Reliable ICT in an Emergency

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1. Introduction

One year has passed since the Great East Japan Earthquake. During that time, investigations of rebuilding/rehabilitation and the state of damage have been vigorously carried out in many areas. As a result, details about the situation during the disaster have been revealed .

The earthquake and tsunami smashed the information and communication systems, creating an information vacuum. It is impossible to prevent and mitigate disasters without information and communication systems confirming to various proposals from related institutions. Dr. Toshitaka KATADA, a professor at Gunma University, refers to three major rules for surviving catastrophes: “Do not be shackled with assumptions, do your best, and try to be the first person to run”. Information and communication technology (ICT) plays important roles in this regard.

2. ITS (Intelligent Transport Systems)

The information in “Traffic Availability and Suspension Information” proved useful at the initial stage of the Great East Japan Earthquake. This information consists of probe data (travel records) and traffic suspension information from road administrators, which is available on the internet. It attracted great attention at international conferences on ITS. It helped people take first action in the midst of widespread disruptions and information shortages in the earliest stages of the disaster. Large amounts of probe data have been collected by ITS Spots (Road Side Units): ITS spot services have just started nationwide in August 2011, and it was hoped that probe data would be utilized as “bond links”, as it were, by combining their capabilities to help people in an emergency.

Because people are now accustomed to using Twitter, Facebook and other social networking services, they served as effective platforms for people to contact each other and to undertake rescue operations even though ordinary telephone call communication was shut down. People also made good use of Google Person Finder[1] (whereabouts information) whose capabilities were enhanced by combining it with digital mapping information.

It is also necessary that “Road Stations” (rest areas alongside roads) be renewed as recovery bases during disasters. For instance, Takehara(Hiroshima Pref.) Road Station was allocated as a recovery base. A stand-alone power generation facility and a water receiving tank have been installed at this station.

“Connected” has become a keyword of the ITS world recently, especially in an emergency. For example, V2I stands for vehicle to infrastructure communications and several abbreviations’, such as V2V, V2H or V2G, are used to represent the idea of

[1] Google person finder helps people reconnect with friends and loved ones in the aftermath of natural and humanitarian disasters

two-way connections (H: Home, G: Grid of electricity). The ITS world is going into a new phase: vehicles, houses and the smart grid are all connected by means of IT technologies to deal with energy issues as well as traffic issues. There is also a Japanese version of the global navigation satellite system project centered on launching the quasi-zenith satellite in an attempt to link up with space infrastructure.

ITS initiatives have been considered as vehicle-oriented policies to some extent. The new ITS services for cyclists and pedestrians should be considered to deal with the problem of the difficulty people face in returning home from their offices in an emergency. To make that happen, it is also essential to use personal probe data more efficiently. This directly reveals people's movements obtained by mobile phones or transportation IC cards such as SUICA, PASMO or ICOCA to enhance emergency support measures.

3. Unmanned Construction (Construction Robots)

Although Japan has the world's highest level of robot manufacturing technology, how useful the robots are is still controversial. The practical usability of robots has not been as efficient as expected, considering the situation at Fukushima Daiichi Nuclear Power Plant, which was damaged by the earthquake.

Unmanned automation technology has been introduced to construction sites, especially in emergencies where it can manipulate robot-like machines. It is particularly advantageous to make use of these devices under the harsh conditions where a secondary disaster is highly likely to follow an initial disaster. Unmanned vehicles were initially remote-controlled using wired communication (amphibious bulldozers applied to the Joganjigawa River disaster, 1969). These unmanned construction technologies were developed for use in the reconstruction after the eruptions of Mt.Unzen by combining wireless technologies and imaging equipment.

The development of robots could easily be abandoned because research work tends to be isolated due to uncertainty that it will ever be practically applied. Fortunately, construction sites are real, not virtual. Thanks to this environment, when they are needed, they will be used because people in the field are continually involved in encouraging the technology by promoting R&D, building equipment maintenance systems and educating operators.

A few issues remain to be tackled. These include the fact that the range of their operation is limited., And electrical wave interference, work inefficiency and construction accuracy (finished work quality) under the effects of problematic radio wave environments also remain to be dealt with. Manipulation from a more remote place will be necessary when it is necessary to deal with radiation. Also the market is not large enough for every private entity to make profits even if there are real sites in place. Therefore we need to find a way to build a system which enables us to maintain long-term operations by taking measures such as applying the technology to a wider range of situations.

4. CALS/EC

Reconstruction should be executed quickly and public works should play the major role. CALS/EC[2] is a system intended to drive productivity by converting information created by each process, survey, designing, work executions and maintenance management of public works, into electronic data, and by sharing the information using communication

[2] Continuous Acquisition and Life-cycle Support /Electronic Commerce

networks. This system must be used to speed up the process of reconstructions.

Data distributions related to electronic bidding and electronic delivery are successfully progressing in terms of the data distribution speed. On the other hand, the data stream for designing and work executions are not. The introduction of BIM (Building Information Modeling) has been in progress in the building construction world. The purpose of BIM is to enhance productivity by leveraging building information models which consist of three dimensional building models built on computers and combined attribute data including specifications/performance of materials/components or cost information at each stage: construction designing, work executions and maintenance management.

Civil engineers have been utilizing three-dimensional design data necessary to recognize finished work quality control (earthwork) by Total Stations and the machine control of motor graders. Electronic data conversion is important because it enables us to facilitate linkage with information‐oriented construction and unmanned construction. Electronic data conversion also strengthens risk management by enabling us to get quick access to backup data. A disaster could damage a lot of precious paper information such as plans of buildings which are required to manage rebuilding or rehabilitation. Therefore performing electronic data conversion and backups could support BCP (Business Continuity Planning) by using cloud computing.

At the same time, it is also important that, by valuing speed up conscious perception, we make practical efforts by beginning with what is possible while keeping in mind the ideal construction flow process CALS/EC. This will help diffuse CALS/EC throughout local municipalities resulting in them putting it into full use in the case of an emergency.

5. Conclusion

"Only providing precise, prompt and detailed information would be not enough to promote evacuation actions. In addition, it is reported that too much enhanced functionality of evacuation information was found only to deter evacuating actions ("Tsunami Disaster" by Yoshiaki Kawada, Iwanami Paperbacks (in Japanese)). "Information and communication technology" may be imagined as "highly state-of-the-art technology". ICT issues are usually discussed only from a technology standpoint rather than from a user standpoint. We must not forget that it is humans who use either information or communication technology. We are now determined to squarely meet requirements by various people and regions in the society to actually implement the PDCA cycle.

[References]

1) "Urgent Recommendations-Disaster Mitigation (Disaster Prevention and Disaster Reduction) Using ICT-, Integrated Research & Survey Team" by Japan Society of Civil Engineers/Institute of Electrical Engineers of Japan, July, 2011 (in English)

2) "Unmanned Construction Technology Well Utilized for Disaster Restoration" by Kenichi Fujino / Masaharu Moteki, Public Works Research Institute, Construction Robot Forum, October, 2011 (in Japanese)