A Study on Smart Business Continuity Management for Near Future Cities “Differences between Chinese and Japanese Smart Cities as Regards Buildings/Facilities: A Case of Tokyo as the Representative of Japan”

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Abstract. In this study, differences between Japan and China with regard to smart business continuity management (SBCM) of buildings/facilities for near future cities are discussed. Approaches to the construction of smart cities in China have been making incredible progress, which are utterly different from those in Japan. The objective of this study is to identify their differences by taking Tokyo as an example. China is able to construct smart cities for which new technologies are employed, liberally under boldly conceived plans whereas adequate consideration must always be given to the risk reduction and prevention of disasters brought particularly by earthquakes in Japan. In this study, SBCM of buildings/facilities for near future cities have been discussed by taking Tokyo as an example.

1. Introduction
This paper present differences between Japan and China with regard to smart business continuity management (SBCM) of buildings/facilities for near future cities are discussed and Japan's BCP/BCM's disaster prevention and earthquake prevention plan to the next 2020. The objective of this study is to identify Japan and China differences by taking Tokyo as an example.

2. Chinese smart cities at present
Late in August, 2018, the 4th China Smart City International Expo 2018 was held in Shenzhen, where representatives from 500 cities (accounting for 100% of all sub-provincial cities and 76% of local major cities) clearly declared to aim for the construction of smart cities. Naturally, China will be the world-largest test ground for the construction of smart cities. Formidable knowledge of Chinese enterprises will be poured into the construction projects. The main force consists of four companies known as PATH: Ping An, Alibaba, Tencent, and Huawei.

Urbanization has been advocated as a policy by the Chinese government. According to the National Population Development Plan (2016-2030), the rate of population living in urban areas is targeted at 70% by 2030. In the plan, administrative efficiency, population aging, and sustainable real-estate prices which constitute China's lifeline are taken into consideration.

Currently, Shenzhen and Shanghai are the two smart city models. The smart city construction project in Shenzhen is one of the policies with overriding priority. Cooperation with Ping An, Alibaba and Tencent have been promoted to build basic infrastructure such as Internet, IoT and cloud.
computing so that administrative services can be facilitated by taking advantage of smartphones and iris authentication. In the meantime, the city of Shanghai signed for the “Shanghai Smart City” project with two leading IT companies of Alibaba and Tencent in mid-August, 2018. This accelerates the construction of an online administration system. The city of Shanghai describes “WeChat” of Tencent SNS as representing the application standard and “Alibaba Cloud” as the technology standard.

Furthermore, extensive development called "Millennium Strategy" is currently under way in Xiongan New Area on the outskirts of Beijing. Xiongan New Area is considered to become future Shenzhen or another Shenzhen.

Having said that, Xiongan New Area is located within Hebei Province, 150 kilometers away from Beijing. A distance of 150 kilometers is further than a distance from Tokyo to Mt. Fuji. Nearly 150 kilometers southeast of Beijing is situated the giant metropolis of Tianjin whereas Xiongan New Area is 150 kilometers southwest. Currently in Xiongan New Area, fleets of robot cars are under trial operation and the self-driving technology by Apollo with funding from Baidu is experimented on a large scale. The area is expected to make remarkable progress.

3. Japanese smart cities

In the case of Japan, demonstration experiments of smart cities were carried out in four cities of Yokohama, Toyota, Keihanna, and Kitakyushu on the initiative of the Ministry of Economy, Trade and Industry (METI). The final results were reported in the 18th Conference on Next Generation Energy and Social Systems held in November, 2018. In Japan, the smart city is defined as a new city to be built for betterment in the quality of life and sustainable economic growth by efficiently managing and operating basic infrastructure and social services in harmony with the environment by the best use of high-tech IoT (Internet of Things). In the smart city, various types of technologies are introduced to individual areas and intricately linked to each other. Entirely supported by two types of infrastructures, namely a power network and an information network, the city is perfected by data sent from these networks. Nevertheless, Japan differs from China in that adequate consideration must be given to the risk reduction and prevention of disasters brought particularly by earthquakes. Accordingly, smart business continuity management (SBCM) of buildings/facilities for near future cities are discussed in this study by taking Tokyo as an example.

4. BCP&BCM

Since the 2011 Great East Japan Earthquake, the practicability of Business Continuity Plan (BCP) and Business Continuity Management (BCM) has been being examined intensively.

Not only in Japan but also in the global world, smart technologies have been developing rapidly these days, therewith social and human awareness needs associated with business continuity and safety/security have been greatly increasing. Thus, to make BCM smart in near future cities, prospective technologies and needs should be taken as premises into the above mentioned risk quantification logic and measures.

Smart BCM (SBCM) makes it possible to improve its functionality, optimize operation, concentrate information, minimize damage in case of emergency, and shorten restoration time, by integrating information and communication technology (ICT), new energies and other advanced technologies into BCM. Furthermore, BCM which has been independently exercised for an individual building or organization will be conducted and operated in a whole city through a network, to increase urban safety and convenience, eventually adding value to the city.

In order to realize such SBCM, it is important to clarify how the environment will be improved for future BCM and what risk will be entailed, through investigations on actual approaches currently practiced as the foundations of business continuity for the near future.

5. Persistent DCM/BCM risks figured out from the Tokyo Disaster Prevention Plan and the Action Plan for 2020

The Tokyo Metropolitan Area Disaster Prevention Plan for Earthquake [1] (hereafter, Tokyo Disaster
Prevention Plan) was drawn up by the Tokyo Disaster Management Council based on Article 40 of the Disaster Countermeasures Basic Act (1961). Its purposes are: to carry out preventive measures, emergency response, reconstruction measures, and other measures related to earthquake hazards; to protect the lives, health, and property of Tokyo residents; and to improve and increase resilience of Tokyo by maintaining its urban functionality.

In the Tokyo Disaster Prevention Plan, current disaster prevention projects, basic viewpoints and specific measures against an earthquake in the metropolis are systematically elaborated.

On the basis of the Tokyo Disaster Prevention Plan, risks in urban structures, buildings, facilities, and fittings to urban business continuity were picked up and sorted out as shown in the left columns labeled “Prevention Measures in the Tokyo Metropolitan Area Disaster Prevention Plan” in Tables 1, 2 and 3.

In these tables, under the primary category of “Realization of Safe City Planning,” for example, “City Planning for Secured Livelihood” comes as a secondary category and “Localized disaster prevention plans including the creation of fireproof high-density wooden residential areas” as a specific tertiary subcategory, showing strategies relating to district continuity management (DCM) and BCM.

The future images of Tokyo in 2020 depicted in “New Tokyo. New Tomorrow - The Action Plan for 2020” were sorted out in relation to the above stated three-level categories in Tables 1, 2 and 3 and mentioned as “Tokyo in 2020” according to the “New Tokyo. New Tomorrow.”

Finally, based on “Cityscapes of Tokyo in 2050,” “Persistent DCM/BCM risks” were estimated and presented in the right columns of Tables 1 to 3. This implies that some risks are considered to linger until 2050 even if measures are taken according to the current disaster prevention plan and the vision for 2020. “Cityscapes of Tokyo in 2050” were foreseen from the perspectives of safety and business continuity.

The following Table 1. Tokyo Disaster Prevention Plan, Tokyo in 2020, and Persistent DCM/BCM risks (1) illustrates the preventive measures in the Tokyo Metropolitan Area Disaster Prevention Plan for Earthquake.

| Preventive measures in the “Tokyo Metropolitan Area Disaster Prevention Plan for Earthquake” | Tokyo in 2020 according to the “New Tokyo, New Tomorrow” | Cityscapes of Tokyo in 2050 (presumed from the information offered by the TMG) | Persistent DCM/BCM risks |
|---|---|---|---|
| City Planning for Secured Livelihood | * Localized disaster prevention plans including the creation of fireproof high-density wooden residential areas. | * Removal of utility poles from roads reinforces urban disaster prevention functionality, maintains safe and comfortable pedestrian zones, and creates fine cityscapes. | * Comfortable living is not secured for many Tokyo residents in an earthquake. |
|  | * Development of river, seaside and port facilities. | * Fireproof communities are established in high-density wooden residential areas. | * Functions of private businesses cannot be maintained or restored earlier. |
|  | * Safety measures for high-rise buildings and underground shopping areas. | * Earthquake/water resistant embankments and floodgates protect lives and properties of Tokyo residents from tsunami/high tide in a worst conceivable earthquake and secure central functions of the capital city. | * An elevator in a high-rise building often stops suddenly or traps people in, requiring much time for restoration. |
|  | * Prevention of landslides and landslips. | * Urban scenery improves in the absence of utility poles, thus gridlock is avoided in an earthquake. | * Secondary members such as the ceiling of a general structure collapse, causing many injuries and stalls. |
| Promotion of Earthquake Resilient Buildings and Safety Measures | * Development of earthquake resilient buildings. | * Important buildings from the viewpoint of disaster prevention are made earthquake-proof. | * *Uncollapsible cities* are realized by building earthquake resilient houses. |
|  | * Improvement of elevators and prevention of furnishings from overturning. | * “Uncollapsible cities” are realized by building earthquake resilient houses. | * Being trapped in an elevator sharply decreases in middle- and low-rise buildings while trapping-in occurs more often in high-rise buildings, requiring much time for restoration. |
|  | * Installation of an emergency automatic elevator landing system is promoted. | * Earthquake-resilient buildings not damaged by secondary members and fixtures. | * An elevator in a high-rise building often stops suddenly or traps people in, requiring much time for restoration. |
Table 2. Tokyo Disaster Prevention Plan, Tokyo in 2020, and Persistent DCM/BCM risks (2)

| Preventive measures in the “Tokyo Metropolitan Area Disaster Prevention Plan for Earthquake” | Tokyo in 2020 according to the “New Tokyo, New Tomorrow” | Cityscapes of Tokyo in 2050 (presumed from the information offered by the TMG) | Persistent DCM/BCM risks |
|---|---|---|---|
| **Ensured Safety of Transport Facilities** | * Ensured safety of roads and bridges, and improvement of information gathering systems. | * Functions of emergency transportation are secured with earthquake resilient viaducts and port facilities. | * Roads, railroads and revetments fail to function, requiring human-wave tactics for restoration. |
|  | * Development of earthquake resilient railroad facilities and measures for early restoration. |  |  |
|  | * Improvement of river/port/airport facilities. |  |  |
| **Ensured Functions of Transportation Network** | * Arrangements and regulations for the removal of obstacles from emergency roads. | * Major routes on specific emergency roads are secured for evacuation, rescue operation, and emergency transportation by making roadblocks buildings earthquake-proof. | * The earthquake resilience of buildings along emergency roads improves, and the strength of viaducts and street trees increases, securing transportation routes for emergency goods. |
|  | * Operation control and management of flood accidents for railroads. | * Operations of emergency transportation are secured by taking measures for handling fallen street trees. | * Traffic is controlled by ICT and automatic operation to prioritize emergency activities. |
|  | * Removal of obstacles and traffic regulations for rivers, waters, ports and airports. | * Traffic signals activated by built-in battery in a blackout and video cameras for gathering real-time traffic information are installed at intersections to secure activities of traffic safety and emergency vehicles. | * Traffic control systems operated regularly by ICT become out of order in an earthquake, causing traffic jams. |
| **Assurance of Stable Public Utilities** | * Major facilities improved in earthquake resilience. | * The earthquake resilience of water supply and sewer facilities improve, but embedded pipes are damaged in an earthquake, requiring a long time for restoration. | * Power, gas, water supply and sewer services are disconnected, requiring a long time for restoration. |
|  | * Networking and backup of public utilities. | * Water supply and sewer services are restored earlier in metropolitan central facilities, emergency medical services and shelters (middle schools) are equipped with earthquake resilient joints. | * Efficient inspections conducted regularly by the use of ICT and IoT technologies, which may not be available in an earthquake. |
|  | * Continuous approach for early restoration of damaged facilities. | * Reservoirs, intakes/conveyance structures, filter basins and distributing reservoirs are developed to be earthquake resilient. |  |
|  | * Survey, inspection and emergency rehabilitation of water supply and sewer facilities. | * Drain pipes from metropolitan central facilities, emergency medical services and shelters (middle schools) are equipped with earthquake resilient joints. |  |
|  | * Inspection and hazard prevention measures for electricity, gas and communication services. | * Water supply and sewer services are secured by earthquake resilient facilities and pipe networks. |  |
|  |  | * Reservoirs, intakes/conveyance structures, filter basins and distributing reservoirs are developed to be earthquake resilient. |  |
|  |  | * Drain pipes from metropolitan central facilities, emergency medical services and shelters (middle schools) are equipped with earthquake resilient joints. |  |
Table 3. Tokyo Disaster Prevention Plan, Tokyo in 2020, and Persistent DCM/BCM risks (3)

| Necessities                                                                 | Tokyo in 2020 according to the "New Tokyo. New Tomorrow" | Citiescapes of Tokyo in 2050 (presumed from the information offered by the TMG) | Persistent DCM/BCM risks                                                                 |
|----------------------------------------------------------------------------|----------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| Development of Information and Communication Systems between Disaster Prevention Agencies | * Establishment of information and communication systems with disaster prevention agencies. * Development of a disaster prevention network based on administrative radio systems. * DIS-based damage reporting system. * Establishment of information gathering systems by taking advantage of aerial cameras and helicopter TV cameras. | * Information systems among disaster prevention agencies are improved, capable of sharing real-time disaster information with higher reliability against an earthquake. * Realtime disaster information can be gathered in detail, by making most of drones and other instruments. | * Functions of some disaster prevention agencies are lost right after an earthquake, failing to share information for swift evacuation guidance and rescue activities. * Realtime earthquake information is too massive to conduct efficient measures. |
| Development of Information Providing System for Residents                | * Effective use of new information tools like social media. * Promotion of cooperation with news media. * Improvement of website functions. | * Information is provided for residents and stranded people in an earthquake by making use of ICT and social media. | * Emergency information cannot be provided resourcefully to meet the situation. * Users unaccustomed to gathering appropriate information in an earthquake fall into a panic. |
| Development of Information Sharing Systems among Residents                | * Knowledge of safety confirmation systems shared among family members. * Establishment of various communication measures. | * Safety of family members can be confirmed in an emergency by using daily community communication systems. * Private communication devices including smart phones improve in reliability, easily rechargeable in an earthquake. * Communication lines improve in the use of satellite communications. | * Sharp increase in communication traffic after an earthquake leads to communication failure. * GPS and navigation systems for daily use become unavailable, throwing users into a panic. |
| Stockpiles of Drinking Water/Food/Living Necessities                      | * Establishment of water-supplying bases. * Stockpiles of food/living necessities * Establishment of cooperative systems under agreements with business circles. | * Each household is encouraged to continuously build "Daily Stockpiles" in accordance with its own lifestyle, by instituting the "Emergency Stockpile Day." * In addition to stockpiles of three-day supply of water and food for employees in business places, accumulation of those for stranded people is encouraged. | * A number of households with no emergency stockpile need to depend on public bodies and others in an earthquake, worsening a shortage of necessities. * Emergency goods are not distributed satisfactorily. |
| Secured Energies                                                           | * Reinforcement of generators in metropolitan facilities. * Assurance of fuel to emergency generators. * Stable supply of various power sources including decentralized self-sustaining power source to base facilities. * Stable fuel supply | * Energy-saving buildings are built in accordance with the ZEB concept. * Implementation of cogeneration systems capable of energy supply in a blackout is supported. * Development of infrastructure necessary for sharing heat and electricity between office buildings and commercial facilities with different energy demand patterns is promoted. * Construction of hydrogen fuel stations is promoted. * Fuel cell vehicles and buses are widely introduced. * The use of fuel cells for domestic and industrial/commercial use is spread. | * A bulk power system is not operable in a wide range. * Decentralized energy systems (e.g. cogeneration, renewable energy, and hydrogen energy) are not workable. * A hydrogen fuel station bring a dangerous threat in an earthquake, and a hydrogen supply chain malfunctions. |
6. Summary and future issues

China is able to construct smart cities for which new technologies are employed, liberally under boldly conceived plans whereas adequate consideration must always be given to the risk reduction and prevention of disasters brought particularly by earthquakes in Japan.

In this study, smart business continuity management (SBCM) of buildings/facilities for near future cities have been discussed by taking Tokyo as an example.

As future issues, we plan to examine smart business continuity management (SBCM) for several future smart cities in Japan and fully compare their characteristics, problems and main points on construction as well as management with those of Chinese counterparts.

Acknowledgment

We would like to express our gratitude to the members of SHASE sub-committee for “Study on Smart Business Continuity Management for Future Cities and Facilities” (led by Shuji Fujii from April 2015 to March 2018), for valuable comments in completing this paper.

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