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Community Diagnosis for Sustainable Disaster Preparedness

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ABSTRACT

The paper presents the "community diagnosis" method which addresses the need for sustainable disaster preparedness at the community level with the assistance of disaster experts. To this end, we present the PDCA management cycle and knowledge creation model. Based on these concept models, we introduce and demonstrate community diagnosis as a method of implementing participatory disaster preparedness.

Disaster preparedness is observed as a participatory community management process, where all participating agents are expected to share knowledge. We discuss the type of knowledge required and how it can be better accumulated and used. This process is analyzed by the knowledge creation model. Community diagnosis is proposed as a method for completing this knowledge creation cycle to enhance disaster preparedness. We discuss the first two phases of community diagnosis. The knowledge externalization phase is designed as a diagnostic survey, the questionnaire survey implying the metaphor that "the community's disaster preparedness needs to be checked." The knowledge combination phase is designed as a prescriptive workshop which is held to find a solution (prescription) to enhance the community preparedness by face-to-face communication.

We present an ongoing empirical study of community diagnosis in urban Nagoya. We also discuss the scheme of the participatory process which makes this study unique. From the tentative results of this community diagnosis, externalized local knowledge regarding "repeatability of preparedness" and "scale of a community" is discussed.

1. INTRODUCTION

Japan, one of the most earthquake-prone countries in the world, has developed various techniques for natural disaster risk management. The country encounters new challenges every time it is hit by a disaster. One of the issues raised after the tragedy of the Kobe (Hanshin-Awaji) earthquake in 1995 was family and community preparedness: how individual citizens and local communities can prepare in advance to survive earthquakes.

The purpose of preparedness is to anticipate problems in disasters so that methods can be devised to address the problems effectively and so that the resources required for an effective response are in place beforehand (Mileti, 1999). Although the importance of preparedness is known among disaster scientists, at the policy and practice level, it has not been thoroughly addressed.

After World War II, Japanese disaster prevention policy was oriented towards investment in infrastructure to mitigate disaster damages, as typified by high quality dykes or reinforced highway networks. The policy was helpful in saving many lives and property, but some experts claim that it also made people unaware of and insensitive to disaster risks.

The Kobe earthquake provided an opportunity to remind people about the earthquake risk, and the importance of non-structural proactive countermeasures for disasters. The lesson Kobe earthquake taught people was that the impact of a catastrophic disaster would exceed the capacity of the public rescue services, therefore, citizens should have sufficient knowledge and preparation done instead of depending completely on public services.

Another foreseeable social trend after the Kobe earthquake was that, not only government-led programs, but also many neighborhood communities autonomously started taking proactive countermeasure to enhance their preparedness, eventually leading to improvement of the quality of their living environment. Motivation for such self-help community activities arises from various opportunities: internal discussion of residents, collaboration with different community associations, or stimulation by third-parties. In most cases, autonomous activities take a participatory approach because community-initiated activities cannot be sustained without the participation of multiple agents.

The biggest earthquake threat facing Japan is the Tokai and Tonankai earthquakes. **Figure 1** shows the official announcement of the expected epicenter of the Tokai earthquake and seismic intensity distribution. Geological experts predict that there is a 40-50% probability of this catastrophic earthquake occurring within the next 40 years. This earthquake tends to take place along the Pacific coast from Tokyo through Nagoya to Osaka and further south-westwards, the most densely populated metropolitan regions in Japan. To add to the difficulty, this periodic earthquake with a

KEY WORDS: disaster preparedness, knowledge management, community diagnosis

frequency of 100 to 150 years is a twin or triplet earthquake that is likely to occur concurrently. The magnitude of each earthquake is predicted to be more than 8 on the Richter scale. In collaboration with researchers and local governments, the Japanese Government is now taking a strong initiative in pursuing proactive countermeasures such as infrastructure reinforcement, hazard information disclosure, and raising awareness of the people. Some forward-thinking communities in this region even have started activities to enhance preparedness for these earthquakes.

With the above-stated background in mind, the paper proposes a method of community diagnosis as a scientific instrument for sustainable disaster preparedness at the community level. First, community preparedness is interpreted as sustainable community management and knowledge management. Then how to manage various knowledges using the knowledge creation model is discussed. Based on this, the concept of community diagnosis is reconsidered as a method to manage knowledges. In the second part, an ongoing challenge of community diagnosis is reported as a study of a case station (A base for contentious disaster case study).

2. COMMUNITY PREPAREDNESS

2.1 Management perspective of community preparedness

Disaster preparedness can be deemed sustainable only if knowledge acquisition and appropriate action is continuously repeated until the day a disaster occurs. Thus, it is closely related to the management science term of "sustainable management." To be effective it needs to be managed in an integrated manner by incorporating disaster risk management as a part of sustainable community management. Especially, the strategy for disaster preparedness is contingent on the local community's characteristics and conditions.

The basic management cycle, the PDCA cycle, consists of a repetitive process of Plan-Do-Check-Action (**Fig. 2**). The cycle depicts conventional public planning and management (government-led planning) very well, because when the government is simply the agent leading the process, its goal and problems to be solved are (at least for the government) well-defined and unwavering.

However, in many cases of participatory community management, all the agents (participants) need to share the current status (status-quo) in the community before they start planning. In this case, the process starts with the phase of "Check" and "Action," and then it is completed as the CAPD cycle (Check-Action-Plan-Do). It is shown in **Fig. 2** that this cycle should be effectively repeated in an adaptive manner, with workability of countermeasures and policies being experimentally tested.

If it is assumed that community preparedness by a participatory approach can be interpreted as the CAPD cycle, its management method must have the following function: 1) to help participating agents share the current condition, and 2) to provide a communication platform for disaster preparedness policy.

2.2 Role of knowledge for community preparedness

Preparedness can hardly be sustained unless appropriate knowledge is shared and transferred among the agents. Of course, knowledge may not be effective until being implemented. Therefore, we propose considering "adapting a countermeasure" as a kind of knowledge. In the CAPD cycle, through the phase of "Check,", the agents share a certain kind of knowledge. Let us examine what kind of knowledge is particularly required for disaster preparedness.

The first type of knowledge is hazard information mostly provided by the government. If people do not know the existence of some risk, then there is no motivation to prepare for it. Hazard maps like that shown in **Fig. 1** are a typical methodology to provide hazard information.

The second type of knowledge is know-how information to survive disasters. It may include, for instance, how to reinforce houses, or where to evacuate in an emergency. Such knowledge can be provided by experienced experts or professionals. The presence of this knowledge explains why communities cannot be independent in sustaining disaster preparedness but they require other agents' participation. To some extent, professional knowledge is required to enhance disaster preparedness.

The third type of knowledge that is emphasized in the paper, is local knowledge provided by residents in the community. Local knowledge may include the, semi-private (not public) shelters they have, or their very local evacuation or food storage rules. Their needs, questions and opinions on disaster preparation based on

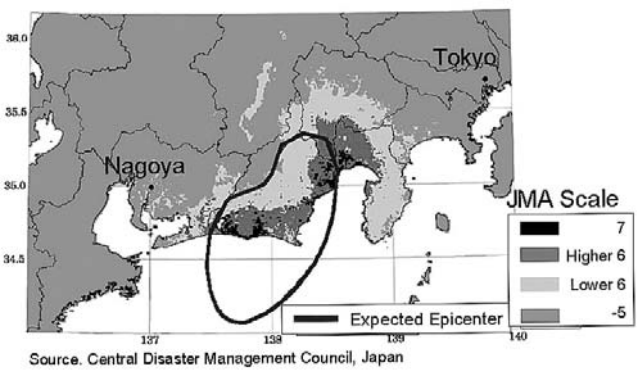

Fig. 1 Expected epicenter and distribution of Japanese seismic intensity of the Tokai earthquake (Central Disaster Prevention Council, 2002)

Fig. 2 PDCA (CAPD) management cycle

their daily lives may well be considered as local knowledge.

Local knowledge is important for community disaster preparedness for the following two reasons. 1) It is hidden in people's daily life, thus it is difficult to share without installing the designated device, and 2) the end-victims of a disaster are none other than community people, and they are eventually responsible for their own survival and saving their property. Therefore, their ideas, their attitudes and their questions should be thoroughly taken into account in the management process. Put another way, it is an advantage of self-help activities to make the most of local knowledge.

Any of these three kinds of knowledge is essential for community preparedness which needs to be shared. However, it is difficult to implement sharing knowledge in a modern society, because community linkage is less connected so that people lose opportunities to form a common platform for communication. This tendency is stronger in urban areas where people have other communities in their workplace or personal interest groups. In addition, usually people are not aware of disaster preparedness in everyday life, and not willing to think about disasters.

Above all, examination from the knowledge aspect states that the management method should be designed 1) to elicit the embedded local knowledge, and 2) to transfer the local knowledge in the community and among the agents.

2.3 Knowledge creation model

The section closely examines managing knowledge to identify the role of the management method. To this end, we will try to introduce the knowledge creation model.

Nonaka and Takeuchi (1995) proposed a theory for examining the organizational knowledge creation. They stated that knowledge creation is a process of knowledge-conversion, which is a spiral process of knowledge "socialization" (tacit knowledge to a new tacit knowledge), "externalization" (tacit knowledge to explicit knowledge), "combination" (explicit knowledge to a new explicit knowledge) and "internalization" (explicit knowledge to tacit knowledge). The process is called the SECI model named after the initials of each phase (**Fig. 3**). Nonaka stated that organizational knowledge is created through a continuous dialogue between tacit and explicit knowledge (Nonaka, 1994).

In the knowledge creation process, *ba* is another essential and fundamental concept. As a brief explanation of *ba*, Nonaka and Konno (1998) explain it as follows. "*Ba* can be thought of as a shared space for emerging relationships. This space can be physical (e.g., office, dispersed business space), virtual (e.g., e-mail, teleconference), mental (e.g., shared experiences, ideas, ideals), or any combination of them. What differentiates *ba* from ordinary human interaction is the concept of knowledge creation. *Ba* provides a communication platform for advancing individual and/or collective knowledge." In the SECI model, *Ba* makes knowledge conversion possible.

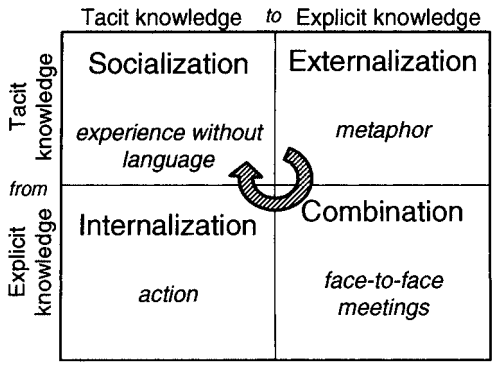

Fig. 3 SECI model (Nonaka, 1994)

Originally, the knowledge creation process model and the concept of *ba* were developed for enterprise management, but recently they have been adapted to public domain issues (Nonaka et. al., 2003) as a fundamental model for knowledge management. In line with this philosophy, here we apply the model to community preparedness for disasters.

The SECI model explains that quantitative and qualitative knowledge conversion is accelerated when appropriate *ba* is provided.

In Section 2.2 we stated that a desirable method can elicit embedded local knowledge, and transfer it to other agents. When we consider the process along with the SECI model, eliciting local knowledge corresponds to knowledge externalization and transferring it corresponds to knowledge combination. That is to say, providing *ba* coincides with the management method.

The SECI model determines knowledge conversion facilitators working in each *ba*. As shown in **Fig. 3**, "a metaphor can play an important role in externalization." When knowledge without language is changed to documented knowledge, only the concrete concept which has the same embedded structure (which means a metaphor) can play this role. It helps people convert their tacit knowledge to words. In the combination phase, a "face-to-face meeting is the efficient way of creating different explicit knowledge from other knowledge." To combine knowledge, connect externalized knowledge, opportunities to share opinions and information directly.

3. COMMUNITY DIAGNOSIS

3.1 Definition

Okada et al. (2001) introduced "community diagnosis" as a tool to externalize tacit knowledge (including ideas, opinions and attitudes) about common space related social problems.

According to Okada (2006), characteristically community diagnosis is designed analogous to a liberal, sound relationship between medical doctors (corresponding to disaster and urban experts) and patients (corresponding to local citizens). Moreover, it is intended to explicitly indicate that the methodology has its foundation in the vision that cities, regions and communities are living body systems, not mechanistic bodies as conventionally treated.

The specific procedure can be interpreted depending on the contexts. We will establish the following two steps: the diagnostic survey and the prescriptive workshop. The details of these contents are explained in the next chapter.

3.2 Community diagnosis as a management method

In the previous chapter, we summarized the conditions of the management method for sustainable community management.

Table 1. Community diagnosis and as a management method

Community diagnosis	Diagnostic survey	Prescriptive Workshop	*Treatment*	*Implementation*
PDCA management process	Check	Action	*Plan*	*Do*
Local knowledge creation phase	Externalization	Combination	*Internalization*	*Socialization*
Knowledge conversion facilitator working in ba	Metaphor (diagnostic survey)	Face-to-face (prescriptive meeting)	*Action*	*Experience without language*

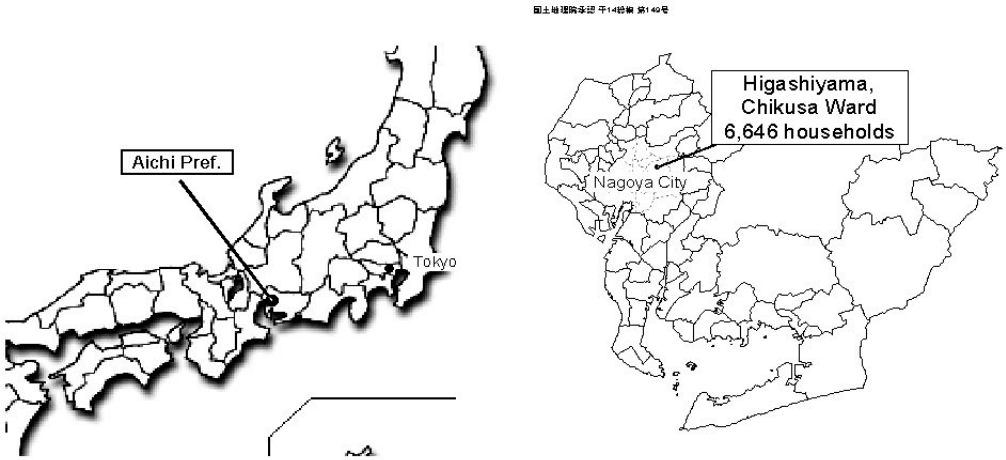

Fig. 4 The location of the Higashiyama area

Section 2.1 stated the requirement from the community management perspective. Section 2.2 stated the conditions from the knowledge management perspective. Based on these, in Section 2.3 we showed that providing *ba* corresponds to employing the management method. In the previous section, we introduced the idea of community diagnosis.

Here, let us assume community diagnosis is the management method providing *ba*. **Table 1** shows the relationship between community diagnosis and the management cycle, local knowledge creation phase and knowledge conversion facilitator working in *ba*. We established two phases in community diagnosis: diagnostic survey and prescriptive meeting.

Diagnostic survey checks the status-quo, and externalizes hidden local knowledge. In this phase, we note that the name "diagnostic survey" itself has a special meaning because it is positioned in the entry of "metaphor" in the SECI model. For externalization, the metaphor of the patient-doctor relationship as indicated by "diagnosis" helps us illustrate the characteristics of our scientific approach.

Prescriptive meeting provides *ba* of a face-to-face meeting in order to 1) share the survey results by the agents and 2) to combine the elicited local knowledge. It also plays the role of providing a community with a solution (prescription) to enhance the preparedness.

The terms of the last two phases, *treatment* and *improvement of living* are derived from the last two phases. In line with the flow of community preparedness, these two will play an important role in community diagnosis. However, these two phases are not dealt with in this paper.

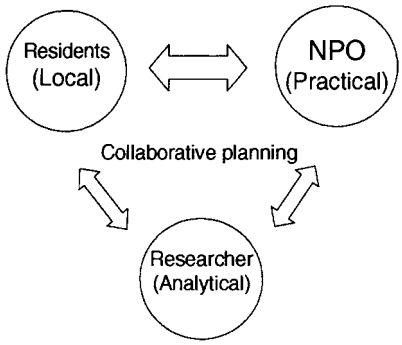

Fig. 5 Collaborative planning of Higashiyama

4. STUDY OF A CASE STATION: HIGASHIYAMA, NAGOYA, JAPAN

4.1 A Case station

The Higashiyama elementary school area (hereinafter called Higashiyama) is located uptown of eastern Nagoya (**Fig. 4**). It is an urban residential area consisting of traditional houses, new con-

Table 2. List of questions and seven categories

Self-evaluation Category	Self-evaluation Questions / Preparedness Index Questions (3- or 4-point Likert scale)	Preparedness Index (average score over each category adjusted to scale of ten)
	1 How much do your family prepare for earthquakes on a scale of ten?	
	2 How much do your community prepare for earthquakes on a scale of ten?	
Housing Safety	3 Do you think your house will be damaged by an big earthquake (larger than JMA scale 6)?	/10
	4 Do you know about geological layers around your house?	
	5 Have you had your house checked for earthquake-proof?	
	6 Have you reinforced your house?	
	7 Did you secured your furniture to wall?	
	8 Do you think buildings in your community are reinforced well?	
Storage	9 Do you prepare an emergency kit?	/10
	10 Do you examine the contents of your emergency kit?	
	11 Is your emergency kit placed where you can easily access?	
	12 Do you have emergency stock other than emergency kit?	
	13 Do you think your stock is sufficient?	
	14 Does your community store emergency supplies?	
Shelter	15 Do you know your designated shelter nearby?	/10
	16 Do you know a rout to the shelter?	
	17 Is there obstacle on the route to the shelter?	
	18 Do you think you call for your neighbors when you evacuate?	
	19 Do you know in what condition a shelter is provided?	
	20 Do you know about management of shelters?	
Special Support	21 Do you know what kind of people need special care in case of emergency?	/10
	22 Do you know that many of dead and injured are elderly people?	
	23 In your family is there anyone who has difficulty in evacuation by him/herself?	
	24 Do you know where elderly or handicapped people and infants live in your community?	
	25 Do you know how to guide hearing- or sight-impaired people?	
	26 Do you know what kind of support the elderly, handicapped and infants need?	
Community linkage	27 Do you participate in community disaster preparedness activities?	/10
	28 Do you think residents in your community are aware of earthquakes?	
	29 Do you think your neighbors can rescue each other in case of emergency?	
	30 Does your community have a reliable person for disaster preparedness?	
	31 Do you talk about disaster preparedness in your community?	
	32 Do you have anyone who can consult with about disaster preparedness?	
	33 Do you have communication with your neighbors?	
	34 Do you think enterprises in your community are helpful in case of emergency?	
Fire	35 Do you know how to treat with a fire extinguisher?	/10
	36 Do you prepare a fire extinguisher in your house?	
	37 Do you know where fire extinguisher and fire hydrants in your neighborhood?	
	38 Have you treated a fire hydrant or fire hose?	
	39 Do you know the word "initial fire fighting"?	
	40 Are houses located close together in your community?	
	41 Can fire engines access to any streets in your community?	
	42 Do you see illegal parking in your community often?	
Emergency contact	43 Do you discuss emergency contacts with your family?	/10
	44 Do you know about emergency message dial service "171"?	
	45 Do you know about i-mode emergency message board?	

dominiums and apartments for single people. The community has 6,646 households (as of 2004) over an area of 1.5 km^2, divided into 24 smaller community units (citizens' association, or *chonai-kai*). In the urban areas of Japan, an elementary school area (*gakku*) is traditionally the second smallest community unit followed by citizens' associations.

A non-governmental organization for disaster prevention, Rescue Stockyard (RSY) has an office in the area. Since RSY is on good terms with community representatives, they have organized disaster preparedness activities such as lectures and furniture nailing campaigns for two years since 2002.

As Community Representatives and the RSY have committed themselves to community based activities, there was no opportunity for them to learn of residents' attitudes and behavior towards Tokai and Tonankai earthquake risks. Our group selected Higashiyama as a case station (long-term observation target for disaster science) (Okada and Gopalakrishnan, 2004) for the community diagnosis. To investigate the questions of these three parties, we agreed to conduct a diagnostic survey in this area.

4.2 Study outline

(1) Uniqueness of the Higashiyama case

In the previous chapter, we stated that the community cannot drive forward the management cycle by themselves but they require experts' help. However, we did not mention who should organize community diagnosis. It could be researchers, or it could be a local government. The uniqueness of the case of Higashiyama is that the management is implemented as collaborative planning of the three agents of authors' group (researchers), RSY (practical expert) and community representatives (residents) as shown in **Fig. 5**.

In particular, at every step of the program, the three agents collaborate by gathering and pooling their knowledge. In designing the survey, our group developed the survey based on the ideas and the past experience of RSY. The survey was conducted in the name of the community representative, with the cooperation of RSY.

In the prescriptive meeting, the combined knowledge (prescription) was expressed by the community, and analyzed by our group.

Higashiyama's model was made available because of a unique encounter of the three agents. Although admitting further verification is required to expand the model as a general community diagnosis model, we investigated the case as one of the new challenges to meet our research purpose.

(2) Designing the diagnostic survey

As explained in the previous chapter, the diagnostic survey corresponds to knowledge explanation and the prescriptive meeting to knowledge combination. In the following sections, we explain the details of these two programs in Higashiyama.

The list of questions for the diagnostic survey is shown in **Table 2**. The survey questions consist of two parts. The self-evaluation part asks a respondent to evaluate their self and community preparedness for an earthquake on a scale of 1 to 10.

The following 43 questions (No.3 to 45) are regarding behavior, present state, and attitude of earthquake preparedness, provided by the three- or four-point Likert scale. The set of questions covers both family and community preparedness. The source of the questions is a list of "anxieties" raised by past participants in the workshops organized by RSY. The questions are divided into seven categories: *Housing safety, Storage, Shelter, Special support* (the elderly, handicapped and infants), *Community linkage, Fire* and *Emergency contact.*

(3) Community Preparedness Index (CPI)

The Community Preparedness Index (CPI) is derived from the survey responses. CPI is calculated for each category to show the community's level of preparedness. A lower CPI mean less prepared in the category, that is, the community is vulnerable to earthquake risk. The index is a source to feedback the survey results to the residents.

The response for each question is converted to a score. 3-point scale questions are scored 1, 5 or 10, and 4-point questions are scored 1, 5, 7 or 10 depending on the respondent's choice. CPI is defined as the mean score of the questions in a category over all respondents in a community (Okada and Matsuda, 2005). Therefore, all CPIs are shown in the numbers normalized to a scale of 10.

(4) Conducting the diagnostic survey (Knowledge externalization)

The survey sheets were distributed to all 6,646 households through the community association in December 2004. Valid responses totaled 3,613 (response rate 54.4%). For the purpose of regional comparison, the same diagnostic survey was conducted in "A" Town and "K" Town in Aichi Prefecture. Both of the towns are suburban areas of Nagoya City, where the population consists of both commuters to Nagoya and agricultural workers. Note that in these two towns, the surveys were conducted during the workshop so the samples are biased. **Table 3** shows the survey facts.

(5) Distributing a leaflet and organizing the prescriptive meeting (Knowledge combination)

After the survey, a 4-page leaflet with a survey summary and comments from academic experts were distributed to all the households in the community (**Fig. 6**).

In April 2004, the prescriptive meeting was co-organized by the community representatives and RSY. The purpose of the workshop was 1) to understand Higashiyama's CPI and survey

Table 3. Survey period and the number of valid responses

Survey Area	Survey Period	Valid Response
Higashiyama	Dec. 2004	3613
A Town	Nov. 2004	1155
K Town	Jan. 2005	184

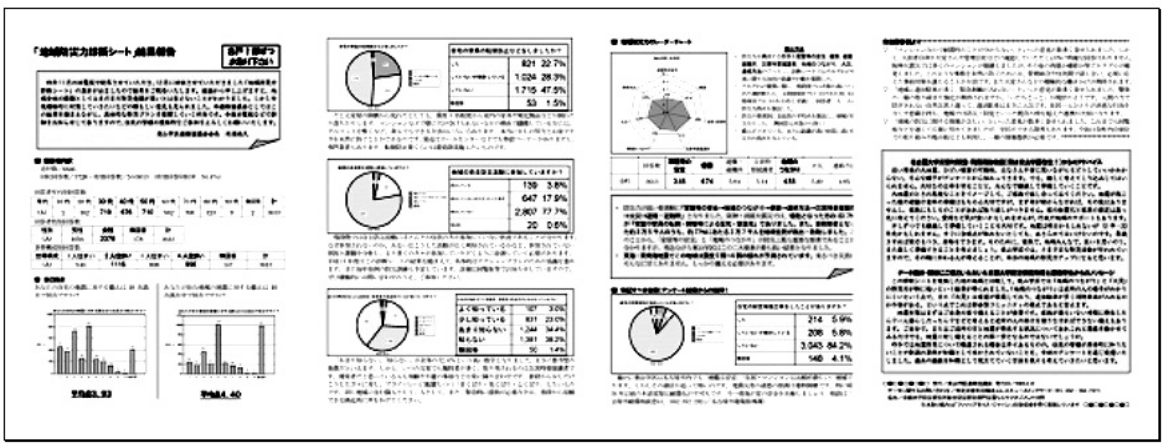

Fig. 6 Leaflet for households with survey results summary

Table 4. Community Preparedness Index

	Housing safety	Storage	Shelter	Special Support	Community Linkage	Fire	Emergency Contact
Higashiyama	3.45	4.74	5.94	5.14	** 4.55	** 5.20	4.95
A Town	3.35	** 4.31	5.95	5.16	5.03	6.21	** 4.57
K Town	3.46	4.86	++ 6.35	5.33	5.38	6.63	5.03

**: the mean score (CPI) is significantly lower ($P < .05$) than that of the other two areas.
++: the mean score (CPI) is significantly higher ($P < .05$) than that of the other two areas.

Fig. 7 CPI (A Town, Higashiyama, K Town)

results, and 2) to collect participants' ideas (prescriptions) to improve Higashiyama's CPI. 24 residents including community association representatives participated in the workshop. The program consisted of 3 parts, instruction by the RSY representative, explanation of the survey results including CPI by our group, and group discussion for expressing ideas.

4.3 The diagnostic survey results

(1) Regional comparison

Table 4 shows the CPIs in the three survey areas. Looking at Higashiyama's score, the table shows the lowest category is *housing safety* (3.45), followed by *community linkage* (4.55). In A and K Towns, the same as Higashiyama's result, the score of *housing safety* was the lowest (A Town: 3.35, K Town: 3.46), while the second lowest category was *storage*, (A Town: 4.31, K Town: 4.86) instead of *community linkage.*

To compare CPI between Higashiyama and the other two areas, a two-sample *t*-test was conducted. The two-sample *t*-test can detect the difference between the mean values of two different populations. Here, every pair of CPI score (mean value over the area) in the same category (3 pair in each category) was tested. For Higashiyama's score, the *fire* and *community linkage* scores were significantly lower than those of either two towns.

For visualization of the result, the radar charts of CPI are provided for every area (**Fig. 7**). Comparison of the figures helps residents understand the above result that Higashiyama is vulnerable in the category of *fire* and *community linkage.*

(2) Distribution of individual residents in the community

Figure 8 is a scatter chart showing the individual distribution of the personal Preparedness Index (PI) and self-evaluated score (*SES*) for community preparedness. A group of individuals located

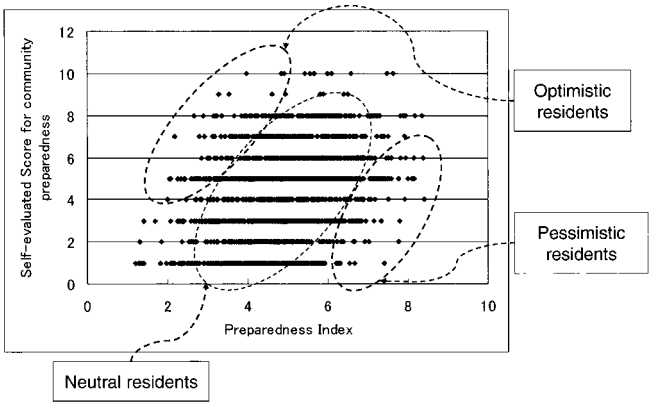

Fig. 8 Individual distribution (community preparedness)

left above seems optimistic because their self-evaluation is relatively high compared to their low CPI. On the contrary, those who are located right below could be comparatively pessimistic. Based on such criteria, the population is divided as follows.

Optimistic group (347 households) $(SES) - (PI) \geq 2$

Pessimistic group (376 households) $1 \geq (SES) - (PI) \geq -1$

Neutral group (1,903 households) $-2 \geq (SES) - (PI)$

This fact implies that researchers should not discuss the community using representative values for all households, but should conduct additional analysis with clear objectives. It is important for community based mitigation activity to treat a community as an aggregation of various households.

(3) Findings

The survey results show that (1) the vulnerable category for Higashiyama is specified by statistical regional comparison, and (2) the community is heterogeneous so that analysis with detailed focus is essential.

4.4 The outcome from the prescriptive workshop

(1) Collected combined knowledge

During the prescriptive workshop, participants were asked to list up "ideas and opinions to enhance Higashiyama's earthquake preparedness" and 24 participants listed up the 143 ideas shown in **Table 5** by category.

(2) Findings

An examination of combined knowledge revealed two remarkable findings. Here these are explained with some representative examples of collected knowledge.

First, it is obvious that the participants already understand the importance of "sustainability" for disaster preparedness.

- (Storage) Let us know repeatedly to encourage personal storage.
- (Others) We have a vague consciousness of a disaster. But we need to be stimulated by posters and other printed materials to be made constantly aware of it.

The keywords such as "repeatedly" and "made constantly aware of" in the above examples indicate that they are aware of the importance of repetitive actions and continuous signals in daily life. This finding also implies that community people realize that disaster preparedness is an issue with low priority in their life and is easily forgotten.

The second finding is that participants' cognitive unit for "community" is much smaller than the elementary school area, which was initially defined as the community by us and RSY.

- (Shelter) It is not possible for all of us to be sheltered in the school (Officially designated shelter). It's better to have an unofficial place for evacuation in our neighborhood.
- (Shelter) We asked a neighboring church to open as a shelter in an emergency to the over-80s, and the injured handicapped.
- First is ensuring myself and my family's safety. Second is the safety of my neighbors. Community's linkage is an important factor that needs to be maintained for such a purpose.

For example, their needs for unofficial shelter in their own neighborhood arise from their actual feeling that the official shelter (Higashiyama elementary school) is still too far for some people.

Not only geographically, but the spatial unit of community for disaster preparedness raises another question. Higashiyama is the aggregation of more than 7,000 households, and the community board its 24 citizens' associations. Each association has about 100 to 500 households. At first, the RSY and the community board intended to disseminate preparedness actions through the existing citizens' associations. Through the discussions, it is found that citizens' association is far too big organization for community unit for disaster preparedness.

From the participants, concrete proposals were also listed:

- How about making an evacuation map in collaboration with the club for the elderly?
- I heard the blast of a siren the other day, but I couldn't understand what it meant. I want a recorded tape to learn it.

These findings, the importance of repeatability and the cognitive unit of the community are newly created (combined) knowledge, being the key to preparedness measurement both for the community and RSY. Based on the findings, the community board decided to provide a short video tape as learning and discussion material in the smaller units within the neighborhood. In the context of community diagnosis, this resolution will be a curing action for the community. We intend to continue to monitor and analyze the process in the Higashiyama area.

Table 5. Number of ideas listed in the workshop

Category	Number of respondents	Number of Ideas
Housing Safety	15	16
Storage	14	14
Shelter	11	11
Special Support	11	11
Community linkage	17	20
Fire	15	15
Emergency contact	15	15
Others	19	41
Total	---	143

5. CONCLUSION

The paper discussed the ongoing research of community diagnosis for disaster preparedness. In the first part of the paper, the knowledge creation process with the SECI model wasis introduced to explain sustainable community-based disaster preparedness. Then, the concept of community diagnosis was explained.

In the following part, an observed study of Higashiyama in Nagoya was discussed from which certain findings were obtained from the diagnostic survey and the prescriptive workshop. The survey revealed that (1) the scored vulnerabilities of the community are specified by the regional comparison, and (2) the community's population is heterogeneous. From the workshop as knowledge combination phase, the diagnostic survey revealed the new findings of the importance of repeatability and focus on the smaller unit.

Our research problem was how communities can be managed to sustain preparedness for disasters. For such a problem for which even experts cannot provide an answer, we tried to conduct the study in an adaptive manner: repeating verification of a presented model on site and its adjustment in the laboratory. Admitting it is only verified under limited conditions and further examination is required, the proposed model contributes to implementing sustainable community preparedness.

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