

Public Perception of Flood Risk and Community-based Disaster Preparedness

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1 Introduction

To carry out participatory flood risk management in local communities, it is necessary to understand how residents perceive flood risks in their areas and what type of consciousness residents have regarding disaster preparedness actions. Since not all people are so tolerant of flood risk in the areas where they live, it is important to identify which factors affect the degree of acceptance of people to flood risk. In Japan, community organizations such as volunteer fire organizations and flood fighting organizations play a role in preventing disasters. It has been pointed out, however, that the ability of communities to prevent disasters has declined as nuclear families increased, traditional communities declined, and solitary, live-alone old people increased. In order to perform early relief activities quickly in the event of a disaster, it is necessary to make local disaster prevention efforts on a daily basis. The public as well as the administrative authorities also need to participate and cooperate to protect their communities so that their efforts should be reflected in administrative planning. In order to find ways to involve local residents in disaster-prevention activities, there is a need of conducting a study to identify factors contributing to the participation of local residents in disaster prevention activities. This chapter examines consciousness in accepting flood risks and the intention to participate in community-based disaster preparedness activities and carries out studies on each causal model based on questionnaire surveys.

2 Public Acceptance of Flood Risks

2.1 Factors to determine acceptance of flood risks

One of the characteristics of recent flood disasters in Japan is that there is an extremely huge economic loss although the number of human casualties is declining. It is frequently pointed out that one reason for people's lack of preparedness against flood disasters is that there is an inappropriate perception about flood risks.

It has been shown in most studies on natural disaster that it is difficult for people to appropriately perceive natural disaster risks (Slovic *et al.*, 1974). For example, people tend to perceive flood disasters as periodic phenomena instead of as probable and random phenomena. Furthermore, people tend to believe that if a major flood disaster occurs in a certain year, no major flood disasters will occur for some time after. In addition, many people believe that when levees, dams, and other structures are newly constructed, disasters are completely prevented. It can be pointed out that these perceptions of people about natural disasters are affecting recognition of flood risks among the public in Japan.

Japanese flood disaster mitigation have heavily focused on preparing dams, levees, and other hardware structures. As a result, the level of frequency of occurrence of major flood disasters has declined, and the number of human casualties has fallen. However, flood-disaster preparedness measures that rely on preparation of hardware structures tend to incur large costs. Under such measures, there is also a possibility of serious damage if there is an unexpectedly heavy rainfall. In addition, as environmental problems are now attracting much public attention, a high value is set on the idea of living together with nature, making it impossible to promote public works projects that consider only disaster preparedness. From a different viewpoint, not giving the highest priority to disaster preparedness means accepting a certain level of occurrence of damage. In fact, river improvement works that presuppose certain levels of floods have been undertaken following a revision to the River Law. In line with these changes, it is necessary to come up with measures to reduce damage, instead of preparing only hardware structures in order to completely protect areas from disasters. Such measures to reduce damage include those to make houses waterproof, regulate the use of land, improve software, including information on disasters, and promote disaster preparedness measures among the public.

In recent years, much importance is being attached to integrated flood control measures that emphasize both hardware and software. Integrated flood control measures presuppose that there may be river floods. As a result, it will be more necessary than ever for residents to accept flood risks by understanding that their living areas may be flooded and to make preparations. As long as cities have been developed on alluvial plains, which have a high risk of river floods, with people and assets concentrated in such areas, it is impossible to achieve zero risk. However, as improvement in hardware is currently being promoted, residents have become totally accustomed to a situation in which there have been no flood disasters for many years. Residents may believe that

levees will protect their living areas from flood disasters and perceive that zero risk can be achieved. Therefore, factors to determine consciousness to accept flood risks among residents are studied below.

2.2 Method

Participants and Procedure:

Questionnaire surveys were conducted on 4,000 households in areas that suffered from the Tokai heavy rainfall in 2000. The survey forms were mailed to 2,000 households in Nishi-ku of Nagoya-shi, 1,000 households in Shinkawa-cho, and 1,000 households in Nishibiwajima-cho, and the forms were collected through personal visits by staff. The staff asked those who failed to fill in the survey forms or those who were not at home to mail back the forms. As only some parts of Nishi-ku and Shinkawa-cho were flooded, the households in Nishi-ku and Shinkawa-cho were chosen from the flooded areas through a random sampling procedure on residential maps. As almost all parts of Nishibiwajima-cho were flooded, the households in Nishibiwajima-cho were chosen through a two-stage random sampling procedure from the residents register.

Period of surveys:

The questionnaire surveys were conducted in about 17 months after the Tokai Region Torrential Rains in 2000. The survey forms were mailed out on January 30, 2002, and the forms were collected between February 1 and February 19, 2002. The collection of the survey forms via mail was closed on February 28, 2002. Of the 4,000 households, survey forms were collected from 3,036 households (with a percentage of valid responses of 75.9%). In this research project, data from a total of 2,811 households (2,659 households living in single-family housing and 156 households living on the first floor of apartment houses) were used for analyses. The average age of the respondents was 57.6 ($SD = 12.58$).

Survey items:

There were 150 question items listed in the questionnaire. The items covered by the analyses in this section are acceptance of general risks (Yoshino and Kinoshita, 1996), consideration of society (Yoshida *et al.*, 1999), and perception regarding recognition of flood control and flood disasters, including perception of risks, consciousness about zero risk, self-responsibility, trust in administrative bodies, and interest or concern about flood disasters (refer to Appendix A). In addition, consciousness of the acceptance of flood risks is covered by the following three items: (1) it is considered to be appropriate to accept river floods to a certain extent as long as there is a risk of flood disaster in your living area; (2) there is no choice but to accept river floods to a certain

extent as river floods are the works of nature; and (3) a water level up to the floor level can be tolerable to a certain extent when flood disasters occur. For all the items, responses were measured on a five-point scale ranging from 1 (disagree strongly) to 5 (agree strongly).

2.3 Results and Discussion

By carrying out structural equation modeling, a path diagram to show causal relations regarding acceptance of flood risks was created (Fig. 1). It was shown that consciousness of the acceptance of flood risks was affected by the following four factors: The first factor was consciousness of self-responsibility. The path coefficient from self-responsibility to acceptance of flood risks was .29. When people have a strong consciousness of self-responsibility, they accept flood risks. It has been revealed that people's intentions for actions regarding disaster preparedness measures against tornadoes or earthquakes increase when they have a strong consciousness of self-responsibility (Duval and Mulilis, 1999; Mulilis and Duval, 1995, 1997; Mulilis *et al.*, 2001). People do not carry out disaster preparedness measures unless they perceive that disasters can occur. As a result, it can be viewed that taking disaster preparedness measures is related to an attitude that is to perceive and accept disaster risks. These relationships are supported by the results of this study, and it was revealed that people accept flood risks when they have a strong consciousness of self-responsibility. Administrative bodies or experts on flood disasters are asked to try to provide information that helps increase consciousness of self-responsibility.

On the other hand, the path coefficient from consciousness of zero risk to acceptance of flood risks was -.36. In other words, residents who depend on measures to prepare dams, levees, and other hardware structures and believe that science and technology make it possible to achieve zero risk, perceive that it is impossible to accept flood risks. The information that is currently encountered by residents is about preparation of hardware structures, including improvement of levees and widening of rivers. Based on such information, the public tends to create a perception that it is possible to eliminate flood disasters. Nakayachi (2002) found that there is a low expectation for zero risk regarding natural disasters. However, the results of this study showed that many of the public seek to achieve zero risk and believe that it is possible to achieve. For example, for the question item "it is possible to achieve a society without flood disasters if public works are strengthened to carry out river improvement," 27.0% of the respondents chose 5 (agree strongly) on the five-point scale, and 32.5% chose 4 (agree moderately). This showed that there is a strong perception that it is possible to achieve zero risk. These results were

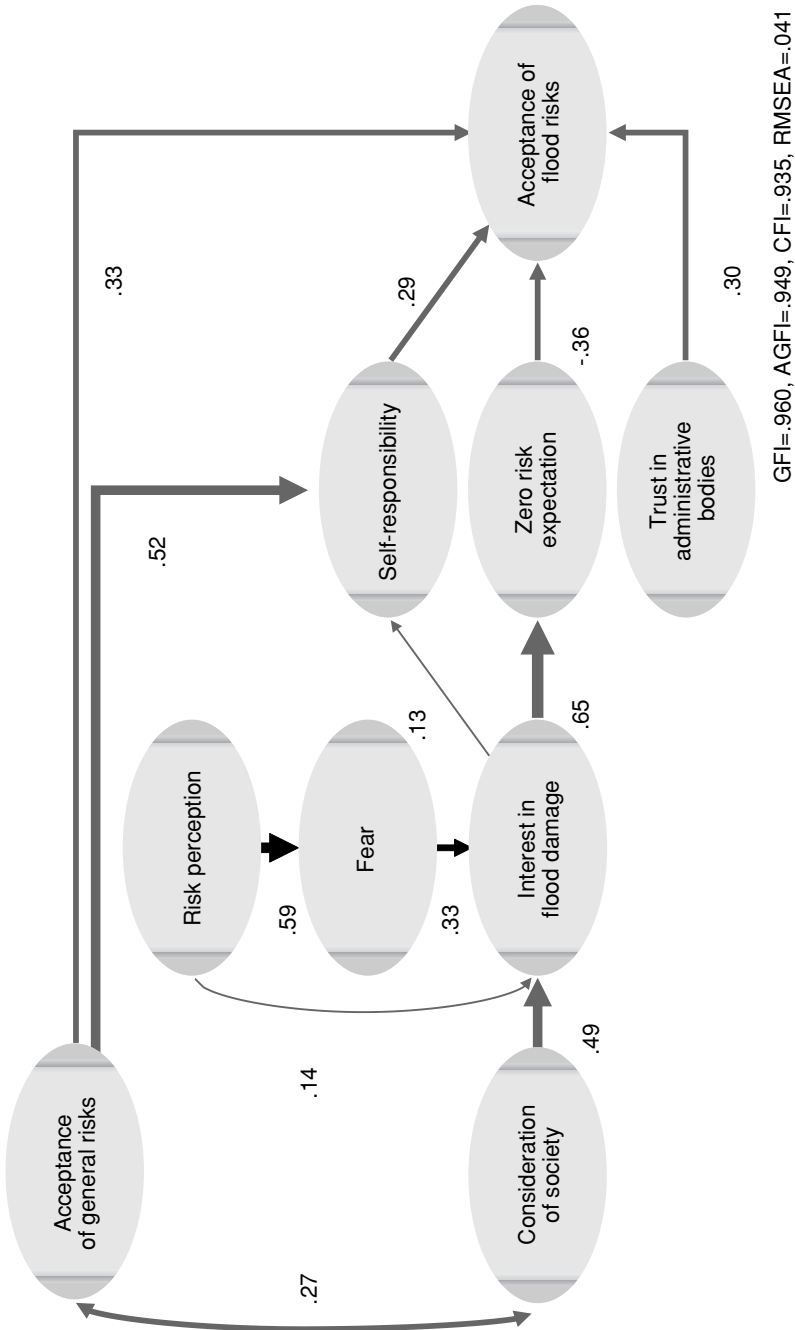


Fig. 1. Structural model of acceptance of flood risks with standardized path coefficients.

related to the “not me” factor (Joffe, 1999). In other words, people tend to perceive natural disasters as phenomena unrelated to them because there is a low occurrence probability of natural disasters. Furthermore, there is generally a low expectation for zero risk. However, when people experience a nearby disaster, become concerned parties, and recognize that natural disasters are phenomena related to them, there is a high expectation for zero risk. Experts or administrative bodies perceive as a matter of course that it is impossible to achieve zero risk regarding flood disasters, and they are asking residents to understand this by providing information through hazard maps. On the other hand, residents still have a strong consciousness that it is possible to achieve zero risk. There is a perception gap about zero risk regarding flood disasters between experts or administrative bodies and residents, who are concerned parties. When information is provided to residents, it is necessary to properly inform residents that it is impossible to achieve zero risk regarding flood disasters.

The third factor that affects acceptance of flood risks was reasonable consciousness of acceptance of general risks. The path coefficient from acceptance of general risks to acceptance of flood risks was .32. In addition, while there is a small relationship between interest in flood disasters and consciousness of self-responsibility, the path coefficient from acceptance of general risks to self-responsibility was higher at .52, confirming that there is an indirect effect on acceptance of flood risks. People who have consciousness to accept general risks, have acceptance of flood risks. When information regarding flood disasters is provided, it is necessary to provide information on not only flood disasters but also general risks. It is important also to provide the uncertain or probabilistic nature of risk and inform that all matters in society involve risks and it is impossible to achieve zero risk.

The results of this study showed that the other factor that affects acceptance of flood risks was related to trust in administrative bodies. When occurrence of flood disasters is accepted, some damage reduction measures, including buying insurance policies and making houses waterproof, can be undertaken at an individual level. However, for the whole of a community, there is no choice but to depend on administrative bodies, to a certain degree. It is necessary for administrative bodies to provide enough risk information for the residents to make an appropriate choice of risk reduction measures based on their acceptance of flood risk.

Based on the above, it can be pointed out that risk communication regarding flood disasters is necessary to promote integrated flood control measures as was illustrated in various risk scenes in Japan (e.g., Kikawa, 1999). This

study showed that residents have a strong consciousness about zero risk although experts or administrative bodies are endeavoring to inform residents that it is impossible to achieve zero risk by providing information through hazard maps. In order to help residents have a proper understanding of flood risks, risk communication that enables residents and experts or administrative bodies to provide information interactively or express and exchange opinions, seems to be necessary, in addition to one-way provision of information through hazard maps and other means. In addition, risk communication between residents and administrative bodies is expected to help develop trust in the administrative bodies. The goals regarding risk communication among residents, administrative bodies, and other stakeholders, related to flood disasters include the following: (1) to strengthen consciousness about self-responsibility regarding disaster preparedness; (2) to understand that it is impossible to achieve zero risk regarding flood disasters; (3) to understanding not only flood disasters but also overall risks; and (4) to develop trust between the public and administrative bodies through risk communication.

3 Participation in Community-based Disaster Preparedness Activities

3.1 Factors to increase the intention to participate in community-based disaster preparedness activities

In Japan, where there are many natural disasters, the role of preventing disasters is partly delegated to fire-fighting organizations, flood-fighting organizations, and other community-based organizations. However, the abilities to prevent disasters in local communities are declining due to an increase in nuclear families, a decline in conventional communities, an increase in elderly people living alone, and other factors. To swiftly carry out relief activities in local communities at the initial stages after the occurrence of disasters, it is necessary to carry out community-based disaster preparedness activities on a habitual basis. In addition, it is also necessary for not only administrative bodies but also residents in local communities to participate in disaster preparedness activities, and residents need to cooperate with administrative bodies. It is desired that not only administrative bodies but also residents in local communities come up with community-based disaster-preparedness measures by themselves, which are reflected in administrative plans. To achieve this, it is necessary for more members of residents to participate in community-based disaster preparedness activities. Through past researches, it was revealed that past experience of disasters, demographic characteristics, including level of income, type of residence, and educational level, feeling of control against disasters and anxieties, which are individual characteristics, and other factors

are related to disaster preparedness actions (e.g., Lindell and Perry, 2000). However, many of these researches focused on disaster preparedness actions for households, and community-based disaster preparedness activities were studied only on a supplemental basis. Among these researches, Rochford and Blocker (1991) examined disaster preparedness activities in local societies, including fund-raising campaigns, petitions to administrative bodies, and solidarity movements in local communities, and revealed that evaluations of possibilities to control flood disasters or coping styles are factors that affect participation in community-based disaster preparedness activities. However, there have been almost no findings on the level of intention to participate in community-based disaster preparedness activities among flood-fighting organizations, independent disaster preparedness organizations, and other organizations in Japan. As a result, factors to determine the intention to participate in community-based disaster preparedness activities are also studied through surveys covering residents in local areas that have a high level of weakness towards flood disasters.

Many of the past studies on disaster preparedness regarded disasters as stress events and treated disaster preparedness actions as measures to deal with such events (Mulilis and Duval, 1995; Rochford and Blocker, 1991). However, community-based disaster preparedness activities by independent disaster preparedness organizations, flood-fighting organizations, and other organizations can be regarded as voluntary activities in local societies. As a result, among the researches dealing with relationships between attitudes and actions, this research project carries out studies by using the theory of reasoned action, which is pointed out to be highly persuasive regarding voluntary actions, as the basic framework (Ajzen and Fishbein, 1977, 1980; Fishbein and Ajzen, 1975).

3.2 Method

Participants and Procedure:

A questionnaire survey was conducted to study factors that affect intention to participate in community-based disaster preparedness activities. The subjects of surveys and the period of surveys were the same as those of the surveys mentioned in the previous section.

Survey items:

As factors to determine the intention to participate in community-based disaster preparedness activities, a total of 13 items related to interest or concern about flood disasters, consciousness related to subjective norms that show expectations from important others about disaster preparedness actions, recognition of costs of community-based disaster preparedness activities, and

recognition of benefits were used (refer to Appendix B). For all the items, responses were measured on a five-point scale ranging from 1 (disagree strongly) to 5 (agree strongly).

3.3 Results and Discussion

As to the condition of participation in disaster preparedness classes or disaster preparedness drills, 188 respondents (6.2%) said that they attend all such events, 1,330 (43.8%) said that they sometimes attend such events, 658 (21.7%) said they cannot attend such events because they cannot obtain information, 550 (18.1%) said that they do not attend such events because they have no interest, 183 (6.0%) said that they cannot attend such events because they are disabled or sick, and 127 (4.2%) did not respond. Almost half of the respondents said that they have experience in participating in community-based disaster preparedness activities. Data from 2,726 respondents, excluding 310 respondents who said that they cannot attend disaster preparedness classes or drills because they are disabled or sick and who did not respond, were used for the following analyses.

By carrying out structural equation modeling, a path diagram to show causal relations regarding participation in community-based disaster preparedness activities was created (Fig. 2). From the results of the analyses, it was revealed that people have a high intention to participate in community-based disaster preparedness activities when they have a high intention related to a subjective norm. Subjective norm is an important determinant of regarding public activities carried out in the presence of acquainted others (Hirose, 1992). These estimates are supported by the results of this research project, which suggest that a subjective norm is an important factor to determine intention regarding actions carried out in the presence of others.

In addition, recognition of costs has a strong negative effect on intention to participate. When people have a high recognition of costs, their intention to participate declines. On the other hand, recognition of benefits has only a small positive effect on intention to participate. As disasters do not occur frequently, people feel highly burdened to participate in community-based disaster preparedness activities during normal times when nothing happens. To activate community-based disaster preparedness activities, it is extremely important to reduce the public's recognition of costs. On the other hand, recognition of benefits had only a small effect. Damages from flood disasters cannot be eliminated only through community-based disaster preparedness activities. Furthermore, it is difficult to see detailed benefits from carrying out community-based disaster preparedness activities. It could be pointed out that these are the reasons why recognition of benefits had only a small effect.

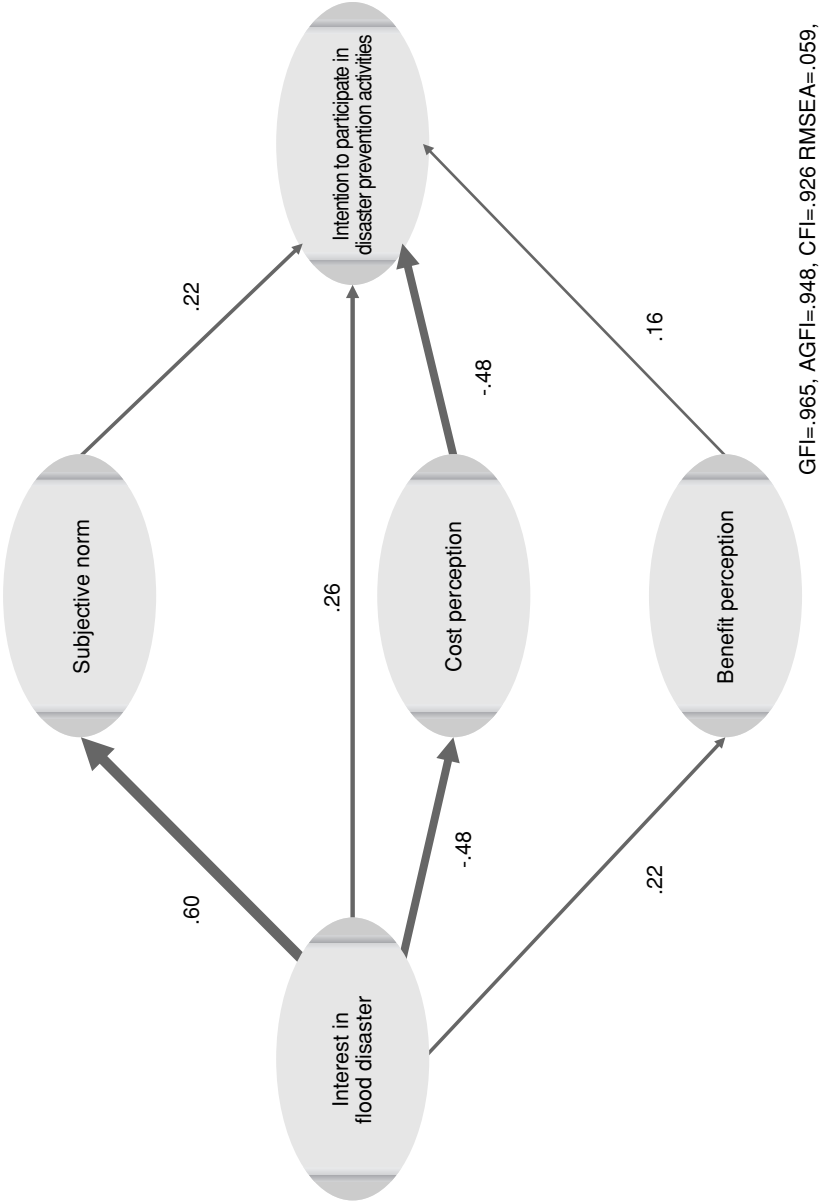


Fig. 2. Structural model of intention to participate in disaster prevention activities with standardized path coefficients.

Interest in or concern about flood disasters is a conception that is not dealt with under the theory of reasoned action. However, interest in or concern about flood disasters serves as a direct factor that determines intention regarding actions in this study. In addition, interest or concern about flood disasters was regarded as a factor that heightens a subjective norm or recognition of benefits and lowers recognition of costs. Furthermore, interest in or concern about flood disasters had an indirect effect on intention regarding actions. Interest or concern about disasters serves as an important factor to increase intention regarding community-based disaster preparedness actions. To activate community-based disaster preparedness activities, it is first important to encourage residents to take interest in disasters in local areas. It was suggested that it is possible to activate community-based disaster preparedness activities by providing information in such a way that residents take more interest in disasters.

Research that studied relationships between social attributes and disaster preparedness measures (Russell *et al.*, 1995), research that studied disaster preparedness activities as stress-coping activities by regarding disasters as stress events (Rochford and Blocker, 1991), and other researches have been carried out in the past. On the other hand, this study regarded disaster preparedness activities as voluntary activities in local areas and revealed that the three factors—subjective norms, recognition of costs, and interest or concern about disaster preparedness—affect intention regarding community-based disaster preparedness actions. This points out that it is possible to activate community-based disaster preparedness activities by regarding disaster preparedness activities not as measures to reduce disaster risks but as voluntary activities in local communities. Disaster preparedness measures are often studied from the viewpoint of completely understanding risk information and making preparations. However, it is also necessary to carry out studies to activate community-based disaster preparedness activities from the viewpoint of focusing on community-based activities.

4 Conclusion

Two findings were obtained through this study. First, self-responsibility, consciousness about zero risk, acceptance of ordinary risks, and trust in administrative bodies affect acceptance of flood risks. From this result, it is pointed out that in order to promote acceptance of flood risks, it is important to increase self-consciousness about disaster preparedness through risk communication, understand that it is impossible to achieve zero risk, deepen understanding of not only flood disasters but also overall risks, and establish

relationships of trust between the public and administrative bodies.

Second, people have a greater intention to participate in community-based disaster preparedness activities when they take great interest in subjective norms and flood disasters. Furthermore, recognition of costs of disaster preparedness activities serves as a factor to decrease intention to participate. As a result, it was pointed out that it is possible to activate disaster preparedness activities by regarding these activities not as measures to reduce disaster risks but as voluntary activities in local communities.

Appendix A. Questionnaire survey items in Section 2

Reasonable perception of general risk

- I think everything that occurs is accompanied by risk, and nothing can be done about it.
- I think that the world is made up of risk and safety.
- I think living with risk is a fact of life.

Consideration of society

- I think about how society is made up.
- I think about how I should act in society.
- I think about the society in which I live.

Appendix B. Questionnaire survey items in Section 3

Interest or concern about flood disasters

- I feel concern for the details of flood damage mitigation measures being taken by administrative organizations.
- I often read newspaper articles about flood damage.
- I am interested in how much money they spend for flood damage mitigation measures and flood control works.

Subjective norms

- I will feel ashamed if I make no preparation while my relatives and family were taking action for flood protection.
- If I take action for flood protection, I think my close friends will be impressed with what I do.
- I will feel ashamed if I do nothing while my neighbors are taking measures for flood protection.

Cost and benefit perception

- I think it's difficult to find the time to participate in evacuation drills and disaster prevention seminars in the local community.
- I think it's too much of a bother to check if there are any flood-prone areas in residential areas.
- I think that flood damage can be minimized if everyone takes disaster prevention measures.
- I don't think whether or not I do something to reduce flood damage makes any difference.

Intention to participate in community based disaster preparedness

- I want to participate in disaster preparedness classes or disaster preparedness drills.
- If administrative organizations or fire stations hold seminars or disaster prevention drills, I want to participate.
- I want to join a voluntary disaster prevention organization

Participation in local disaster prevention activities

- How often do you participate in disaster preparedness classes or disaster preparedness drills?

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