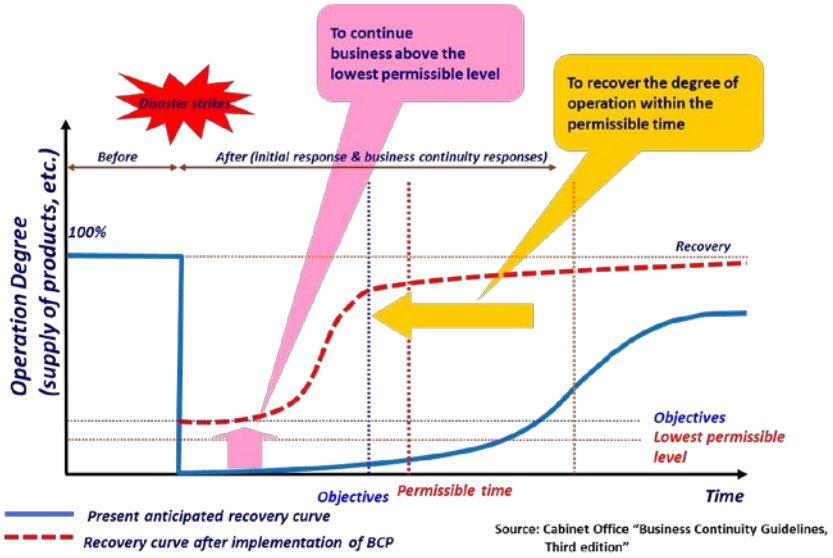


Fig.1 – Concept of Business Continuity

Typical important actions of BCM after the occurrence of an incident are;

1) To make efforts to continue critical operations of the head office and other key sites of the organization by securing necessary resources. When the ordinary sites turns to be unusable, an alternative sites is the most important necessary resource.
2) To transmit information outside the company and information sharing with the interested parties. To let the interested parties know the real damage and probability of recovery often prevent the damaged company from losing credibility from the interested parties and being cut transaction with them.
3) To manage the supply chain of important goods and services of the company. It includes securing alternative suppliers of critical materials and parts if the ordinary suppliers stop their operations by a disaster.

2.3 BCM Promotion Policy of the Government and Disasters

The Japanese government started to prepare the promotion measures for BCM/BCP in 2014, and Cabinet Office (CAO) published the "Business Continuity Guidelines, First edition [3]" in August, 2005. The author was a director in charge of drafting the guidelines in CAO. A trigger to make the guidelines was the terrorist attack on September 11 as mentioned in section 2, and another trigger in Japan was publication of the estimated damage of

the Tokyo Inland Earthquakes in December, 2004. If it occurs, by way of suspend of critical supply chains in wide range of business transactions, expansion of economic damage is strongly concerned to nationwide and worldwide. Therefore the Japanese government stared promoting BCM/BCP in addition to the traditional disaster prevention countermeasures.

Furthermore the Niigata Chuetsu Earthquake occurred in October, 2004 and the damage to factories producing automotive meters, semiconductor etc. caused the disruption of the supply chains. This incident was also an important background of formulating the guidelines.

In the next February, the Small and Medium Enterprise Agency (SMEA) published "Guidelines on the Development and Implementation of SMEs' BCPs" mainly for small and medium-sized enterprises (SMEs). In the guidelines, some forms of simple BCP were prepared. However dissemination to SMEs was thought to be rather difficult task by only providing simple BCP forms.

Alongside, regional governments and public organization also began the promotion of BCM/BCP to companies in their own region. One of the early examples was Tokushima prefecture's BCP guidelines in April, 2007. This guidelines was based on the "BCP Step-up Guide for SMEs, First edition" published in 2006 [4] by the author and the Business Continuity Advancement Organization (BCAO, non-profit organization, set up in 2006).

It is needless to say that governmental organizations should formulate BCPs. "Business Continuity Guidelines for Ministries of Central Government" was published in June, 2007. This guidelines was mainly prepared for the Tokyo Inland Earthquakes. In accordance with the guidelines, all ministry and agency of the central government were requested to formulate their BCPs in fiscal year 2007 and all of them completed in this period.

In July, 2007, the Niigata Chuetsu-oki Earthquake occurred, and Kashiwazaki factory of "Riken Corporation" supplying the automobile parts stopped its operation. It occupied domestic share more than 50% with the piston rings which was a vital element of the engine for the motor vehicles. Domestic auto makers were forced to stop production caused by lack of these parts because tis factory was only one producer and alternative production was not easy in a short period. This case was another serious lesson for Japanese companies and the government for improving BCM and supply chain management.

A unique case of promoting BCM which the author contribute to was "Simple Guide for Business Continuity for Construction Companies in Case of Disasters" by Kanto Regional Bureau, Ministry of Land Infrastructure, Transport and Tourism (MLIT), published in December, 2007. Subsequently, the bureau started the "Approval System of Constructors' Business Continuity Ability at the Time of Disaster" in June, 2009. This was the first example that a governmental organization approved companies' business continuity ability. The bureau gives the additional points to approved companies in the comprehensive evaluation of the tendering procedure of public works and this was an incentive for applying this system. Similar approval system has been introduced by several other regional bureaus of MLIT.

As for prefectural government, Tokushima prefecture led the formulation of BCP and completed its first edition in 2008, and Tokyo, Osaka and several other prefectures followed it. In April, 2010, CAO published "Manual and Commentary of Business Continuity for Local Government at the Time of an Earthquake." However, the number of the prefectures holding BCPs was not easily increased before the GEJE.

The pandemic influenza H1N1 broke out in 2009, and it was the next momentum for enterprises and public organizations to introduce BCPs that could cover pandemic. "Business Continuity Guidelines, Second edition [5]" of Cabinet Office was published in November of 2009 and a reason of this revision was to make wider the scope of the business risk including pandemic.

3 Experience and Lessons of the GEJE

In March, 2011, the GEJE occurred. The companies and organizations located in affected area received direct damage by the motion of earthquake and tsunami. There were also many companies nationwide faced the disruption of supply of raw materials and parts.

3.1 Influence to Major Business by GEJE

About one month after the earthquake, on April 8-15, the Ministry of Economy, Trade, and Industry (METI) conducted its "Emergency survey on the actual status of industries after the GEJE" [6] directed at 80 major companies (55 in manufacturing and 25 in retailing/service). Regarding the reasons of difficulty in obtaining raw

materials and parts/components (multiple answers), 88% of companies of the raw materials-producing industries cited "damage to the suppliers we procure from" and 42% cited "damage to the suppliers supplying the companies we procure from," while 82% and 91% respectively of the companies of the processing industries cited these reasons (Fig.2). These indicate that the processing industries were being strongly impacted from two levels up the supply chain.

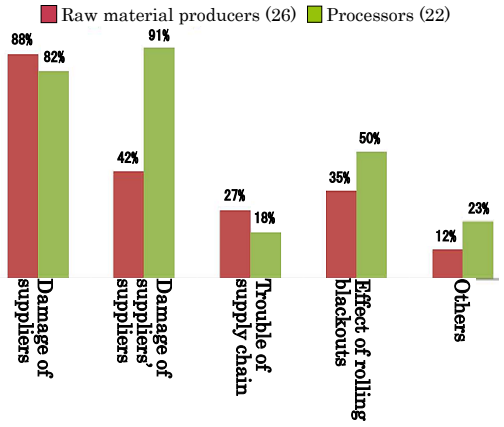


Fig.2 – Reasons of Difficulty in Obtaining Row Materials and Parts/Components

In the GEJE, there were a lot of examples that the influence of damaged companies' production stoppage spread to the whole country and even overseas through the supply chains. One of the most famous trouble was that damage to Naka Factory of "Renesas Electronics Corporation," a factory of microcomputer of cars which stopped production for about three months, and caused decrease and delay of the production in the factories in North America, Asia and Europe [7]. This showed that an influence of the disaster in other countries spread to foreign countries easily as the globalization of supply chains progressed more and more.

At that time, many companies had not sufficiently grasped the location of producers higher up on their supply chain. Especially, some of them might have multiple suppliers only to find that they were relying on the same supplier two or three levels up the chain. This type is called "diamond-shaped" supply chain. Based on these experience, Japanese companies have made efforts to know about suppliers two or more levels upstream on the supply chain after the GEJE. However in some cases, it was not easy to get cooperation from suppliers because secret procurement sources with advantageous condition for them were the important foundation of competitiveness and benefit.

To reduce a problem of stoppage of the supply chain, finished product manufacturers need to give more emphasis to the stable supply, even though it means sacrifice in terms of procurement cost and product differentiation. Specifically, they should consider in setting specifications, that narrow down the parts and materials that take a role of strategic differentiation. For those parts and materials, seek to have suppliers secure alternative supply sites, or strengthen their BCM if substitution is very difficult. For other parts and materials, apply rules which emphasize the possibility of alternative procurement [8].

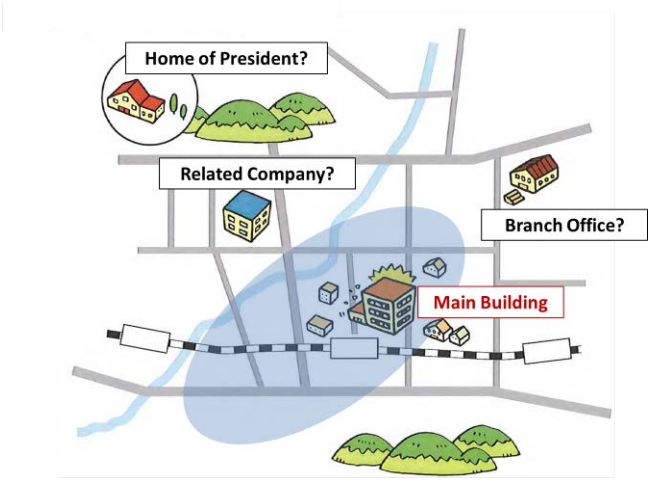
3.2 Necessity of Substitute Strategy Recognized after the GEJE

If companies assume the damage of the earthquake, it is necessary to secure earthquake resistance of buildings, facilities and essential utilities. In addition, it is strongly recommended to prepare for business sites, persons and suppliers based on the substitute strategy of their BCM. As for a business site, substitute strategy means having an alternative site when a site used in ordinary times turns to be unusable. On the aspect of personnel, it means securing persons who can act as substitute for a president and key persons. Clarification of a deputy and delegation of authority are effective. On the aspect of goods and materials, substitute strategy means securing alternative suppliers to prepare for the stoppage of supply of indispensable raw materials, parts and so on.

However, it is not easy for an enterprise which usually has finance restrictions to prepare for an alternative site with the same production ability or functions as the site used in ordinary times. Therefore, when promoting the substitute strategy, the fact should be explained that an alternative site can be effective even if they have less production ability or and function because the company is required to execute the limited critical operations in the aftermath of a disaster. The examples of alternative sites below are methods that have been found from past experiences including those of in the GEJE [8].

(1) Alternative Communication Bases

The first method is that a company designates an "alternative communications base" in some location where it can communicate with employees and important business contacts (Fig.3). Perhaps it is even useful to use the president's home. The location should be one where the same hazard will not cause damage simultaneously as to the original base. The company should provide a place and contact information to business partners and other interested parties.



Sauce: Materials of Associated General Constructors of Japan, Inc.

Fig. 3 – Where should be the Alternative Communication Bases

(2) A Plan setting up an Alternative Site and Exercises

The second method is that a company with one production site for an important product decides clearly on a location for an alternative production site, deliberately plans how to set up facilities in the site, and carries out virtual exercises for setting up the base many times. This seems to be useful for a manufacturing site using very expensive facilities, and therefore the cost of preparing second site would be very high. Their profitability would be not enough if they had to produce in two sites.

The successful example of Fujitsu Group during the GEJE has been published. A factory of a group company in Fukushima prefecture which was producing desktop PCs suffered and was unable to operate. The group set the substitute strategy in operation quickly: they built up the alternative production line in another group company in Shimane prefecture, where laptop PCs were produced at ordinary times [9, 10].

(3) Cooperation with a Company in the Same Industry in a Distant Place

The third method is cooperation with a company of the same industry in a distant place where a disaster will not strike both companies simultaneously. One of the typical shapes is to conclude a "mutual cooperation agreement in a time of disaster" and to help each other as a sort of an alternative site (Fig.4). When early recovery of own business site is unavailable, this method makes it possible for a company to utilize its technology and knowhow in association with the other company, maintain its relations with important customers and even keep some of its workers employed.

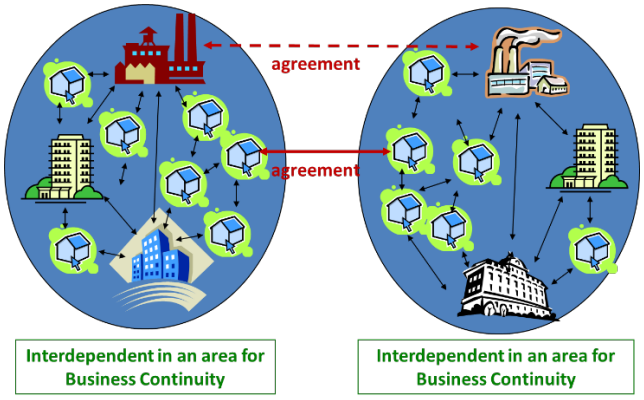


Fig.4 – Agreement with another Company in the Same Industry Located in a Distant Place

An early actual case was that electroplating associations of Kanagawa prefecture and Niigata prefecture signed a mutual cooperation agreement for alternative production in April 2011 [11]. As it is essential that the two parties have strong mutual trust, the examples are regretfully not so many until now. Efforts to seek a mediating role for governmental or economic organizations could be expected.

3.3 Local Companies' Response in the GEJE

In 2014 and 2015, the author performed the hearing survey to thirteen SMEs which realized quick recovery after the GEJE [12]. Two-thirds of the companies belonged to manufacturing industry and ten companies did not have BCPs at that time.

There were four companies whose factories were severely damaged and successfully got their alternative sites by the quick action aftermath the disaster. And two other companies used alternative supply from other factories quickly. However five of these six companies did not have their BCPs. This fact suggests that BCP document was not indispensable for SMEs, as far as the top management took business continuity actions to keep alternative business sites quickly, considering the allowable time of customers.

On the other hand, there was a company for which only on-the-spot recovery was available and five companies which faced difficulty moving to the alternative site in the distant place, because they deeply relied on specific resources of the area including a spring (brewing), famous tourist attraction (tourist hotels, souvenir shops) or local customers (some kinds of local stores). Therefore, alternative site strategy was not applicable for them. Enterprises of such kind are recommended to secure the quake resistance of a building and facilities, and improve BCM on the aspect of information/communication, finance and personnel.

The companies which had their BCPs answered that employees were expected to recognize which resources are required for the operation in charge, and at the time of disaster, to act quickly for securing the necessary resources without the order from the top management. Additionally, they thought that thick and detailed BCP document was not effective for ordinary employees, because they would not read such a thick document. Simple BCP documents seemed to be better also in view of maintenance for long terms by successive persons in charge. Furthermore, most of the companies emphasized that training and exercise of BCP should be repeated regularly.

Other necessary elements of the early recovery that the author could find out are; 1) To contact business partner quickly so as not to cut transaction, and to be able to receive recovery support from them; 2) Means of telecommunication is required as soon as possible. An example was that a president of a damaged company asked his employee to telephone the important counterpart by walking out the damaged area which needed several hours. 3) Insurance against earthquake contributed to early recovery in financing aspect.

3.4 BCM Promotion Policy of Japanese Government after the GEJE

Utilizing lessons of the GEJE, CAO of Japanese government published the "Business Continuity Guidelines, 3rd edition－Strategies and Responses for Surviving Critical Incidents－" in August, 2013 in order to encourage the

implementation of BCM. The main points revised are 1) necessity of implementing BCM even in normal times and improvement of related contents, 2) importance of including broad responses to risks and consideration of the supply chain, and necessity of a flexible business continuity strategy for them, and 3) importance of involvement by the top management. In addition the guidelines' commentary which contained various charts and examples was published in July, 2014. The author joined the committee which revised or formulated them.

Guidelines on the Development and Implementation of SMEs' BCPs of the SMEA was also revised in March, 2012, based on the lessons of the GEJE. "An introduction course" was added for newcomers including small enterprises, and examples according to the type of business were also enriched.

As for Governmental organizations, "Business Continuity Guidelines for Ministries of Central Government" was revised in April, 2016, and using this, the CAO requested revision of each ministries' BCPs. For city, town and village governments, "Guidelines for formulating BCP of Municipality" was published by the CAO in May of 2015. The guidelines showed six important elements for BCP, which even small municipality whose population is less than 10,000 should work on as soon as possible. "Manual and Commentary of Business Continuity for Local Government at the Time of an Earthquake" was also revised by the CAO in February, 2016.

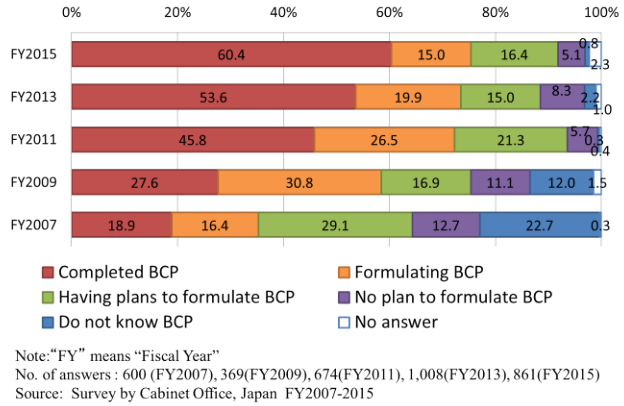
3.5 Diffusion Status of BCPs before and after the GJGE

According to the "Survey on the Situation of Companies in Business Continuity and Disaster Management" [13] by the CAO, the diffusion ratio of BCP of Japanese companies has risen steadily. In FY2015, 60.4% of large-sized companies completed BCPs, compared to 27.6% in FY2009 which was before GEJE (Fig. 5).

As for medium-sized companies, the diffusion ratio in FY2015 was 29.9% compared to 12.6% in FY2009 (Fig. 6). In addition, it deserves attention that the ratio of "companies which do not know BCP" decreased from 45.3% (FY2009) to 7.0% (FY2015).

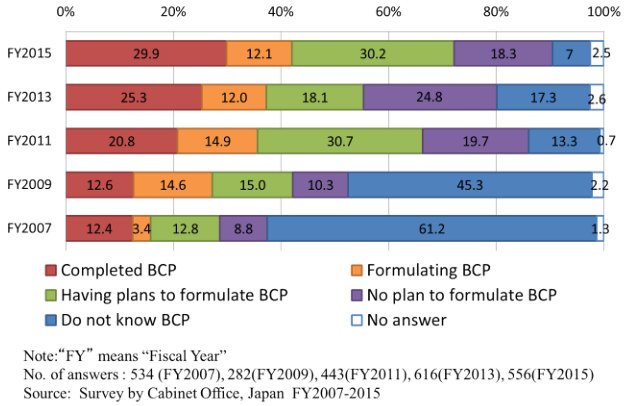
These results show that the experience of the GEJE of 2011 was a reason of increase ratio of companies with BCPs. However, 2011 Thailand Flood which started in July seemed to be another reason because this flood caused stoppage of production of factories in Thailand including a lot of Japanese-affiliated companies and it considerably affected production in Japan.

Additionally, middle-sized companies in general should make effort to formulate BCPs, compared to large-sized companies whose main issue has been maintenance and improvement BCPs.



Note:"FY" means "Fiscal Year"
No. of answers : 600 (FY2007), 369(FY2009), 674(FY2011), 1,008(FY2013), 861(FY2015)
Source: Survey by Cabinet Office, Japan FY2007-2015

Fig.5 – Diffusion Ratio of BCP (Large-sized Companies)



Note:"FY" means "Fiscal Year"
No. of answers : 534 (FY2007), 282(FY2009), 443(FY2011), 616(FY2013), 556(FY2015)
Source: Survey by Cabinet Office, Japan FY2007-2015

Fig.6 – Diffusion Ratio of BCP (Middle-sized Companies)

4. Conclusion

Since the Great Hanshin-Awaji Earthquake in 1995, Japanese industries have frequently faced the concern of stoppage of important business caused by major disasters. The Japanese government and local public organizations prepared some guidelines for formulation of BCP since 2015. The GEJE in 2011 was the most serious incident for business continuity especially in terms of damage diffusion nationwide and worldwide through supply chains. The governments have promoted substitution strategy, supply chain management and maintenance/improvement of BCPs by revising guidelines. However, dissemination of BCM to SMEs is still not easy task.

The author believes for the SMEs detailed BCP documents were not necessary if the top management recognizes important elements of BCM and is prepared to act quickly including the necessity of alternative business sites when a serious incident occurs. Simple BCP documents is advantageous to keep the effectiveness of BCM and to get understanding from employees. The approach to make much of periodical training/exercise of BCP is proper and useful.

Supply chain management is apparently an important element of BCM in Japan where natural disaster occur frequently. After the GEJE, Japanese companies have made efforts to know about suppliers two or more levels upstream. Though it is not an easy task to get complete information of whole supply chain, the continuous actions to know as much as possible should be inevitable to tackle with the disruption of supply.

In April, 2016, the 2016 Kumamoto Earthquakes (magnitude up to 7.3) occurred in Kyushu, west part of Japan. The earthquakes hit some important factories producing automobile components, semiconductors, etc. The stoppage of production happened again in automobile industry, for example, but it seemed that affected companies of the earthquakes started considering alternative production/supply very earlier than before. Japanese industries might make use of the lessons of the GEJE.

As there is concern over major earthquakes in Japan such as the Nankai Trough Earthquakes and Tokyo Inland Earthquakes, Japanese enterprises are strongly expected to improve business continuity ability and get apprehension of the preparedness from interest parties inside and outside Japan.

Acknowledgements

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References

[1] Kobelco (2015): Kobelco Sustainability Report 2015 (in Japanese), p7, Website of Kobelco, http://www.kobelco.co.jp/about_kobelco/csr/kaiji/report/2015/files/2015csr_report.pdf [accessed April 30, 2016]

[2] Cabinet Office, Japan (CAO) (2013): Business Continuity Guidelines, Third Edition (Provisional Translation, in English), *Website of the Asian Disaster Reduction Center*, http://www.adrc.asia/publications/psdrr/pdf/guideline03_en.pdf [accessed April 30, 2016]

[3] Cabinet Office, Japan (CAO) (2005): Business continuity Guidelines, First edition (in English), *Website of CAO*, http://www.bousai.go.jp/kyoiku/kigyou/minkan/pdf/guideline01e.pdf [accessed April 30, 2016]

[4] Business Continuity Advancement Organization (2008): BCP Step-up Guide for SMEs, Forth Edition (in Japanese), Website of BCAO, http://www.bcao.org/data/pdf/03_1.pdf [accessed April 25, 2016]

[5] Cabinet Office, Japan (CAO) (2005): Business continuity Guidelines, Second edition (in Japanese), Website of CAO, http://www.bousai.go.jp/kyoiku/kigyou/keizoku/pdf/guideline02.pdf [accessed April 30, 2016]

[6] Ministry of Economy, Trade, and Industry, Japan (METI) (2011): Emergency Survey on the Actual Status of Industries after the GEJE, *Website of METI*, http://www.meti.go.jp/report/whitepaper/mono/2011/pdf/honbun02_02_01.pdf [accessed April 30, 2016]

[7] Renesus Electronics Corporation (2012): CSR, Environment Report, 5-7, Website of Renesus Electronics Corporation, http://am.renesas.com/media/ir/library/pdf/csr/2011_csr_all.pdf

[8] Maruya H (2013): Proposal for Improvement of Business Continuity Management (BCM) Based on Lessons from the Great East Japan Earthquake, *Journal of JSCE Vol. 1(2013)*, No. 1, pp.12-21, Japan Society of Civil Engineers, https://www.jstage.jst.go.jp/article/journalofjsce/1/1/1_12/_pdf [accessed April 30, 2016]

[9] Fujitsu (2011) : *Fujitsu Journal 2011 June*, Vol.37 NO.5 NO.338 (in Japanese), http://jp.fujitsu.com/journal/publication_number/338/journal338-solutions1.pdf [accessed April 30, 2016]

[10] Nikkei BP (2011) : "Process of Recovery, Direction for Alternative Production 12 Hours after the Earthquake, Fujitsu Isotec Headquarter Factory," *Website of Nikkei BP*, http://www.nikkeibp.co.jp/article/reb/20110614/273913/ [accessed April 30, 2016]

[11] Nikkei Inc. (2011): "Agreement between Industrial Associations of Electroplating in Kanagawa and Niigata Prefecture to Promote Alternative Production in Times of Disaster", *Website of Nikkei Inc.*, http://www.nikkei.com/article/DGXNASFK2600G_W1A420C1000000/

[12] Maruya H, Torayashiki T (2016): Required Factors of Business Continuity and Problems in Restoration Systems for Business Continuity Found in the Hearing Survey on Companies Affected by the Great East Japan Earthquake, *Journal of Institute of Social Safety Science (E-Journal)*, Vol.28, No.8, http://isss.jp.net/isss-site/wp-content/uploads/2016/03/2015-077.pdf

[13] Cabinet Office, Japan (CAO) (2016): Survey on the Situation of Companies in Business Continuity (in Japanese), *Website of the Cabinet Office*, http://www.bousai.go.jp/kyoiku/kigyou/pdf/h27_bcp_report.pdf [accessed April 30, 2016]