Lessons learned from the Great East Japan Earthquake

The Japan Times held a forum recently to discuss the lessons learned by industry experts in light of the March 11 Great East Japan Earthquake, tsunami and nuclear accident. Joining the discussion were Yoshimitsu Okada, president of the National Research Institute for Earth Science and Disaster Prevention, Shota Hattori, CEO of Kozo Keikaku Engineering, and Hideo Watanabe, manager of resilience engineering at IBM Research. Yuzo Suwa, an editorial writer at Kyodo News, served as moderator of the discussions held this month in Tokyo.

Excerpts of their discussions follow.

Lessons from the earthquake

Moderator: A year has passed since the Great East Japan Earthquake, when close to 25,000 people became victims. In the beginning, the magnitude of the earthquake, the accident at the Fukushima No. 1 nuclear power plant and so forth was as expressed as unaccepted and unprecedented events, but since then many things have been subsequently revealed. Big lessons, such as “How the government and residents prepare for an earthquake disaster,” “What companies’ business continuity plans (BCP) should be,” were obtained through these events.

With this as a theme, please outline your business and tell us what lessons were learned from the earthquake?

Yoshimitsu Okada: The disaster prevention department deals with earthquakes, volcanoes and other natural disasters, such as storms and floods. It is based in Tsukuba, Ibaraki. In Miki, Hyogo Prefecture, we have a seismic observation facility. We are mainly focused on buildings not being damaged. The interaction between a building and the ground, resulting in ground movement, causes the building to suffer damage. For instance, in the Kobe earthquake occurrence in 1995, 3,000 people died due to damage from buildings collapsing. In the Great Hanshin Earthquake in 1995, people in multi-story houses suffered many injuries, but those in single-story houses suffered fewer injuries. The structure design must be made more durable in the future. The safety can be improved. By using the cloud, it is easier to make BCPS compared to 15 years ago.

Watanabe: IBM has developed and used a weather simulation system called "Deep Thunder" for a long time in the Smart City simulation. This can predict the weather, ice, rain, wind direction, etc. In this system, many people who are on power lines go out due to storms, tornadoes, etc., so that an earthquake or maintenance staff immediately can be sent to the damaged areas. With an electric company for a wide area, people are stationed beforehand. When something is used for the dispatch of people can be performed in an efficient manner.

Hideo Watanabe: IBM, with the vision called "Smarter Planet," has already developed various solutions and computer systems. Not only in a company but also in a country and also in the whole world, we are addressing the social system altogether. Lessons have been learned not only from the Great East Japan Earthquake, but also from China’s Sichuan Earthquake, Haiti’s earthquake, and New Zealand’s earthquake. Among those, using the information and communications technology (ICT) is particularly important, both in BCP and BCPS. We are considering what kinds of solutions and services can be developed.

Moderator: While still focusing on the problems we faced during the Great East Japan Earthquake, let me re-ask the question of how to respond to these issues? And what are Japan’s capabilities in this field?

Okada: There are many levels to simulation, too. A scientific-technological simulation can have many difficult fields to predict. It is a big problem depending on what kinds of ideas are needed to be predicted in the process. When we have any information on the underground conditions, it is a big problem. In our simulation, we are currently recreating earthquakes from the past and recording it. If the model is correct only when an earthquake occurs, since the cyclic in which a big earthquake occurs, we cannot predict so. We must predict it very well. So, it is very difficult to have a model that can be fully reliable.

On the other hand, we have been able to simulate precisely the simulation with the wave motion of an earthquake, the propagation of tsunami and the shaking of a building. I believe Japan’s technology is probably one of the leading technologies.

Watanabe: Regarding the importance of computer simulations, I have been working on them for a long time. I think that we should try to actually simulate it, but having the information of where each individual is and having the real-time data on how the tsunami and tornadoes are approaching, together with the data on the shaking of buildings and the other data, it is very important to give good directions. Like "Please evacuate now in this direction," I think such things are what we should be aiming for as the ultimate goal.

Okada: The role companies have to play is in the part of mutual aid, which is being brought closer together. It is because we feel that we can no longer be depending on the government, and not only in companies but also in our neighborhood associations and schools.

Using the K supercomputer

Moderator: Simulations and models are important in the process of acquiring early warning signals to early evacuation, and they are needed for future predictions. Currently, the Japanese supercomputer K is an important tool in speed and capacity that is the best in the world. If utilized, the prediction of large earthquakes and thunderstorms will be done more swiftly and can be applied to the prevention and evacuations.

Okada: A high-office building, copy machine, computers, etc., all are different, thus vulnerable to change, even if the technology is the same. The computing ability of a computer increases, not only for hardware but also for the software technology, and all the data sets are put together in the same framework. It can actually be made into a realistic simulation. The technology is developing so fast, in order to link to diesel and electrical emergency management, it is important to consider both the situation and shape of a building. However, changing from a "one to many," to many to one, people are still able to exchange information with various people on a personal level. They also deal with various issues, such as fake information. So the U.N. reckons, "Although information is very important, it must be reliable and accurate." Information cannot race much smoother next time.

Watanabe: The seismic movement of the subduction zone for the Great East Japan Earthquake was a great deal of damage, affecting not only the domestic but also the global economy. From a viewpoint of the supply chain being disrupted, not only can it happen in Japan, but also the companies that are active in seismology all over the world. We prefer solutions such as not only changing the model of a tsunami warning system itself, but also the information support. Like showing a picture of a tsunami coming has much more impact. Or asking every person the structure of their house and seeing on a computer how it will actually shake. If we can show, "This is how it will shake," "How this much will collapse," then they will think, "We need to strengthen it more." It is important to develop the visual effects and spread them to the world, not just doing calculations.

I think the ultimate goal of disaster response simulation is to be able to bring it to the state of evacuation instructions, like "Please escape now in this direction."
Supercomputers such as K should be utilized more, but the country should show its support to promote this use or it would be a good thing gone to waste.

Shota Hattori and Kozo Keikaku Engineering

The development of software, there are still numerous scenarios for entire cities will be utilized more, but the country should show its support to promote this use or it would be a good thing gone to waste.

Shota Hattori, Kozo Keikaku Engineering

In developing countries such as Southeast Asia, despite using simulations and the observation records are inaccurate, to bring Japan’s technology is so to is these locations will be very difficult. Deciding on methods that will be useful in those locations and working with the local researchers and citizens how to utilize them is important. There is work being done to create a database of low-cost disaster prevention measures such as planting mangroves along the coast for protection from tsunamis.

Watanabe: Regarding Japan’s contribution, there is no approval for land that is gone for property insurance. Our company is also participating. Insurance companies are important for developing countries. Many times, due to standards, the environment has a risk of it falling to the Shannon system. But, depending on regions and need to be dealt with differently. If they all have different evacuation plans, aversions of regional differences will increase.

Hattori: Electronic and automobiles are globally targeted, but there are many fields and lacking a structure. Our company tries to have foreign investors who received their master’s in engineering from Tokyo University to come to Massachusetts University as much as possible. We will have four or five times a year. The training of staff abroad will be useful and the use of supercomputers for weather change, using supercomputers will be put to good use.

Watanabe: Natural disaster simulators using computers need to be thought of, for example. Natural disaster simulators using computers can be organized in each region to provide information such as how evacuations in cars will lead to traffic or how people with children and the elderly should evacuate. This will be crucial in the future. In occasions of natural disasters, governments and leaders must make decisions while being in control. This control system and simulations will be applied together in decision making. It is necessary as well.

Hattori: If we can use this system, there is a risk of it falling to the Galapagos effect, the Japanese will believe I would like to see the government become more understanding and supportive of the global contribution of Japan’s technology.

Watanabe: There are over dozens of huge screens in Japan. For example, evacuation simulations can be organized to make decisions how to utilize it. There was an indication that need to be turned on at times of emergencies.

Country authorities and local governments attend training sessions in the Cabinet Office changes working full time on these matters for years. They are taking a way to manage this.

Hattori: Even if they did not know the absolute amount, the system showed high radiation in the submersible, which should have been applied in evacuation instructions. That those who decided on policies did not use these results is disappointing.

Watanabe: We feel that a lot of different types of simulations should be performed because it is necessary to confirm the situation greatly changes on where the nuclear plants were the usage of the System for Prediction of Environmental Emergency Dose Information (SPEEDI). Even if it did not show the absolute amount, the system showed high radiation in the submersible, which should have been applied in evacuation instructions. That those who decided on policies did not use these results is disappointing.

Hattori: In building cities, funds that can be used in systems only for emergencies are limited. If the systems can be used regularly, that would be best. Even in a center city this is initially for flood prevention, but it is improved to operate traffic and for dispatching police cars and ambulances for accidents. It has been mentioned many times, but a system that can integrate component technology to make a decision is needed.

Hattori: By using information technology, we now have the ability to plan ahead based on situations and in segments. For example, if an earthquake hits us directly, a detailed plan for students, young children, and the elderly needs to be created. It is essential that people acquire this knowledge through training for future cities.

Moderator: To utilize supercomputers, the growth of society’s systems and the development of the technology to acquire data is needed. I think we all confirmed that simulations will not solely resolve all the problems. Apply the observations in politics, education, and daily life. At the same time, it is also essential to build a strong city using the “Environmental Future City” as a model.