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Investigating Risk Communication Process for Community's Disaster Reduction with a Framework of "Communicative Survey Method"

Yukiko TAKEUCHI*
Wei XU**
Yoshio KAJITANI***
Norio OKADA****

*Graduate School of Global Environmental Studies, Kyoto University, Japan
Yoshida Honmachi, Sakyo-ku, Kyoto 606-8501, Japan
y.takeuchi@fw7.ecs.kyoto-u.ac.jp
**State Key Laboratory of Earth Surface Processes and Resource Ecology, Beijing Normal University, China; Academy of Disaster Reduction and Emergency Management Ministry of Civil Affairs & Ministry of Education, China
No.19, Xinjiekouwai Street, Haidian District, Beijing 100875, China
xuwei@bnu.edu.cn
*** Disaster Prevention Research Institute, Kyoto University, Japan
Gokasho, Uji, Kyoto, 611-0011, Japan
kajitani@imdr.dpri.kyoto-u.ac.jp
****Disaster Prevention Research Institute, Kyoto University, Japan
Gokasho, Uji, Kyoto, 611-0011, Japan
n_okada@drs.dpri.kyoto-u.ac.jp

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ABSTRACT

Risk communication is considered as an important step of risk management process. An appropriate risk communication needs holistic learning, facilitation between the information sender and receiver, and trust. The paper proposes a new method of risk communication emphasizing the trust building with the local communities through communicative survey. Applying the method in Nagata elementary school, the paper provides a case example with illustration and analysis on useful communicative survey, and exemplifies the shelter planning (shelter location and residents' assignment) process. The participants' ideas and their opinions are best used to adaptively modify and eventually reach the most appropriate assignment plan. It is argued that the process builds trust in the risk information and enables residents to take decisive actions.

Keyword: Risk communication, Communicative survey, Questionnaire survey

1. Introduction

To protect themselves from natural disaster, people have to make various preparations such as checking risk areas, developing information system, and understanding environmental conditions. After

the Nagasaki Disaster in Japan, in 1982, people were informed about government's activities or possible activities, which were essential for residents' decision making and action. Specifically, the development and distribution of regional hazard maps by the government greatly increased local residents' understanding of disaster information.

For strategic risk management, people should apply management methods and develop appropriate action plans to evaluate vulnerability in the community. A participatory approach is useful for developing good action plans which should include long-term and diversified viewpoints for sustainable community development,. Various stakeholders such as the government, community, research institutes, and individuals should collaboratively develop action plans for disaster risk reduction (DRR) in the community.

A disaster prevention system often has three major internal stakeholders. These include the government, community, and the individual members of the community. Besides these, there are other stakeholders such as the civil society, academe, corporate sector, media and international agencies. The role of the government in disaster prevention is that of formulating and executing the disaster management plan, of comprehensively coordinating, formulating, and promoting the execution of the Basic Disaster Management Plan; and of forming and executing the disaster management operation plan. The community's role includes preparing materials and machineries in the region, and practicing disaster management drills, among others. In addition, individuals should prepare evacuation routes and emergency bags and perform other necessary activities. For sustainable and strategic disaster prevention, people and community have to develop a disaster prevention action plan that includes or covers as much information, opinion, and perspective.

Risk communication is one of support systems of risk management. Fig. 1 shows the basic risk communication framework developed by Kikkawa (1999). On the left is the information sender and on the right is the information receiver. Usually, the information sender is the government, university, or research institution which has much specialized information on disaster prevention. On the other hand, the information receivers are the communities and individuals who have a lot of local information. Risk communication consists of understanding of risk and implementing of risk reduction plans. To make risk communication successful, three elements are necessary namely holistic learning, facilitation, and trust. Communication cannot go smoothly when there is a gap between information sender and receiver. Thus, to reduce gaps, measures should be carried out through both hard measures such as enhancing engineering structures, and soft measures such as disaster education and evacuation training. Soft measures are particularly important for residents. To sustain and save lives, people need to act. Related literature (e.g., Takeuchi *et al.*, 2005 and Kawashima *et al.*, 2006) tried to develop and implement supporting tools for the understanding of risk information. However, information sender should not only try to help local residents understand risk information, but also need to build relationships including trust with community people for successful risk communication. To achieve successful risk communication, trust is the most important element (Hovland and Weiss, 1951). When a risk information sender (e.g. researcher, NPOs/NGOs, and official, among others) is not trusted by risk information receiver (e.g. local people, and local association, among others), risk communication would be difficult to establish. Communicative Survey method can reduce this kind of distrust gap very well (Takeuchi et al., 2007).

This paper firstly addresses the need for a new type of social survey characterized by a two-way communication approach—Communicative Survey method between information sender (or investigator) and information receiver (or responder). Furthermore, the development process and function of risk communication are discussed.

2. Communicative Survey Method

A methodological framework of "Communicative Survey" is proposed here to systematically study the process of risk communication among concerned stakeholders by way of participating in and observing its mutual learning activities. This was first developed by Takeuchi et al (2007 and 2008) to build trust between risk information sender and receiver based on

research activity. Risk information sender tries to collect needs and concerns of risk information receiver by using social survey methods such as questionnaire survey and workshop. In general, it is difficult to obtain minority's opinion through a simple social survey. During a social survey, the generic opinion is obtained through questionnaires [for quantitative survey] and focus group discussion [for qualitative survey]. However, it is difficult to understand the minority opinion, since the statistical analysis mainly gets the majority views. The key point to understand the minority opinion is the time factor, where the researcher needs to understand the community well to draw the opinion of the minority groups. The "Communicative Survey" method can help to collect opinions because of its flexibility due to strong and long-term relationship between researcher and community member. Such information sharing framework is called the "Communicative Survey Method" (Fig. 1). Because of the limitations of interactive mode, there is a need to learn direct and collective communication. This survey method is developed based on the following objectives: (a) to find out the needs and concern of the community; (b) to design questionnaire sheet with community members; (c) to carry out questionnaire survey among local residents; and (d) to organize a workshop. More specifically, the design and operation of the "Communicative Survey" framework adopted in this study is characterized as follows:

i) Members (especially the leaders) of the autonomous council ("Jichi-kai" in Japanese) or voluntary disaster prevention organization ("Jisyu-bousai-kai" in Japanese) are identified as key persons who serve as the bridge for risk communication between risk management specialist and local residents.

ii) Through a long process of continuous survey, feedback and risk communication, the specialist and local residents are expected to mutually share and eventually reach a common understanding of the community's needs.

Through these activities, trust could be established between risk information sender and receiver. Needs and concerns of risk information receivers have been identified by risk information senders through long term and continuous communication. With such long-term communication, DRR capacity will be build.

3. Study Area

Nagata ward, which is located in the west part of Kobe City, has a long and narrow shape. The north

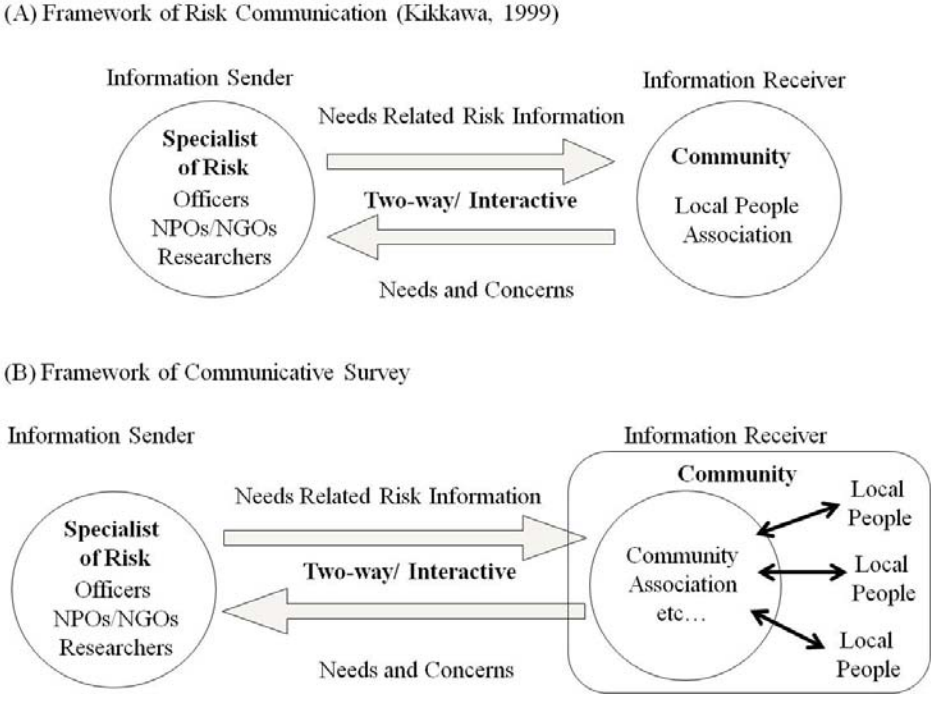

Fig.1: Differences between Risk Communication and Communicative Survey
(Takeuchi *et al.*, 2008)

half of the ward is mountainous while the south half is plain and next to the bay. The west and east sides are surrounded by river. During the 1995 Hanshin-Awaji earthquake, the Nagata Ward area received serious damage when 921 people died and 28,575 houses collapsed. At present, the ward has a population of 101,677 in 48,225 households (Kobe City, 2011). After the Hanshin-Awaji earthquake disaster in 1995, Kobe City established the "Bousai Fukushi Community (Bokomi)", which is a self-organized community association for disaster reduction and social/welfare care in each elementary school. One of the experiences of the Hanshin-Awaji earthquake was that community relationship is very important for community based disaster risk reduction, and these relationships are developed through communities' daily activities. One of the aims of Bokomi is to develop cooperation in DRR and welfare (Yoshikawa, 2005).

The Nagata Elementary School (Nagata ES) community is located in the center of Nagata ward. The Kobe city government designated four schools for evacuation shelter in this area, namely Nagata Elementary School (Nagata ES), Takatoridai Middle School (Takatoridai MS), Nagata High School (Nagata HS), and Miyagawa Elementary School (Miyagawa ES) (Fig.2). A typical school community is a cluster of neighborhood, which includes the housing, nearby roads, school locations, park and parking places. The people living in this area are entitled to register in the neighborhood elementary school [for public schools]. Therefore, school community plays an important role in community DRR and is a good representative element for conducting different DRR activities. Bosai Fukushi Community (Bokomi) of Nagata ES community published hazard maps in 2000 (Fig. 3) and distributed these to each household. The hazard map typically show the hazard [in case of earthquake, it is the probable intensity], locations of evacuation shelters and open spaces, and important lifeline utilities like hospitals. In the Nagata ES community, Bokomi has the role of managing the evacuation center which is critical when disaster happens. A disaster drill and sports event in collaboration with the women's association and other associations were organized in 2006. The Nagata ES community consists of 13 autonomous councils ("Jichi-kai" in Japanese).

After the Hanshin-Awaji earthquake disaster in 1995, several researchers have been assisting the local government and communities in developing a disaster information system. Nagata ES is one of the communities that were assisted through collaboration to develop a simple GIS system to identify vulnerable people (e.g. the elderly who require the assistance during disasters). Through this activity, a relationship based on trust was developed between researcher and community which formed a foundation for the rela-

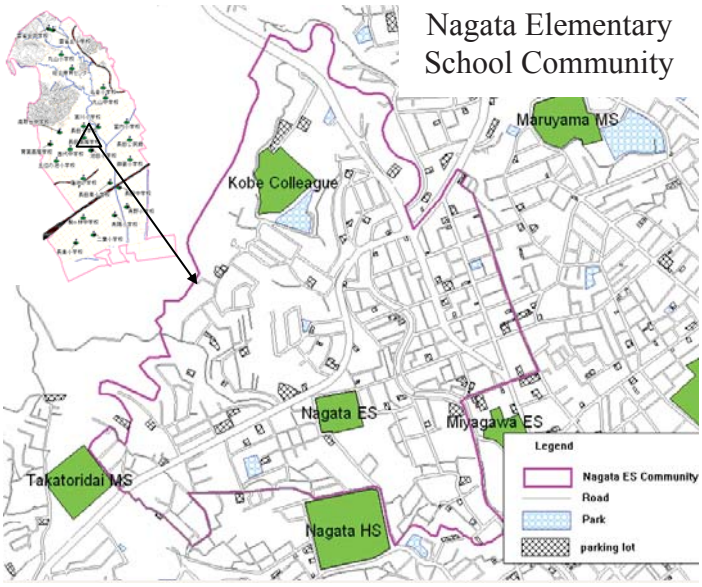

Fig.2: Location of the Nagata ES Community

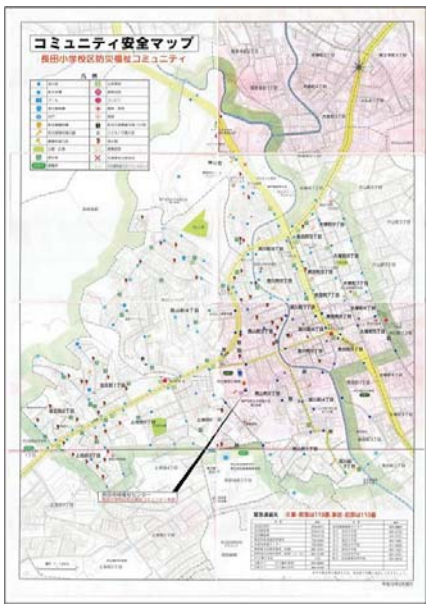

Fig.3: Community Hazard Map of the Nagata ES Community

tively smooth acceptance of the proposed survey by the community.

4. Flow of Communicative Survey in Nagata Elementary School

The Plan-Do-Check-Act (PDCA) cycle is a management method (Aguayo, 1991) which has been used for quality management in many cases. It is a continuous improvement cycle of the actions "Plan", "Do", "Check" and "Act" often used in production management and quality control in industry. This cycle fits well with the evolving perspective of participatory disaster planning and management. Okada (2002) introduced this PDCA cycle into urban risk management tasks which emphasize the diagnosis of the status quo based on the practice of "Check" and "Act" before "Plan". Thus the cycle is also called CAPD cycle in the field of disaster risk management. In practical cases, the cycle starts from "Check" because the community has undertaken certain measures on its own, hence, it makes sense to start from "Check" and link it to the next PDCA cycle.

Bosai Fukushi Community (Bokomi) in Nagata ES community functions as an evacuation management center in times of disaster. Members of the Bokomi realize the challenges of residential evacuation but know that management of evacuation center is important. The hearing survey of Bokomi members finds evacuation issues very evident from the collective community activity at the affected of the Hanshin-Awaji earthquake disaster in 1995 and the post recovery process.

Fig. 4 presents the communicative survey framework at the Nagata ES community. The leaders of Bokomi and Women's Association in the Nagata ES community are identified as key persons who serve as the bridge between researchers and local residents in the questionnaire survey and information distribution.

4.1 Check: Collect and Share Problems and Concerns

First part of this communicative survey is "Check" of the CAPD cycle for problem and concern collection and sharing. The steps are the following:

1. Interview with Bokomi member on the issue of evacuation activity and make questionnaire based on Bokomi member's opinion.
2. Distribute and collect the questionnaire sheets to local people through the Bokomi and women's association.
3. Analyze questionnaire results and make evacuation simulation.
4. Explain to Bokomi and women's association the results of questionnaire and simulation.

A questionnaire survey was carried out in July to August 2006 with the 50 heads of households. The questionnaire included queries as to disaster experience and evacuation experience, disaster shelter planning, evacuation route, hazard map and personal information. A 100% response rate was attained (on the content of shelter planning, the response rate was 90%) with 92% of the respondents having experience in disaster. By reviewing related literature (e.g., Takagi et al., 2006) and interviewing key people in the "Bousai Fukushi Community" with a focus on earthquake disaster shelter and differentiation of temporary shelter (primary shelters) and accommodation shelters (secondary shelters), 17 indicators were obtained such as shelter location safety, evacuation distance, evacuation road condition, lifeline maintenance service, and

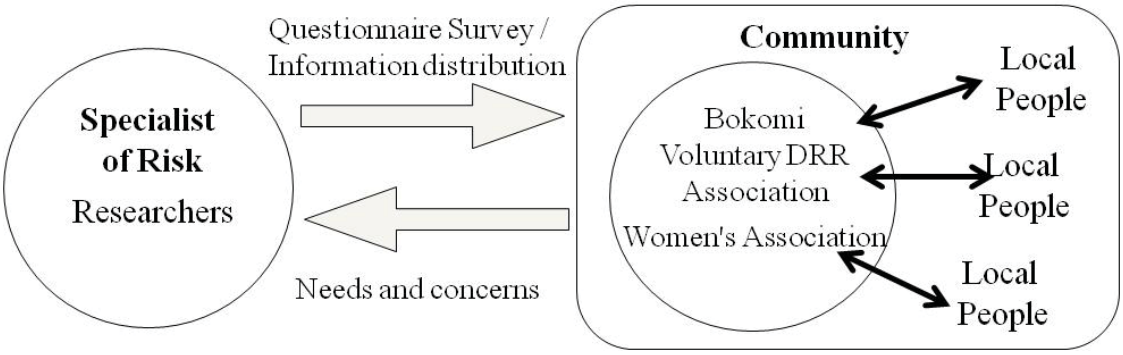

Fig.4: Communicative Survey Framework in the Nagata ES Community

information support, among others. The 17 indicators were grouped into six categories on the following performance criteria: (1) security; (2) stability and continuity of lifeline service (shortened as stability and continuity); (3) accommodation capacity (shortened as capacity); (4) comfortable; (5) accessibility to shelter (shortened as accessibility), and (6) connectivity to external resources and information (shortened as connectivity) according to the work done by Xu et al. (2006, 2007). The six performance criteria for shelter planning may not be inclusive but are considered to represent the main features of shelter planning. Furthermore, the priority issues on disaster srelter planning in all 17 indicators were identified. Taking the example of households with disaster vulnerable members and households without disaster vulnerable members, the weights of criteria were found to vary among households (Fig. 5) (Xu, 2007). It should be noted that Bokomi members feel the aging population issue in this area. On the other hand, the survey tried to find the difference between with or without disaster-vulnerable members. Disaster-vulnerable member here refers to a person who is older than 65 years, younger than 6 years, is handicapped or cannot evacuate to the shelter without assistance.

From the results of questionnaire survey (Fig. 5), the biggest concern of the people regarding evacuation center is accessibility, connectivity and security. There is no obvious difference between the result for normal people and the one for disaster vulnerable members. 48 people (N=50) identified the Nagata Elementally School as evacuation shelter. The Nagata ES Community has four evacuation shelters but most people prefer to evacuate to Nagata ES. From this result, it can be said that there is a high possibility of overcrowding to occur in this evacuation center when a disaster happens. This research, therefore, tried to make simulation focusing on accessibility for visualization of residents' shelter assignments. How to support and whether to support disaster vulnerable member to evacuate are important issues which needs to be further reviewed. These results were reported at a workshop in October 2006 participated by 20 people from the Bokomi and women's association. On this workshop, Bokomi members wanted to know about people's evacuation in more detail. Two issues were cleared during the step of "Check". One is support system of disaster vulnerable people in evacuation and another is how to assign residents to other evacuation center and move them away from the Nagata ES. These issues or concerns drawn from the "Check" step will be further discussed in the next step "Act" of CAPD cycle.

4.2 Action: Discuss about Evacuation with Risk Communication Tool

The Cross Road Game is a discussion tool for DRR. This tool was developed based on interview of the people who experienced the Hanshin-Awaji earthquake (Yamori et al., 2005). The Cross Road Game needs to choose between a Yes or No answer and thereafter, a discussion follows to understand the reasons people choose Yes of No. This game does not

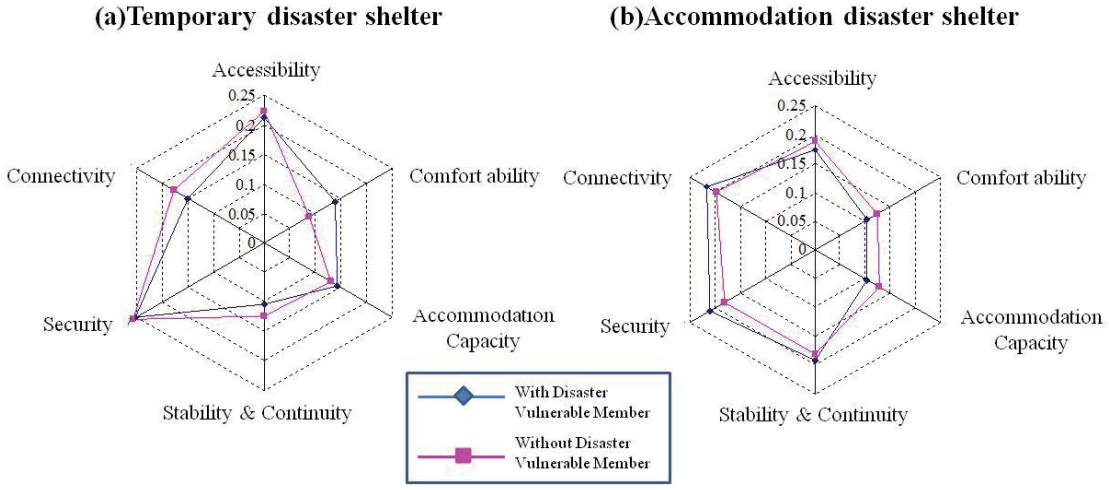

Fig. 5: Weights of Performance Criteria for Evacuation Shelter Planning based on the Questionnaire Survey in the Nagata ES Community (Xu, 2007)

need to obtain a final answer of Yes or No. Rather, people who have the minority voice on either Yes or No can voice out their opinion and reasoning. This provides a basis for discussion of multiple issues. This communicative survey at Nagata ES Community selected this Cross Road Game for discussion and applied it to the Nagata ES Community (Takeuchi et al., 2008).

In 2007 April, a workshop on the Cross Road Game was held in Nagata ES Community. 29 people participated from the Bokomi, women's association and local residents. This workshop looked at three Cross Road items, one from general version of Cross Road Game and two from the Nagata ES version. The first item is from general version on the "pet" issue in evacuation situation. The other two are from the Nagata ES version. They are "Will you help disaster vulnerable people to evacuate when an earthquake happens?" and "Will you evacuate to other shelters if Nagata ES is crowded?" The detailed procedure is shown in Fig. 6. Through this workshop, people shared some detailed situations in evacuation. The following are examples of the opinion gathered during the workshop:

With regards to supporting/helping disaster vulnerable people to evacuate, there were different opinions like:

- If there is disaster vulnerable member in my family, then I will. But it is very difficult.
- During the Hanshin-Awaji earthquake, people cooperated and helped each other. Next time I will do also.
- I do not have the power.
- I will ask for an expert (Bokomi, fire fighter, etc.)
- It is my role. Because I am member of Bokomi.
- Yes, I will. It is a natural thing.
- We do not have relationship and information about those people.

About re-evacuation, the following were some of the opinions:

- I will be in Nagata ES, because I have already discussed with my family.
- Nagata ES is very near to my house.
- I will go to other school if there is space.
- Nagata ES is located in the mountain area and it is difficult to reach. Therefore I will evacuate to another school (shelter).

Opinions like these are important in discussions about community level evacuation plan. For better implementaion of evacuation plan, Bokomi needs to

Fig. 6: Process of Cross Road Game in Nagata ES Community

update the hazard map of the community. From "Action" stage of CAPD cycle, people's detailed opinion about evacuation can be collected. Therefore, the next stage would try to find and re-find community situation in the step of "Plan" in CAPD cycle.

4.3 Plan: Rediscover Community through Town Watching

The aim of "Plan" is to know the community geographical context (e.g. narrow road, high wall, long and steep road, etc.) in making the evacuation plan. Town watching is an effective tool for discovering and rediscovering the community. At the workshop of the Cross Road game, people mentioned detailed community issues and opinions. To understand issues raised in the workshop discussion, Town watching was held in August 2007 participated by 5 people from the Bokomi to show actual how discovering and rediscovering of community is done from a DRR point of view.

4.4 Do: Remake the Community Hazard Map

One crucial aspect of evacuation planning is updating the community hazard map. The Nagata ES Community developed hazard maps in 2000. The hazard map is very important risk information. When updating the hazard map, the results from "Check", "Act" and "Do" of CAPD cycle are incorporated. Hazard maps are considered as a large risk communication output and a result of communicative survey. When the revised version of hazard map is published, community people acquire interest and perception of risk information.

Table 1 describes the activity outline of communicative survey in Nagata ES community. This communicative survey at Nagata ES community is made according to the CAPD cycle. As shown in the

Fig. 7: Town Watching in Nagata ES Community

Table 1: Activity Outline of Communication Survey in Nagata ES Community

Step of CAPD	Tool	Primary Target	Output	Comment
Check	- Questionnaire - Simulation, analysis - Workshop	- Voluntary Disaster Prevention Association (Bokomi) - Women's association	Identify and prioritize issues on temporary disaster shelter and accommodation disaster shelter	Simulation, which was done based on the findings of question -naires, had a direct relation to community perceptions.
Action	- Crossroad game - Workshop	- Voluntary Disaster Prevention Association - Women's Association	Review identified issues on evacuation	Clarification of the reasons behind community opinions of "yes", "no".
Plan	- Town watching	- Voluntary Disaster Prevention Association	Identify and check community simulation related to evacuation	Collective watching and reinforcing of dangerous places in the community related to evacuation.
Do	- Hazard mapping	- Voluntary Disaster Prevention Association	Revisit community and produce updated version of hazard map	Understanding of risk information and importance of hazard map.

table, the tools for "Check" are questionnaires, simulation analysis and workshop; for "Action" these are cross-road game and workshop; for "Plan", it is town watching; and for "Do", it is hazard mapping. The primary targets are mostly voluntary disaster prevention organizations and/or Bokomi (school community) and women association. From "check" of CAPD cycle, two issues were identified. One is supporting system for disaster vulnerable people in evacuation, and second is how to reassign residents to other evacuation center from Nagata ES. From "Action" of CAPD cycle, people's detailed opinions about evacuation could be collected. In "Plan", town watching was done. From this activity, Bokomi members were able to reinforce dangerous places in the community.

5. Discussion and Conclusion

This paper discussed a specific method of risk communication. A collaborative modeling for shelter planning (shelter location and residents' assignment) has been developed based on which a questionnaire survey has been designed and conducted in the Nagata Elementary School Community, with a focus on earthquake disaster. The current administrative residents' assignment plan has been reassessed in the framework of this collaborative modeling. To make an overall assessment of prospective residents' assignment alternatives based on simulation model, workshops and crossroad game were held. The participants' ideas and their opinions are best used to adaptively modify and eventually reach the most appropriate assignment plan. The process builds trust in the risk information and enables residents to take decisive actions.

Trust issue is a challenging problem and difficult to prove with empirical data. However, trust is the key to decision making process in a community. People will listen to the leader only when there is a trust to the leader as well as to the local government. When an external researcher enters the community, the trust building with the local residents is the most important issue to understand the process, challenges and solutions of community activities. The communicative survey tries to attain this trust with longer term involvement with the local leaders and residents, threfore the local information is properly understood and used in risk communication. On the other hand, the information provided by the researchers is usually difficult to understand. Thus, visual tools like simulation, cross road, and town watching are necessary to be used to explain researcher's information to the people and make them understand the results and outputs of the researchers, and imprimenting them into taking actions at the local level.

Community people have relationship and trust in general. Specialist and related stakeholders need to

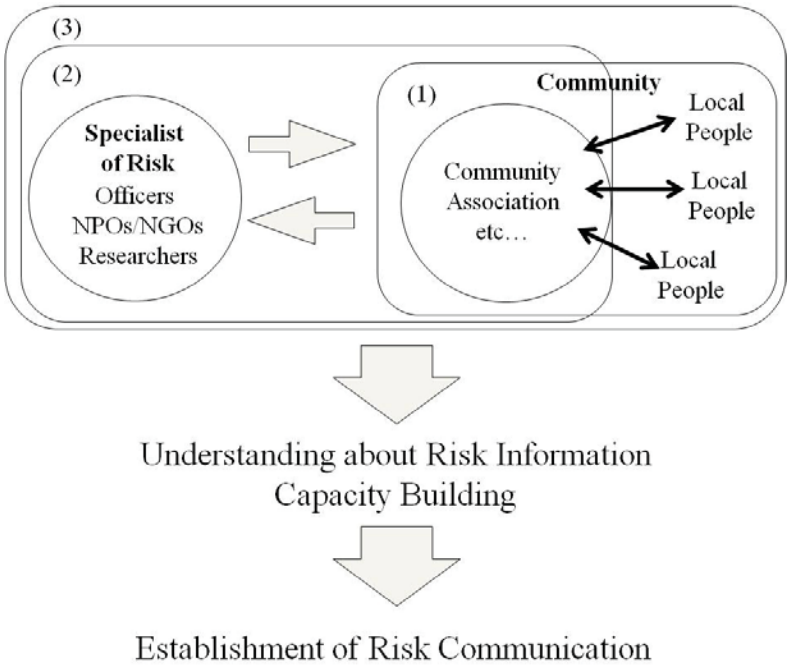

Fig.8: Effectiveness of Communicative Survey

develop this trust with the community, especially on the risk information they are providing. Fig. 8 shows the different steps and processes of the risk communicatiton frame work focusing on this trust. Boxes (1), (2) and (3) denote the sequence of the process, where Box (1) is the community and people trust, which exists naturally; Box (2) is the relation of specialist with community leaders; and Box (3) is the collective involvement of the specialists, community leaders and local residents. This becomes a comprehensive risk communication framework where there are three main outputs: understanding of risk information, building trust on risk information provided and capacity building of the local community leaders. Generally, community people do not have direct relationship with the risk specialist. Therefore, community people feel, at first, that researchers will bring good things. Through communicative survey, however, community people gain an understanding of risk information and community situation. Thereafter, community people decide to take action. Such change and effectiveness are capacity building for DRR.

REFERENCES

Aguayo, R.: Dr. Deming: The American who taught the Japanese about quality, Fireside, 1991.

Hovland, C. and Weiss,W. ：The influence of source credulity on communication effectiveness, 1951

Kawashima, K., Tatano, H., and Hatayama, M.: A flood risk communication support system to promote safe autonomous evacuation, Infrastructure Planning Review, Vol.23, No.2, pp.309-318, 2006 (in Japanese).

Kikkawa, T.: Risk communication: Aiming at mutual understanding and better decision making, Fukumura Press, pp197, 1999 (in Japanese).

Kobe city home page. http://www.city.kobe.lg.jp/ward/kuyakusho/nagata/annai/data.html, 2011

National Research Council, ：Improving risk communication, National Academy Press. Public Opinion Quarterly, Vol. 151, pp. 635-650, 1989

Okada N, 2002. Disaster Mitigative Urban Diagnosis (DiMUDnosis) Viewed as Process of Risk Management, 2nd Japan China Joint EQTAP Meeting on Urban Disaster Risk Management, Beijing, China, 2002.

Okada, N.: Integrated disaster risk management (IDRiM) and governance: a perspective and methodology of enhancing the quality of disaster prevention, International Risk Governance Council (IRGC), Beijing, China, September 21-22, 2005.

Takagi A., Hirozumi N., and Sawada M.: A comprehensive evaluation index for evacuation planning with the characteristics of community and residents, submitted to Journal of Infrastructure Planning Review, 2006 (in Japanese).

Takeuchi, Y., Xu, W., Kajitani, Y. and Okada, N.: Investigating risk communication with “the communicative survey method”, Annuals of Disa. Prev. Rese. Inst., Kyoto Univ., No.50B, p171-176, 2007 (in Japanese).

Takeuchi, Y., Xu, W., Yamori, K, Kajitani, Y. and Okada, N: Investigating Risk Communication with “the Communicative Survey Method” –Using Disaster Prevention Game “Crossroad”- , Journal of Risk Research Japan, Vol.18, No.1, p39-44, 2008 (in Japanese)

Yamori. K, Kikkawa. T, and Amishiro. T,: Risk Communication learn by disaster risk reduction game –Invitation to Cross Road, Nakanishiya Press, pp75, 2005 (in Japanese)

Yoshikawa T, : Established “Bosai Fukushi Community” at 183 elementary school –Issue for continuous and substantiality considerate of community character, Japan Center for Regional Development, No. 188, 2005 (in Japanese)
http://www.chiiki-dukuri-hyakka.or.jp/book/monthly/0502/html/t08.html

Xu W., Okada N., and He C.: Conceptual model of shelter planning based on the Vitae System, Annuals of Disaster Prevention Research Institute, Kyoto University, No.49B, pp.181-188, 2006

Xu W., OKADA. N, TAKEUCHI. Y, and KAJITANI. Y, : A Diagnosis Model for Disaster Shelter Planning from the Viewpoint of Local People—Case Study of Nagata Ward in Kobe City, Hyogo Prefecture, Japan, Annuals of Disaster Prevention Research Institute, Kyoto University, No.50B, p233-239, 2007

Xu W.: Development of a Methodology for Participatory Evacuation Planning and Management: Case Study of Nagata, Kobe. Kyoto University, 2007.