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Local Safety Map for a Cornerstone of Local Disaster Prevention: A Case Study of a Historical Local Town in Japan

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Abstract: This paper examines the requirements for creating a local safe map, which is the core of regional disaster prevention, through a case study in a historical local city in Japan. Amid the rising awareness of disaster prevention, efforts are being made in various places to voluntarily create disaster prevention maps through town walks. It is expected to improve residents' awareness of disaster prevention, improve local disaster prevention capabilities, and revitalize local communities. What are the requirements for a local safety map creation to continue to play a central role in regional disaster prevention rather than being a temporary event? Based on our past experiences, we review our research activity what is necessary to make such map-making the core of regional disaster prevention. The following is findings through our experience in the map-making activities. Sustainable development is possible by making it a regular activity in the district rather than a one-off event. Sharing of subjective information in cooperation with the disaster prevention division leads to improve reliability of information by consensus with the members and revitalization of activities through workshops. it is also necessary to select media that provide information from the user's perspective.

Keywords: local disaster prevention, safety map, voluntary disaster prevention, historical local town, community participation

1. Introduction

In response to the occurrence of natural disasters such as earthquakes and heavy rains, hazard maps that expresses disaster risks are attracting attention(ICTDSE2021 in ICCE2021, Japan Tourism Agency,2022). Hazard maps are used for disaster preparedness and evacuation behavior. In addition to these hazard maps, voluntary disaster prevention maps are also actively being worked on (Mitsuhara, H., 2018; Yoshino, T., et al., 2017). By walking around one's own town and researching it, information on possible hazards in the area is gathered, and the information is used to improve each person's awareness of disaster prevention and evacuation behavior (Enokida, S., et al., 2018). In particular, in areas where historical townscapes have been preserved (Japan Guide.com, 2012), it is difficult to respond to disasters through road improvements and rebuilding. Therefore, it is desirable to highlight and share the dangers that local residents feel in their daily lives from the perspective of local residents (Mishima, N., et.al, 2014).

We have selected Hizen-Hamashuku, Kashima City, Saga Prefecture, which still retains the townscape of the Edo period (Agency for Cultural Affairs, 2017; Saga Trip Genius, 2014), as a model area, and have been working with local voluntary disaster prevention organizations to support the creation of local safety maps using ICT (Okazaki, Y. et al., 2016; 2017; 2018; 2019; 2020;2021). There are two national Important Preservation Districts for Groups of Traditional Buildings here. The government continues to implement measures based on past disasters, such as installing sprinklers in thatched houses, installing fire hydrants in areas where wooden houses are densely built, and repairing the river that flows

through the center of the district. In addition, active disaster prevention activities have been carried out through collaboration among residents through voluntary disaster prevention organizations.

In this study, we examine what is necessary for a local safety map to continue to play a central role in regional disaster prevention. From the perspective of (1)Revitalization of voluntary disaster prevention organizations through efforts to create local safety maps, (2)the relationship with the official hazard map and (3)Information provision media from the perspective of residents, we examine the mechanism for continuing to work as an activity that contributes to the safety and security of the region, not limited to natural disasters, and present future issues.

2. History of our research activities

Our activities over the past seven years can be divided into four phases (Table 1).

Table 1. History of our community-based disaster prevention activities using ICT

Phase 1	2015-2017	Map creation
Collecting information by walking around the town + Summarizing as a map Local danger information sharing (Limited to those involved) (Okazaki, Y. et al., 2016; 2017; 2018)		
Phase 2	2018-2021	Map improvement
Review of information presented through workshops and meeting Update information, reconsider display methods and media Review of information by local residents (Okazaki, Y. et al., 2019; 2020;2021)		
Phase 3	2022	Expansion of target area
Expand area and update information Expansion and improvement of information		
Phase 4	2023	Expansion of target people (plan)
Update and review information for distribution to all households Local danger information sharing (Everyone in the community)		

In Phase 1, we developed a hazard map creation support system with the aim of collecting specific local information and centrally managing and visualizing it. We realized information gathering by voluntary disaster prevention officers walking around town, centralized management of information using a server, and information visualization.

In Phase 2, we verified the collected information and improved the local safety map. We examined the type of information to be presented, the presentation method, and the media to be presented to improve the visibility and reliability of the local safety map.

In Phase 3, the target area was expanded to the entire Hizenhama district. Participation from districts that had not participated in the past was also made, and further information was added and updated to enhance the map. As a result, we were able to create a foundation for a relief map for the entire district.

In Phase 4, we aim to distribute the map to all households in the district, and we are proceeding with work toward completion of the map as a training session for voluntary disaster prevention. Figure 1 shows the latest version of the map.

Through the ongoing implementation of these community activities, we analyze the impact and challenges of creating the local safety map on community activities.

3. Continuous map making activities for safe community

3.1 Revitalization of local community activities

Since before 2015, when this activity began, firefighting drills and meetings of voluntary disaster prevention officers have been carried out by local voluntary disaster prevention organizations. At the meeting, risk information was exchanged between the officers of each district, but it was an oral exchange of opinions, and it was not enough to confirm the scattered danger information of areas.

Figure 1. The local safety map(January 2023 edition).

Therefore, first of all, efforts were made to collect and visualize the danger information of these areas. We developed a system using an iPad, and were able to collect information efficiently through city walks by district voluntary disaster prevention officers (Okazaki, Y. et al., 2016). By using an information collection system, it is possible to collect data, including photographs, in a predetermined format immediately on the spot, and by saving that data on a server, centralized management of data is possible (Okazaki, Y. et al., 2017).

In order to verify the collected data, a workshop was held as a training session for voluntary disaster prevention. It was an opportunity to reconsider the whole area by aggregating the scattered danger information of the areas. Participating in the workshop gave the participants new realizations, and it was a good opportunity for them to update their own local danger information (Okazaki, Y. et al., 2018).

3.2 Relationship with the disaster prevention division and hazard maps

The local safety map is an extension of the Voluntary Disaster Prevention Map. The information is based on the subjectivity of the residents, and may not have sufficient scientific basis. There is also the possibility of overlooking invisible dangers. From this point of view, it is important to cooperate with the disaster prevention division in government agencies.

In our activities, city officials in charge of disaster prevention participate in town walks and information review workshops, so that information on map creation as a voluntary disaster prevention activity of the district is conveyed to the administrative side. In addition, we sent the created map to the disaster prevention division of the city which is in charge of creating the

hazard map in the area, and receive feedback on evaluation comments, which we use to make improvements. In addition, in March 2021, we conducted an interview survey with the staff of the disaster prevention division and evaluated the contribution to the safety and security of local residents by various hazard maps provided by the city and this local safety map (Okazaki, Y. et al., 2021).

3.3 Paper media or digital devices

The choice of media for providing information should be carefully considered, taking into account the circumstances of use and the characteristics of each media. We have developed and put into practice a local safety map creation support system using an iPad. Its effectiveness was demonstrated through information gathering through town walks and information sharing and verification through workshops by members of voluntary disaster prevention organizations (Okazaki, Y. et al., 2019).

It was shown that it is possible to operate with a tablet that is not usually used, and we thought that we could proceed with the creation of a local safety map using a digital map. However, there was an opinion that conventional paper maps would be preferable considering the use of maps in addition to resistance to putting local information, especially information related to crime prevention, online. Therefore, we have explored two directions: digital maps and paper maps (Okazaki, Y. et al., 2020). In terms of data management of digital maps and paper maps, we created the map using an electronic map Zi20 by ZENRIN CO., LTD. A problem was found in the size and detail of the map.

Assuming use on the Internet, we also tried porting to the map service "Locamo Share" by Locamo AI. However, integration with paper maps was difficult, and there were two independent maps, which left challenges in data management. In response to the request from a voluntary disaster prevention organization to distribute a paper map to households so that it can be used widely, the paper map will be prioritized first (Okazaki, Y. et al., 2021).

4. Discussion

In this section, we discuss the revitalization of the activities mentioned in 3.1 and the relationship with the disaster prevention division mentioned in 3.2 from the viewpoint of information aggregation and sharing of subjective information, as well as the information provision media.

4.1 Effects and Issues of Map Creation Based on Subjective Information

We have created a community-based voluntary disaster prevention map that complements government hazard maps by aggregating the subjective information of local residents. In addition, we have held workshops using the map and have been working on the safety and security of the district. Surrounding the map on which the specific information that they had collected led to more lively discussions than ever before, and information about the district was widely shared. It is thought that the activities were activated by visualizing information, sharing information, and working together on the map.

On the other hand, problems caused by subjective information became clear. Information from walking around town is subjective information, and lacks objective scientific grounds. Cooperation with the government is necessary to ensure the quality of information. This cooperation is significant for the administration as it provides an opportunity to learn about the awareness of residents. In addition, as circumstances change, it becomes necessary to update the map. Besides that, requests for map corrections from residents continued. The factors are classified into subjective gaps and individual fluctuations. In the former, since the subjective view differs from person to person, the point and the range of dangerousness may differ from person to person. In the latter, even those who have participated in the activity so far are requested to correct existing information and add or delete

new information in the middle of the activity. This is thought to be due to the fact that individual perceptions have changed as a result of repeated examination of information.

In any case, instead of reflecting the opinion of one individual on the map as it is, we have been discussing in groups and incorporating information that has been agreed upon. Continuing these activities will promote the sharing of information that has reached a consensus within the community, and we believe that once a certain amount of information is shared, there will be fewer changes in information due to differences in subjectivity. At this stage, we believe that by distributing the map to the entire district, we can play a role as a relief map that contributes to the safety and security of the entire district.

4.2 Map providing media

We have been making a local safety map by local residents using the safe map making support system. The map creation support system centrally manages information on a server, and has the advantage of being able to visualize information on terminals, which actually contributed to workshops using iPads. Compared to the usual gatherings and oral information exchanges, active exchanges of opinions took place while looking at the iPad screens. On the other hand, problems due to digitization have also become apparent.

The advantage of digital maps is that information is easy to manage, and it is possible to search and select the information to be presented, and it is possible to present a variety of information as needed. However, it was pointed out that the lack of a bird's eye view of the whole and the usability issue that it cannot be viewed unless it is started on the device are disadvantages. These disadvantages have a large impact due to the nature of the local safety map. Also, the workshop was conducted using both an iPad and a paper map, but the paper map was easier to implement. This is thought to be due to the direct operation feeling of pasting sticky notes and the bird's-eye view, which gives a real feeling of working.

Also, the quality of the paper map is an element that needs attention. The map offered by ZENRIN CO., LTD. describes the shape of each house. Also, the trails are accurately marked. When compared with other free maps, some commented that there was a clear difference in terms of the clarity of visuals. It can be said that accurate description of the details of familiar areas is an important factor in gaining the trust of local residents.

Our work demonstrates that the premise that it should be digital may not work. In order to solve the issues of bird's-eye view and visibility, a new fusion of paper and digital is required. Electronic paper exists as a means to solve the problem of bird's-eye view digitally, but at present it is expensive and it is not realistic to post it casually like paper.

5. Summary and future works

In this study, we considered the requirements for a local safety map to continue to play a central role in local disaster prevention based on our experience of research activities over the past eight years. The target is a district where historic townscapes are being preserved. In addition to solving the problem of insufficient information sharing due to sporadic verbal communication before our research, by creating a map, we found that collaborative work through the map activates local disaster prevention activities. The issue of reliability of subjective information obtained from town walks can be resolved through continuous study through workshops and cooperation with administrative agencies. We have created a local safety map that summarizes the information collected by the local people. Trough workshops using the map, we clarified the variation in danger information that relied on individual subjectivity, and by repeating active discussions, we were able to contribute to share safe information with a certain level of reliability in the district. In the process, we also showed that it is necessary to consider the method of providing information by assuming the actual use situation.

Future issues include verification of the validity of the information posted on the map and visualization of the information update process. Also, the current map is from an adult's point of view. Children may have a different point of view than adults. Reflecting the opinions

of such children is also an issue for the future. Furthermore, It is also necessary to reconsider research methods. Evaluation of our research up until now has been by activity observations, questionnaires and interviews. It is difficult to conduct quantitative verification based on experiments and statistical data in social case studies. Reexamination of the qualitative research approach, which is known as one of the social science methodologies, is also our future issue.

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