Supply Chain BCP and Area BCP*

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Abstract

Automobiles are produced by the support of global supply chain network. After the Great East Japan Earthquake and Thailand flood, multi-national manufacturing companies are coming up with Supply Chain BCP (Business Continuity Plan) in addition to individual BCP. The government to develop industrial parks is also required to play a role to strengthen regional resilience together with stakeholders concerned by introducing Area BCP. For the resilient supply chain and logistics, this paper proposes Supply Chain BCP including the visualization of whole supply chain, geographically dispersed sourcing, and Area BCP including emergency transport, uniform control of emergency supplies and transfer of BCP-related know-how.

Key Words: Supply Chain Management, Disaster, Resiliency, Business Continuity Plan

I. Introduction

Both the Great East Japan Earthquake and Thailand flood in 2011 were the disasters that noticed us that when the supply of certain automobile parts stops, the automobile factories are easily forced into shutdown. Automobiles are produced by the support of global supply chain network. Some of the automobile parts are centrally produced at one factory because the economies of scale can largely be observed in the production of those automobile parts. When that factory is damaged by a disaster, the assemblers cannot produce automobiles. Once the production of automobile stops, production of other automobile parts at other areas also stops.

Taking these situations into account, each supply chain group is coming up with management policies such as diversification of their parts suppliers, in order to construct disaster-resistant or resilient automobile supply chains. It is quite natural for private companies to introduce Supply Chain BCP (Business Continuity Plan) cooperatively and reflect it on their individual BCPs. At the same time, the government and private companies have incentives to strengthen regional resilience by formulating Area BCP. For example, policies related to development of transportation infrastructure used for the logistics from/to the industrial parks are considered as the governmental issues. They have responsibility to provide resilient transport infrastructure and debris clearing program after disasters.

In this paper, we will review the formation of automobile supply chains, and examine how to construct both Supply Chain BCP and Area BCP for the resilient supply chain and logistics, assuming an auto manufacturing company is located in an industrial park in an emerging country.

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II. The Formation of Automobile Supply Chain

1. Decision factors of factory locations and parts procurement logistics

As the market of developing countries grows, the manufacturing companies are accelerating their global expansion. They need to decide the global production strategies, i.e. which market is important, what product to launch, where to produce (Fig 1). These decisions are influenced by future prospect of the market in the country, and the economic partnerships such as FTA and EPA, among others.

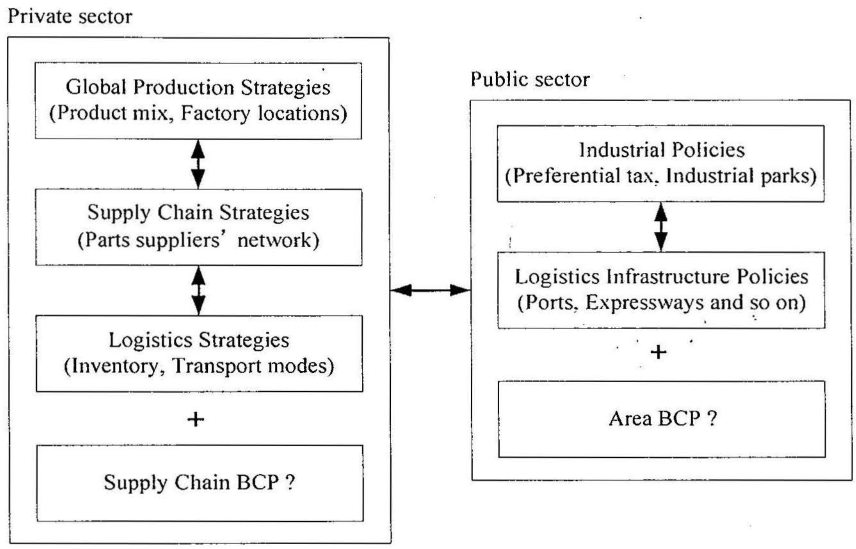
The decision on the establishment of new automobile assembly factory is also based on consultations and negotiations against national and local governments. The establishment of assembly factory is important for local economy, which motivates the governments to negotiate. At the same time the decision is important for the assemblers because the economic and logistics conditions of the industrial park have big influence on their competitiveness. Thus, the assembler considers precisely the preferential taxes, regulations and transportation infrastructure of the industrial park and surrounding areas.

Next, given the establishment of new factory, the assembler faces decision makings of how to choose the pars suppliers and how to construct global logistics system. Those decisions affect each other. The assembler chooses the combination of suppliers and logistics strategies that achieve short-term optimization under many constraints. It is noted that the assemblers formulate Supply Chain BCP trying to make their supply chain and logistics more resilient after two disasters.

Furthermore, a large stock of potential parts suppliers and expandability of logistics has influence on deciding expansion (including withdrawal and scale-down) of factories, which is rather a mid or long-term decision making. For example, automobile assemblers that have many production bases need to decide which factory to increase their production of new model. Seizing on those opportunities to formulate new global production strategies, the assemblers reconsider their suppliers and logistics. Thus, the assemblers are able to shift to long-term optimum structures.

There is no guarantee that a manufacturing company keeps on making their products at the same place. Global companies always search for their best location to produce. Factories may be removed if the company tries to construct more resilient supply chains and logistics learning lessons from two disasters. Thus, the government needs to watch the needs of global companies and examine what kind of Area BCP is accepted, which need to be reflected to their policies for the next term.

<Figure 1> Strategic decisions and BCP needs in the private & public sectors



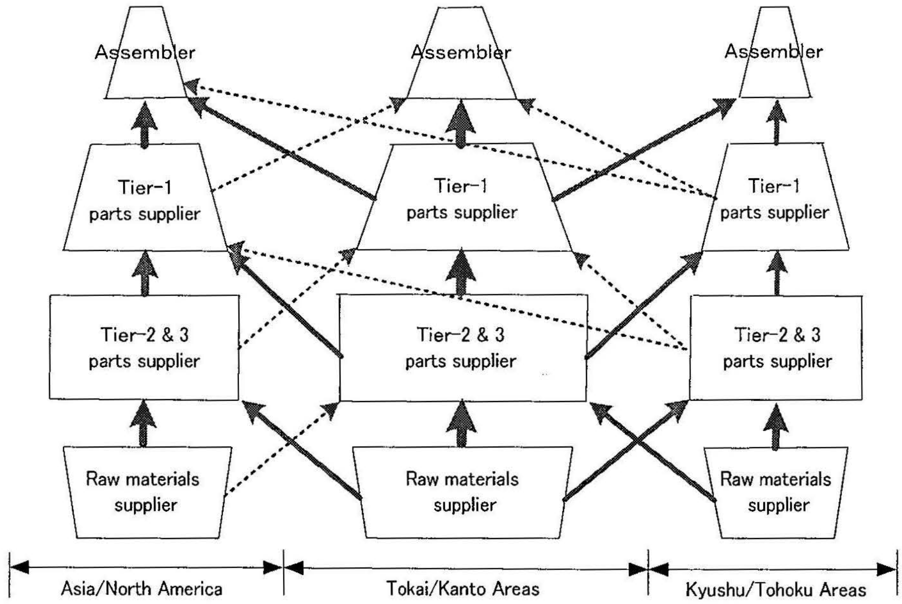
2. Global development of the automobile supply chain

Historically, Japanese assemblers set up major factories in Tokai and Kanto areas, and established the parts supply chains within the areas. However, after the 70s, production was starting to develop in Asian countries and parts required for production of automobiles were exported from Japan and procured from the areas (Fig 2). Since high customs duties were imposed on imported cars, assembly factories had to be established in each country even if the market size was small. After the 80s, in order to lessen the impacts of a strong yen and ease trade frictions, production was likewise started in advanced countries, such as the United States.

Due to developments in the FTA/EPA, customs duties have been reduced for completely assembled cars as well as automobile parts, and integration of production bases has progressed. For example, in Bangkok (Thailand) and Guangzhou (China), concentration of assemblers and parts suppliers has progressed and almost all parts can be supplied domestically or from neighboring countries (i.e. 80 or 90 percent of parts supplied from within Asia).

After the 90s, automobile factories were newly established in the Kyushu and Tohoku areas. This is because production capacity expansion of overseas factories was not able to catch up with an expanded world market. At the same time this has become the perfect opportunity to decentralize factories out of Tokai and Kanto areas in order to disperse disaster risk and to establish new factories (mother factory serving as a model in the case of overseas expansion). There are also support from academia and the local governments while parts supplier's concentration has progressed gradually in Kyushu and Tohoku areas (rate of internal procurement is about 50 percent) and eventually suppliers have appeared to supply automobile electronic components to European and American assemblers.

<Figure 2> Global supply chain of automobile parts

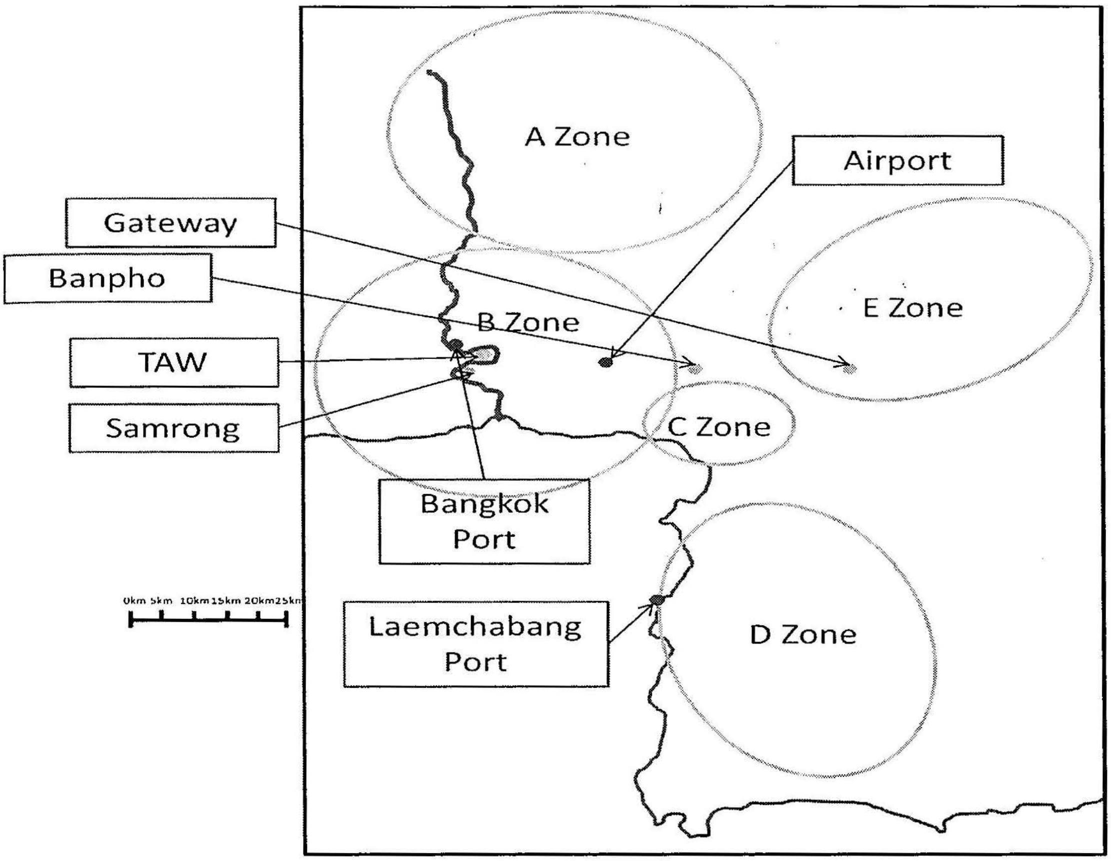


3. Resilient logistics of Toyota Motors Thailand (Nemoto, 2010)

Bangkok is one of the centers of Toyota Motor Corporation's global bases. Although some strategic parts used to assemble the global car are imported from other ASEAN countries in which a system of mutual supplementation is already established, parts that are procured in Thailand account for about 80% (monetary base).

Toyota Motor Thailand (TMT) maintains three assembly factories located in Samrong, Gateway, and Ban Pho and another group company named TAW has one factory in Samrong. At TMT, parts are procured from about 150 suppliers (Fig 3). These suppliers are allocated in five zones in the Bangkok metropolitan area in which the Milk Run logistics is performed (one run made in a range of four hours). Two logistics service providers undertake the Milk Run logistics. One of the larger companies undertaking the Milk Run logistics is a 3PL provider TTKL (TTK Logistics).

<Figure 3> Milk run zones in the Bangkok metropolitan area
Source: TMT documents



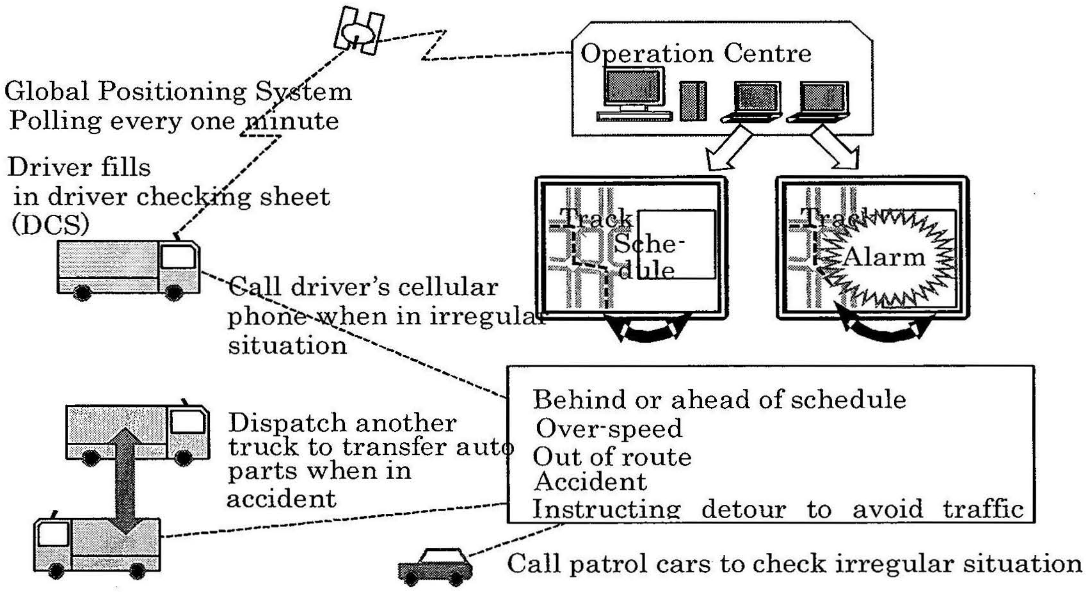
TTKL is a logistics company established in December 2002 to manage the Milk Run logistics of TMT. Its activities are divided into transportation and logistics operations. The transportation operation is composed of the Milk Run logistics of locally procuring automobile parts and other activities which include optimal route planning. The logistics operation, on the other hand, consists of Complete Knock Down (CKD) parts packaging for export, parts consolidation (vendor to vendor), and general warehouse works. The truck centers which maintain a total of 616 trucks and 40 forklifts are located in Amata Nakorn, Samrong, Eastern Seaboard, and Gateway.

The Milk Run logistics for TMT was started by Toyota Tsusho Thailand in 2001, and succeeded by TTKL in 2003. At present, the Milk Run logistics is being implemented for four factories of TMT. About 50 delivery routes are established to each plant, which could be changed in the case of traffic congestion. Six-wheel trucks (4.3 tons loading capacity) are usually utilized but at regions which can accommodate heavy trucks, ten-wheel trucks (12 tons loading capacity) are used.

In actual operation, a guide containing the driver check sheet, route code card, terminal card, and container label is prepared by the TTKL's operation manager for easy understanding of the operational plan. The operation manager assigns a driver for each route, and registers the route information in a geographic information system (Fig 4).

The driver fills-in the check sheet at each stage of operation. During the operation, the operation manager monitors the trucks' location by acquiring GPS data every minute. In cases of non-conformities with the schedule, such as delay, over-speed or out of the route, the information is displayed in the computer terminal of the operation center and the operation manager rectifies the situation by calling the driver on his cellular phone. In cases of traffic congestion, a detour is selected from the alternative routes set beforehand. Furthermore, in cases of accidents, an emergency truck is dispatched to the site and goods are transhipped and delivered to the destination in accordance with the scheduled delivery time.

<Figure 4> Resilient logistics using GPS to cope with daily risks



Source: TTKL

It is noted that Milk run logistics is achieved in Bangkok, even if road congestion is especially severe, through the use of IT and ITS (Intelligent Transport System). Milk run logistics could increase logistics resiliency by coping with daily risks including traffic accidents, street flooding by shower, among others.

III. Supply Chain BCP and Area BCP

1. Supply chain restoration after the earthquake (Nemoto, 2012)

Tier-2 and tier-3 parts suppliers, which supplied automotive electronic components for example, suffered a great deal of damage by the earthquake. Although each assembler was doing decentralized ordering of primary parts, tier-1 parts suppliers were unintentionally consolidating their orders in the secondary and tertiary stages of supply chain. In the production of parts which other suppliers cannot easily provide, restoration of concerned factories is indispensable, and each assembler dispatched staff aids and strove for restoration.

The supply chain was thought to be a pyramid-type model, but after the earthquake it was found that actual situation indicates a diamond-type model. Although the number of tier-2 and tier-3 parts suppliers is very large, electronic components were produced intensively by a limited number of companies due to economies of scale in production. In particular, substitution of several parts seems difficult (several months will be required for production to start even if alternate production is possible).

A typical example is the Renesas Electronics, which produces automotive electronic components. The company was formed through the merging of the semiconductor departments of Mitsubishi, Hitachi and NEC in order to survive intense global competition, and currently enjoys a 30 percent global share of automotive electronic components which controls the car engine. The company's Naka factory suffered a great deal of damage after the disaster which has significantly affected assembly factories globally, so assemblers dispatched a maximum of 2,500 aid workers a day voluntarily to support restoration. As a result, the company was able to restore and reach pre-earthquake supply capacity several months ahead of the original schedule.

The automobile industry needed six months to be restored, or depending on one's viewpoint, it can be thought to have ended in six months. For example, Toyota has attained the production volume in an average year within the fiscal year, with production increases covering the latter half of 2011. Although the problem of supply chain disruption was greatly raised immediately after the earthquake disaster, the influence was not so serious than we had thought. In this regard it would probably be necessary to examine the cost effectiveness of measures that influence the restoration period in the formulation of a Supply Chain BCP.

Apart from cooperation among the members of supply chains, we could expect collaborative disaster recovery action by the companies in the same industrial parks. One of best practices of that kind was found at Iwanuma-Rinku Industrial Park in Miyagi Prefecture after the Great East Japan Earthquake (ERIA(2013)). After the earthquake they set up an emergency operation headquarter, gathered the requests of each member company, and negotiated with both local government and utility companies. As they noticed that the government was busy in taking care of its citizen, they removed debris by themselves in order to build new power poles, resulting in fast recovery. This is a good example to show the importance of an Area BCP.

2. Supply chain restoration after the flood

The cause of flood in Thailand in 2011 was 40% increase in rainfall after July compared to the average year, including the two typhoon attacks. Another reason is said to be the sudden discharge of water from dams. These incidents caused flood that damaged many industrial parks. Although water began draining in late November, the shut downs of factories due to the fragmented logistics network and supply chains stopped the production of downstream companies in ASEAN countries and Japan (Kato et al (2013)).

The total automobile production in Thailand in 2011 was 1.46 million, far below 1.80 million which was predicted at the beginning of the year. It was 11.4% decrease from 2010 that produced 1.64 million. However, most of assemblers resumed their production in 2011, and production in 2012 was 2.45 million, which was 68% increase compared to the year before.

The influence on each Japanese automobile assembler is shown in Table 1. Honda, which is located in Ayutthaya prefecture, was damaged the most. The assembly factory was submerged and the production was stopped for about a half year. Honda, usually produces 240 thousand cars a year, could only produce 120 thousand and ended up with selling the cars produced in other countries. Though the actual number is not clear, there also was big influence on Honda factories in the United States, other ASEAN countries, and Japan, because the supply of auto parts from Thailand was stopped. The influence of flood was comparatively small on other Japanese assemblers, because their factories are located in industrial parks in the Bangkok Metropolitan Area and in the eastern area.

<Table 1 > Production suspension and restoration of Japanese auto assemblers in Thailand

	Production capacity	Production suspension In Thai factories	Reduced car production
Toyota	630 thousand/year	Oct 10 – Nov 20	150 thousand worldwide including other ASEAN countries, Japan, the US
Nissan	200	Oct 17 – Nov 13	40 thousand in Thailand, 20 thousand in Japan
Honda	240	Oct 4 – Mar 25, 2012	120 thousand in Thailand, many reduced in the US, other ASEAN countries, Japan
Mitsubishi	208	Oct 13 – Nov 13	23 thousand in Thailand
Isuzu	220	Oct 11 – Nov 18	30 thousand in Thailand

Source: Mizuho (2011)

It was vital for the industrial parks to secure a logistics network for the transport of parts and products. During the floods, logistics infrastructures were not accessible and this resulted in the disruption of the supply chain. Another problem was the factory managers did not know whether the flood would get worse, and how long it would continue. There was critical breakdown in communication between Thai authorities and foreign affiliated companies because of lack of information in English (ERIA(2013)).

3. Supply Chain BCP sustaining competitiveness

It is revealed through two disasters that the upstream and downstream companies of supply chain need to cooperate to formulate Supply Chain BCP. Individual preparation of a certain company trying to reduce its risks is not effective. If one part of the supply chain is frail, the whole supply chain may also become frail. Since the whole supply chain synchronizes in production, the risks are also need to be coped with cooperatively.

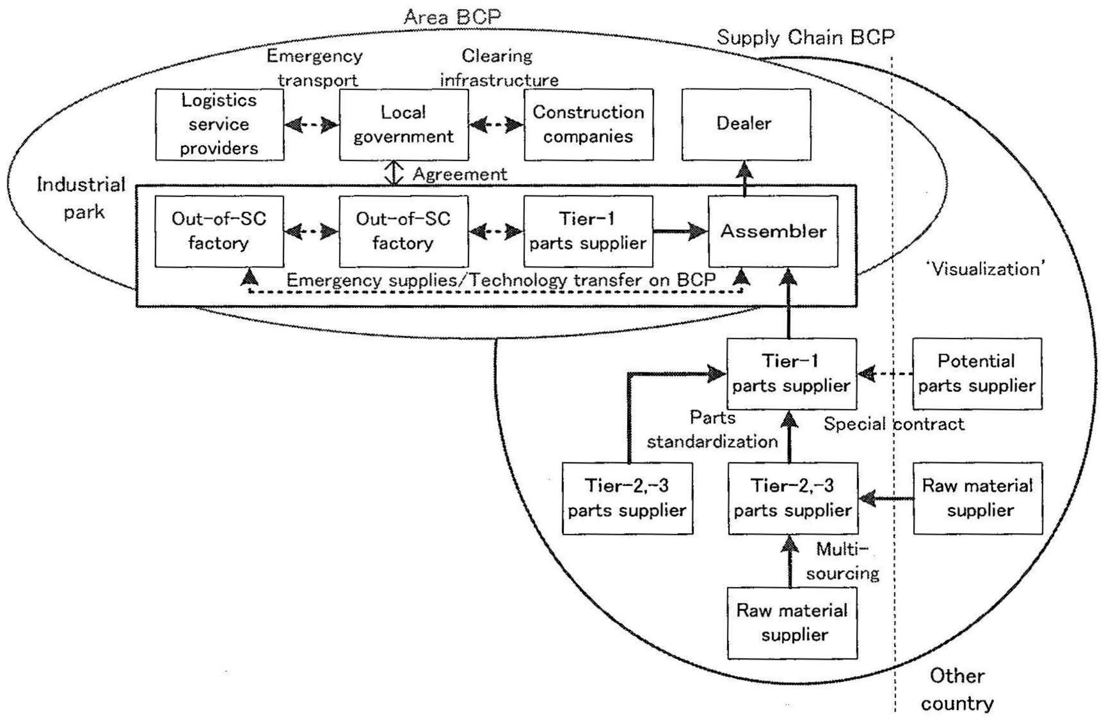
The visualization of whole supply chain is the first task for the companies in the supply chain (Koyama, 2012). It was revealed that even the assembler did not comprehend tier-2 and tier-3 companies. On the other hand, the information about the business partners can be the source of competitiveness, and is hardly able to share with other companies making similar products. The companies in the supply chain could share their information when constructing relationship of mutual trust.

As an assembler's another future measure, geographically dispersed sourcing from two or more parts suppliers are proposed. Through this, even if a certain parts supplier's factory suffers a great deal of damage, parts can still be supplied from another parts supplier. However, the decentralized orders of parts, in which the economies of scale cannot be fully enjoyed, may lead to increase their cost. In order to assure certain amount of order to a parts supplier, the assembler should consider the reduction of parts variety by standardizing parts that do not directly affect the product differentiation or their competitiveness.

Also, for assemblers and parts suppliers, a special arrangement seems effective which carries out alternate parts production from other potential suppliers in times of emergencies. Alternate production strategies of automotive electronic components may be established at production factories in Asia. It is important to standardize a production information system and institute a contract of production during emergency among these factories so that information required for production can be shared in a short period of time.

There are also proposals to correspond by "increasing safety stock at each chain composing global supply chains, and reconsidering Just-in-time system which procures and produces required things at required time of required amount." However, it only offers little bit of merit that it can buy some time. On the other hand, it creates demerit of increasing product and parts stock that is to be wasted. The necessity of quick response to the change in demand may fade, and the product developing power of Japanese manufacturers may also be lost. The restocking in inventory cannot be the solution (Fig 5).

<Figure 5> Supply Chain BCP and Area BCP



4. Area BCP by Public-Private Partnership

The globalization of supply chain requires global perspective in formulating the Supply Chain BCP. On the other hand, automobile assemblers and parts suppliers are producing at the same industrial parks or in the same region with other companies. Though they usually have a limited interests to introduce common transportation services for the workers, waste management and so on, it is conceivable that they support each other at the time of disaster. Hence, the Area BCP to arrange the mutual support under disasters is beneficial.

To formulate the Area BCP, it is important for local government to set up a round table involving not only manufacturing companies but also construction companies and logistics service providers. These stakeholders could share information, such as conceivable risks, problems that may arise, how to deal with, and could make an agreement on clearing transport infrastructure of debris and transport of emergency supplies. The simulation on the desk and practical training assuming disasters are also important.

Uniform control of emergency supplies is one of effective measures in the Area BCP. When transportation to other areas is shut down by earthquakes or water floods, foods and blankets provided for workers can be distributed between the factories in same industrial park. If the uniform control of stocks at each factory is available, they could effectively distribute them and reduce safety stocks.

The large companies like automobile manufacturers could help the smaller companies in introducing their individual BCP consistent with the Area BCP. BCP is new and professional area. Smaller companies may not have room to train staffs to be expert in this field. Thus, it may be beneficial for smaller companies if large companies could provide a model of individual BCP and to take initiative in formulating the Area BCP.

One of the mechanisms to refer to as a formulation of the Area BCP is the organization called FQP (Freight Quality Partnership) in the UK which is to solve the city logistics problems. FQP is an example of PPP (Public-Private Partnership), where stakeholders of city logistics gather at one table to share the information about the problems the region is facing and consider the required solutions. Specifically, the city government taking the lead, manufacturers, retailers, logistics operators, community groups, environmental groups such as NPO, and the police of the region sit at the table to consider city logistics policies such as traffic restrictions of trucks, night time delivery using quiet trucks, and the modal shift from road to railways (Browne et al (2004), DETR (1999), FTA (1998)).

For example, though it is restricted to operate trucks in the city during the night time in the UK, the use of quiet trucks during the night time enables the operators to make delivery more efficiently and the residents to enjoy merit of reduction in traffic congestion during the daytime.

If the stakeholders of each industrial park can gather at one place, it can be the place to formulate the Area BCP. City government need to be clear about the issues in which they want to engage the private sector, and to decide how best to use the time and efforts of the private sector in these initiatives. Focusing on the key issues and outcomes will help to engage and retain the private sector's involvement in such initiatives.

IV. Conclusion

From an investigation of the supply chain of automobile industry, it was clarified that the assemblers choose parts suppliers and introduce logistics strategies under many conditions, and that they optimize the supply chain and the logistics system in the long term. The disasters stopped the parts supply, which also stopped the production of other companies in the supply chain, and it took time for the recovery.

The two disasters stimulate most of supply chains to introduce their own Supply Chain BCPs. In the Supply Chain BCPs, the visualization of whole supply chain, geographically dispersed sourcing from two or more parts suppliers, standardization of strategic parts without damaging competitiveness, and special contract with potential suppliers to conduct alternate production in times of emergencies are proposed.

Area BCPs could play an important role as well when many companies without daily business relations are in operation in the same industrial parks. It is suggested to establish a roundtable of the stakeholders concerned, in order to share information and establish common and effective BCPs in the area. City government can provide a platform to formulate an Area BCP, where uniform control of emergency supplies and transfer of BCP-related know-how are proposed among others.

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