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# Analyzing the Role of Resource Factors in Citizens' Intention to Pay for and Participate in Disaster Management

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**Abstract:** This study aimed to analyze how resource variables (health status, economic affordability, social network, social capital, and neighborhood environment) influence citizens' intention to pay for and participate in disaster management and safety activities. We compared four psychometric paradigm variables with five resource variables and analyzed how the latter moderate the relationships of the perception variables with intention to pay and to participate. A regression analysis revealed that willingness to pay was mainly explained by trust, followed by social capital, economic affordability, perceived risk, and experience, respectively. Participation was explained by knowledge, social capital, age, trust, and social network, respectively. Gender, trust, and social capital had an influence both on willingness to pay and to participate. Perceived risk, knowledge, and trust had a moderating effect on willingness to pay, but this effect depended on the quality of the neighborhood environment. Trust, knowledge, and stigma had a moderating effect on participation intention, but this effect depended on social capital and the neighborhood environment.

**Keywords:** willingness to pay; intention to participate; disaster management; psychometric paradigm; resource factors; risk and crisis management

## 1. Introduction

The disaster management paradigm has shifted from being centralized and government-based to being decentralized, citizen-based, and participatory. The extensive participation of citizens during the occurrence of disasters not only provides support to relieve the gap of disaster damage and solve vulnerability but also has a positive influence on rebuilding after disasters as well as developing the local community [1–5]. Hicks et al. demonstrated that citizens' participation led to global mapping and resulted in enhancing the disaster reduction [6]. They showed how a real-time natural disaster

map was created through a stream participated in by citizens. [6]. Therefore, recent disasters that occurred worldwide have drawn new attention to citizen activities. Particularly, public cooperation and participation in disaster preparedness affect both informal and formal responses to disaster situations. Citizens' activities and participation in disaster management have a variety of influences on disaster preparedness and resilience [7]. Based on both theory and the disaster recovery literature, Vallance [8] studied the possible relationship between actual participation in specific activities (the "fact" of recovery) and the decision to participate (the "process" framework of citizens' recovery activities) in disaster management. Findings revealed an urgent need for participation in disaster recovery, in terms of both procedural and practical aspects.

Citizen participation and cooperation play a decisive role when real disasters occur. An empirical study by Kweit and Kweit [9] found a difference in the resilience of a city in the United States after a massive flood in 1997 where both local governments, which actively depended on the federal government, and citizens participated actively. Particularly, local governments with citizens' active participation showed higher resilience and satisfaction among their citizens than those that relied solely on the federal government. Through experiments, Kweit and Kweit [10] analyzed civil participation related to disasters. They found that although citizens' actual participation did not affect their satisfaction or have any negative effects, it affected disaster management significantly.

In a disaster, it is not only important to participate in disaster prevention and recovery but also to pay for such activities. Generally, the government safeguards citizens' lives and property from the threat of disasters and provides support to encourage individuals, businesses, and communities to return to a normal state when a disaster occurs. However, all governmental activities involve costs. The cost of activities by the government can be finally attributed to taxpayers [11]. Therefore, payment or intention to pay is an important factor in disaster management. For example, in 2016, a 7.8 magnitude earthquake shook the coast of Ecuador, resulting in 663 deaths, 6274 injured individuals, and 80,000 displaced individuals. Further, it caused significant damage to infrastructure. The Ecuadorian government responded to the crisis by setting a reconstruction budget of \$3344 million under the Solidarity Law [6]. This law specified the payment of costs by citizens to finance reconstruction activities and their civic responsibility to reconstruct affected areas. To create the fund for reconstruction activities, the Solidarity Law, implemented in May 2016, imposed a 3.3% tax and value-added tax (VAT) for one year [12].

The Solidarity Law, effective from May 2016, established the following required contributions from citizens to help address the earthquake's aftermath and recovery efforts: an increase in value added tax for one year; an 8-month 3.3% payment from employment wages; a less-than-one percent stipend gathered from equities exceeding one million dollars; existing real property taxation of 3.3%; and a 3% contribution from realized profits [12].

Despite the important role of payment and participation in overcoming disasters, these topics have not been studied adequately. Although there have been previous studies about payment toward the cost of disaster preparation, they focused only on the domain of individuals' willingness to apply for insurance related to natural disasters in order to be protected from danger [13–18]. In disaster situations, payment and participation for the benefit of the community are very important, rather than spending on insurance, which is directly related to personal interests. However, research on this topic is very scarce [13–18]. Accordingly, the present study aimed to identify causal factors that may affect citizens' willingness to pay for disaster management activities and to participate in disaster situations.

## 2. Theoretical Background and Research Model

### 2.1. Role of Citizens' Participation in and Payment toward the Cost of Disaster Recovery/Management

Citizens' participation and willingness to pay are key to disaster management. Participation refers to individuals' degree of intervention and responsiveness to disasters. Individuals who are prepared for disaster management may be less afraid and anxious [19], may have greater self-efficacy [20,21], and may recover faster when they face a disaster. Moreover, citizens can help others in times of disaster.

In fact, when disaster strikes, because citizens are present at the scene of a disaster, they can be the "true" first responders, who can actively address community needs by participating in activities such as the restoration of public services and infrastructure [22–27]. Therefore, the government expects more efficient solutions by encouraging individuals to participate in disaster management. Individuals' active participation in disaster management appears to be effective in disaster prevention, preparedness, response, and recovery [11].

Several empirical studies have examined the role of citizen participation. According to Oulahen and Doberstein [28], citizens' participation in disaster management is defined as a standard feature of democratic planning. They reported that risk mitigation during disastrous floods in Peterborough was characterized by citizens' strong participation, which resulted in successful disaster management. Additionally, by analyzing citizens' use of Social Networking Sites (SNS) to identify their participation in disaster management, Song [29] demonstrated that such activities help them share information and make decisions, finally contributing to reducing the uncertainty of a disaster.

Compared to research on the effects of citizens' participation in disaster management, studies on the payment of costs related to disasters have focused only on determinants of such costs. From the utility perspective, the quality of service and the beneficiary's satisfaction primarily determine the level of payment. Donahue et al. [11] reported that attitudes and satisfaction are important in facilitating the prediction of willingness to pay for government policies. Beck et al. [30] found that general satisfaction with communities is more important than demographic factors in determining the support for tax policies. Simonsen and Robbins [31] used survey data to examine whether citizens' tax preferences are affected by their perceived quality of government services. They found that attitudes toward the government and its services were an important determinant of support for taxes. Glaser and Hildreth [32] asked respondents to indicate whether they would be willing to pay for an increase in taxes or fees for 14 different services in exchange for increased services. About half of the respondents who were satisfied with the government's performance expressed willingness to pay additional taxes, whereas others with low satisfaction showed a lower willingness to pay.

Other studies focus on empirical and structural elements, not satisfaction. For example, Wang et al. [14] found that an individual's willingness to pay toward disaster management depended heavily on his/her disaster experience. As residents from relatively high-risk areas were highly dependent on the government, they revealed a low willingness to pay for disaster management. Interestingly, none of these studies systematically examine the factors that determine willingness to participate and pay. Therefore, the present study analyzes the effects of "perception" and "resources" on individuals' intention to pay for and participate in reducing the "scale" or "magnitude" of a disaster related to climate change that seriously threatens health and life.

## *2.2. The Psychometric Paradigm versus the Resource-Based Approach*

Intention to pay for and/or participate in disaster management is a function of psychological factors and personal resources. Therefore, our study set perception and resources as independent variables that affect the willingness to pay for and participate in disaster management. While perception has been emphasized in the psychometric paradigm, resources are the focus of the structural approach.

The psychometric paradigm assumes that the degree of risk perception depends on subjective judgment about risks and not their objective size. The paradigm has been used to address the research question of why individuals perceive different hazards in a situation, or the same hazards differently, regardless of the objective size of the risk. Baruch Fischhoff, Paul Slovic, Sarah Lichtenstein, Stephen Read, and Barbara Combs proposed that, instead of individuals' revealed preference, their expressed preference is an important factor with respect to risk preference [33]. Risk is subjectively defined to influence individuals through a wide array of psychological, social, institutional, and cultural factors [34]. Chew and Jahari [35] examined the effect of perceived risk on the formation of risk awareness. They found that perceived physical risk had a direct impact on attitude formation toward risk objects, but it did not affect the image of the subject significantly.

The resource-centric approach focuses on the impact of the structural positions of individuals. This approach suggests that, even when individuals think that they are free from danger, such subjective judgments can be restrained by structural constraint factors such as economic or social conditions. The vulnerability hypothesis proposed by Benford et al. [36] accurately reflects the resource factor. They reported that minority groups expressed more perceived risk because they had less “resources or alternatives,” rendering them vulnerable to disasters. As such, individuals with weak defense mechanisms are sensitive to risky or dangerous situations (e.g., exposure to radioactive waste from treatment plants). Pelling [37] reported that marginalized groups with limited social resources (such as women, children, the aged, the economically poor, petty agriculturalists, and squatters) continue to be excluded from local participatory decision-making in environmental management.

Since the psychometric paradigm and the resource-based approach have very different assumptions, they are expected to have different effects on payment and participation intentions pertaining to disaster management. The first stresses the subjective perspective at the individual level, where the second focuses on the structural situation and constraints at the contextual level. Such differences bring out limitations for each theory. The psychometric paradigm overlooks the structural objective constraints, and the resource factor overlooks the actor’s active will and voice operating under the resource constraints. Moreover, something that the two theories have in common is overlooking the great structural power of history and culture. However, as very few empirical studies have tested these assumptions, a comparative study needs to be conducted to examine the two theoretical arguments.

### 2.3. Four Hypotheses in the Psychometric Paradigm

#### 2.3.1. Perceived Risk

Generally, perceived risk is a decisive factor that affects support and action regarding safety policies. For instance, increased risk perceptions since the Fukushima nuclear accident contributed to a shift in the nuclear power policy in Japan. By analyzing nationwide data collected immediately after the Fukushima nuclear accident, Yamamura [38] investigated how these disaster experiences affected individuals’ perceptions of the dangers of nuclear accidents. He reported that the perceived risk of a nuclear accident was positively associated with experiencing a technical disaster, but not with the risk of natural disasters. Perceived risk is important with reference to a disaster. Cliff et al. [39] described the perceived risk and preparedness for disasters in rural hospitals. They confirmed a positive link between risk perception and disaster preparedness. According to Itaoka et al. [40], as willingness to pay is sensitive to expected mortality, the higher the risk, the higher the willingness to pay. They demonstrated that the willingness to pay for reducing deaths from a nuclear disaster is about 60 times the willingness to pay for reducing fossil-fuel generation-related deaths. Moreover, Abbas et al. [15] demonstrated that the perceived risk of flooding, such as damage to livestock, crops, assets, and houses, increases the willingness to pay for insurance. Moreover, risk perception and sense of place had important influences on disaster preparedness. For example, Xu et al. [41] reported that respondents with higher risk perception exhibited more disaster preparedness behaviors. When presenting each hypothesis, we use “H<sub>n</sub>”, which is an abbreviation of the term hypothesis, “H”, and the number of the hypothesis, “n”.

**Hypothesis 1 (H1).** *The higher the perceived risk, the more likely an individual will be to pay for and participate in disaster management.*

#### 2.3.2. Knowledge

Increased knowledge generally leads to action. Seneviratne et al. [42] discussed the need for knowledge to facilitate successful disaster management. They argued that knowledge of disaster management can reduce or prevent potential losses from risk, ensure prompt and adequate support for disaster victims, and achieve rapid and effective recovery. Knowledge management can reinforce

the disaster management process. However, within the real context of disaster management, there is conflict in information coordination and sharing. Knowledge of key success factors helps toward managing disasters successfully; the categories of knowledge include not only technology but also society, law, environment, economy, functioning, institutions, and politics. Objective knowledge lowers risk perception and increases the acceptance of dangerous objects. A study by Stoutenborough et al. [43] showed that the higher the knowledge, the higher the acceptance of dangerous nuclear power.

Mercer et al. [44] developed a scientific knowledge framework for disaster mitigation. To reduce community vulnerability to environmental risks, they presented a participatory framework that integrates relevant indigenous and scientific knowledge. According to Arbon et al. [45], knowledge based on formal education pertaining to disasters significantly influences an individual's willingness to attend and participate in their workplace during a disaster. Valibeigi et al. [46] reported that strengthening crisis coping skills is a key component in improving participation during crises in small cities in Iran.

**Hypothesis 2 (H2).** *The greater an individual's knowledge about risk is, the more active they will be in paying for and participating in disaster management.*

### 2.3.3. Trust

Disasters can change not only the living environment but also trust in the government. As trust in the government can lead to cooperation, it is extremely important for emergency and disaster management. However, the relationship between disasters and trust in the government is complex. Cassar et al. [47] found that the level of community or individual experience in disaster management influences trust in the government. Moreover, trust affects attitudes toward disasters. For instance, Ahsan [48] examined the effects of natural disasters, especially coastal cyclone storms, on individuals' risk perception and trust levels. Findings revealed that trust was negatively associated with attitudes toward risky individual actions. This implies that trust may induce cooperative action in a disaster situation. According to a study by Jung and Kim [49], trust in the government has a positive effect on the acceptability of risk objects, for example, nuclear power. Moreover, trust in the government reduced the perceived risk of nuclear power energy, and finally increased the acceptance of nuclear power [50]. These findings imply that trust increases collaboration, that is, more payment and participation, in a risky disaster situation.

**Hypothesis 3 (H3).** *The greater the trust in the government, the more likely an individual will be to pay for and participate in disaster management.*

### 2.3.4. Stigma (Negative Emotional Image)

Stigma refers to a negative emotional image of a particular risk object. Västfjäll et al. [51] suggested that thinking about big environmental accidents, such as tsunami disasters, leads to negative emotions. These feelings affect how individuals perceive the risk. Okvat and Zautra [52] argued that negative emotions are likely to dominate early on in the disaster zone, whereas positive emotions, such as hopeful images, reduce fearful perceptions. Further, they predicted that positive emotions would increase college students' resilience in a disaster context. On the other hand, Uchida et al. [53] reported that increasing negative emotions through reminding people of a national tragedy reduces positive resilience.

Sharon and Shosh [54] demonstrated how negative emotions affect the willingness to pay for airline tickets. They showed that individuals who indicated higher levels of fear during a war were willing to pay more for airline tickets during wartime. Stigma carries a similar relevance with disasters. During disasters, individuals are placed in critical situations of damage to their wealth and lives, just like in times of war. Negative emotions increase for those who are affected by the crisis. Accordingly, people are willing to pay a higher price to return to a comfortable and safe condition in order to be

assured regarding safety. Based on an extensive literature review, Drews et al. [55] concluded that emotions such as interest and hope influence policy support for climate change. These findings suggest that negative emotion-based fear could increase payment and participation intentions.

**Hypothesis 4 (H4).** *The greater the stigma attached to disasters, the more likely an individual will be to pay for and participate in disaster management.*

#### 2.4. Five Hypotheses in the Resource-Based Approach

##### 2.4.1. Health Status

Health is an important factor that affects attitudes and activities related to disasters. According to the Health Belief Model (HBM), perceived level of health as well as perceived benefits, barriers to behavior, and self-efficacy determine commitment to health-related practices [56]. According to the population health model proposed by Lindsay [57], health status is generally associated with disaster vulnerability. This model explains how a community's or an individual's health vulnerability is affected by a series of social, economic, and physical factors that are linked to disaster management. Zarcadoolas et al. [58] found that perceptions of health could affect attitudes toward public health; those who had poor health did not pay attention to public health messages. Li and Hu [59] reported that current health status as well as perceived health risks from hazardous pollutants affected individuals' willingness to pay for efforts to improve the quality of air.

**Hypothesis 5 (H5).** *The better an individual's health is, the more likely they will be to pay for and participate in disaster management.*

##### 2.4.2. Economic Affordability

The extent of damage caused by disasters differs based on the social and economic class of individuals. Elliott and Pais [60] analyzed the impact of social class when Hurricane Katrina struck the southern United States in late August 2005. They found social class and racial differences in disaster resilience in relation to life savings. Bolin and Kurtz [61] and Pastor et al. [62] introduced a new approach for examining the relationship between social inequality and disaster vulnerability by adopting critical racial theory, political ecology, and social science theories. They found that the more economically rich a group was, the faster it tended to exhibit resilience after a disaster.

Moreover, Li et al. [63] reported that economic wealth as well as public awareness and concerns about climate change had a significant impact on willingness to pay for responding to global warming. Abbas et al. [15] demonstrated that the ability of households to pay insurance premiums had a positive impact on their willingness to pay for insurance. Sadigi et al. [27] found that lack or loss of personal resources rendered affected individuals unable to participate in post-disaster housing reconstruction projects.

**Hypothesis 6 (H6).** *The greater an individual's perceived economic resources are, the more likely they will be to pay for and participate in disaster management.*

##### 2.4.3. Social Network

Natural disasters represent several social challenges that are intertwined beyond the realm and capacity of a single actor. Therefore, formal and social networks in disasters are an important means of ensuring personal safety. Bodin and Nohrstedt [64] examined what fits well between cooperative networks and work interdependence in disaster management. They found that the pattern of actor and job interdependence influences the formation of a cooperative network, which leads to effective collaboration. Particularly, the effectiveness of the network was found to affect disaster management performance more than risk management experience and specialization did. Jung and Song [65]

showed that hierarchical and horizontal emergency networks improve the level of resilience in a disaster. Kapucu et al. [66] found that the efficient use of resources by collaborative networks raises stakeholders' expectations about emergency and disaster management. Social interactions based on social networks mitigate strains arising from disasters, finally contributing to individuals' willingness to pay and to participate.

**Hypothesis 7 (H7).** *The stronger an individual's social networks are, the more active the individual will be in paying for and participating in disaster management.*

#### 2.4.4. Social Capital

Fernando [67] and Mathbor [68] pointed to the effective use of social capital, such as social cohesion, social interaction, and solidarity, to mitigate disasters. The effective use of social capital has a significant impact on building communities' and institutions' capacity to handle disaster management projects. Aldrich and Meyer [69] highlighted the important role of social capital and networks in disaster recovery and provided recent literature and evidence on this subject. Murphy [70] emphasized the importance of disaster emergency management in local government accountability and community initiatives as a social capital resource that can be used to improve community resilience. Nurmandi et al. [71] found that social capital with solidarity among typhoon-affected communities contributed to the recovery of survivors. According to Pelling [37], social assets such as social capital contribute to residents' participation in local, national, and international resources for environmental management. Similarly, Sadigi et al. [27] reported that the loss of community cohesion decreases community-level participation in post-disaster housing reconstruction projects.

**Hypothesis 8 (H8).** *The higher an individual's level of social capital is, the more likely they will be to pay for and participate in disaster management.*

#### 2.4.5. Neighborhood Environment

Quarantelli [72] and Vatsa and Krimgold [73] found that, in the event of a disaster, a poor local environment in terms of economic status results in poorly resilient, incomplete, or problematic responses to the disaster. Particularly, individuals living in poor areas are vulnerable to the impact of disasters. Winsemius et al. [74] analyzed, at the national level, how poor individuals living in underdeveloped areas are often overexposed to disasters. They termed it as the "poverty exposure bias." Local areas with poor-quality living environments are likely to be populated by the most economically vulnerable groups, who in turn tend to be less willing to pay for disaster-related costs. Moreover, the location of the household influences the willingness to pay related to risk. For example, Sinha et al. [75] found that households in the Midwest region of the USA exhibited lower willingness to pay for temperature management than households in the Pacific and South Atlantic regions did.

**Hypothesis 9 (H9).** *The better an individual's perceptions about the quality of their residential environment are, the more likely they will be to pay for and participate in disaster management.*

### 3. Materials and Methods

The survey data used in this study were collected from 18 September 2019 to 16 October 2019 in Korea. Our survey data were collected by a survey research company, Mactromill Embrain. This company had a survey panel of 1,334,771 people. The respondents were selected based on the quota by sex, age, and three cities (Seoul, Suwon, and Yongin). The survey was executed by a web-survey, in which an e-mail was sent three times to each candidate suitable to be a respondent.

We used a probabilistic stratified sampling method based on gender, age, and region. Finally, a total of 859 respondents participated in the survey. Among them, 50.9% were male and 49.1% were female. In terms of age-group distribution, 19.3% of the participants were in their 20s, 20.3% in their 30s,

17.2% in their 40s, 18.6% in their 50s, and 24.6% were in their 60s. With reference to educational level, 16.1% of the respondents had completed high school education or less, while 83.9% of the respondents had completed college graduation or higher. Further, 24.4% of the respondents earned monthly less than 30 million won, 38.7% earned 3 to 5 million won, and 37.1% earned more than 5 million won.

All variables in the psychometric paradigm and the resource-based approach were measured on a five-point scale. All questions asked the respondents to express if they agreed or disagreed with the given statement (1 = strongly disagree, 5 = strongly agree). The dependent variable asked for payment and participation. According to the Theory of Planned Behavior (TPB), intention toward an action is influenced by the attitude toward the action, subjective norm and perceived belief of control [76,77]. However, in this study, variables related to attitude were set as independent variables, and norms and control were excluded. The concepts, variables, and measurement items are presented in Table 1. The reliability of the measured items was determined based on the Cronbach's alpha value, which was more than 0.60 for all items except for stigma. Thus, most items satisfied the general reliability criteria.

**Table 1.** Concepts, variables, and measurement items.

Concept	Variable	Measurement	Reliability
Psychometric paradigm	Perceived risk	It is highly likely that accidents may occur due to the collapse of facilities such as old roads, bridges, tunnels, underpasses, and buildings; or due to the impact of typhoons and explosions.	0.763
		The building I live in is so old that accidents are likely to happen soon.	
		The facilities and buildings I use often (roads, bridges, tunnels and underground roads, schools, subways, public offices, cultural facilities, private complexes, etc.) are so old that accidents are likely to occur soon.	
	Knowledge	I know how to respond in the event of a disaster.	0.800
		I have some knowledge of disaster safety.	
Trust	I consider the government's safety policy credible.	0.869	
	I trust the government's safety policy.		
Stigma (negative image)	When I think of disaster safety, I feel that our future is dark and hopeless.	0.545	
	Thinking about disaster safety brings negative feelings and images.		
Resource factors	Health state	I'm healthy.	0.888
		I'm healthy as compared to others.	
	Economic affordability	I'm economically stable.	0.842
		I'm richer than others.	
	Social network	I usually maintain several social relationships.	0.662
		There are many people who can help me when I'm in trouble.	
	Social capital	People around me are trustworthy.	0.649
In general, I tend to trust people.			
Neighborhood environment	I live in a good neighborhood.	0.712	
	The living facilities are relatively good in the area where I live.		
DV1: Intention to pay	I am willing to pay the central government for disaster safety.	0.892	
	I am willing to pay if the local government charges for disaster safety.		
DV2: Willingness to participate	I am willing to participate in disaster safety training.	0.780	
	I am willing to participate in community activities for disaster safety preparedness.		
CV: Disaster experience	I have experienced a disaster.	0.718	
	I have had a safety-related accident.		

## 4. Results

### 4.1. Basic Data Analysis

To analyze respondents' willingness to pay for and participate in disaster management, mean values were derived according to groups based on gender, age, education level, and income. These results are presented in Table A1.

Figure 1 shows the differences between groups' mean values for willingness to pay. Females exhibited a higher score as compared to males. However, this difference was not statistically significant (F-value = 0.988,  $p$ -value = 0.320). By age group, the 40s group had the highest willingness to pay, followed by those in their 50s (F-value = 2.276,  $p$ -value = 0.057). These results may have emerged because these two age groups may tend to have a better economic status as compared to others. Interestingly, the willingness to pay was higher for respondents in their 20s as compared to those in their 30s, and this difference was statistically significant. This finding reflects younger participants' sensitivity to disasters. Regarding educational level, those with a college degree exhibited a higher willingness to pay than those who had completed high school education or lower. This result suggests that individuals with a higher educational level might have access to more resources to pay for disaster management. However, it is important to note that this difference was not statistically significant (F-value = 1.116,  $p$ -value = 0.291). In terms of income, groups with a higher income were more likely to be willing to pay for disaster-related costs than those with low incomes (F-value = 4.617,  $p$ -value = 0.010). This result is similar to that observed for education because higher income suggests a higher capability to pay for such services. In terms of experience of disasters, the sample was divided into groups that had experienced either more or less disasters. Subsequently, their willingness to pay for disaster management was compared. Those with more disaster experiences had significantly higher willingness to pay as compared to those with fewer experiences (F-value = 11.066,  $p$ -value = 0.001).

Figure 2 presents findings related to participation in disaster management activities. Women were more likely to be willing to participate as compared to men, and this difference was statistically significant. This result suggests that women may be more cooperative in a disaster situation (F-value = 3.119,  $p$ -value = 0.078). Similarly, the participation rate was higher among older age groups than among younger ones (F-value = 4.406,  $p$ -value = 0.002). This result is different from that observed for willingness to pay. Regarding educational level, college graduates exhibited a higher tendency to participate in disaster management activities as compared to high school graduates (F-value = 1.557,  $p$ -value = 0.212). This finding is similar to that regarding willingness to pay. Similarly, high-income groups showed higher participation intention than low-income groups did, and the difference was statistically significant (F-value = 3.288,  $p$ -value = 0.038). Finally, those with more disaster experience exhibited a higher participation intention as compared to those with less experience (F-value = 8.592,  $p$ -value = 0.001).

Significant statistical differences were observed in individuals' willingness to pay for and participate in disaster management based on age, income, and education level. Groups with higher income and education expressed a higher willingness to pay and to participate as compared to their counterparts. However, payment and participation intentions showed different structures with reference to age groups. While participation intention tended to increase with age, there was no linear difference in the case of payment intention. One interesting finding was that the overall mean for participation intention was higher than that for willingness to pay. This implies that expressing cooperation with disaster management through payment may be more difficult than doing so through participation.

Next, to examine the relationships between variables, a simple correlation analysis was performed. The results are presented in Table 2. One remarkable finding was that the simple correlation coefficient between willingness to pay and willingness to participate was not very high (0.374). This suggests that the two variables have very different attributes.

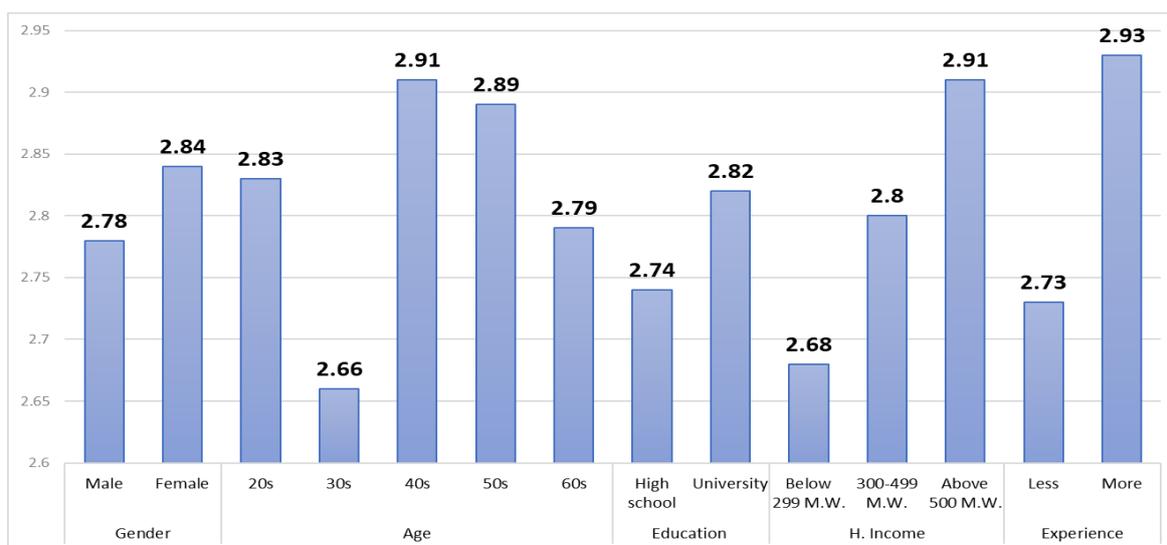


Figure 1. Mean scores for willingness to pay for disaster management.

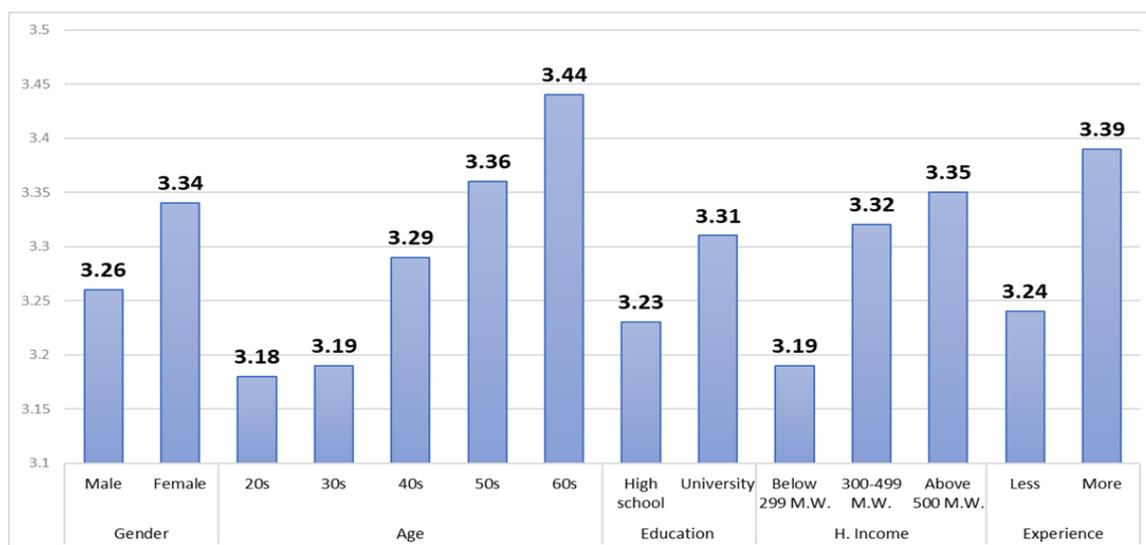


Figure 2. Mean scores for intention to participate in disaster management.

With reference to factors from the psychometric paradigm, perceived risk was positively correlated with willingness to pay and to participate, but these findings were not statistically significant. Knowledge was positively correlated with willingness to pay and to participate, with the latter having a higher correlation coefficient than the former. This suggests that knowledge of disaster management could be a stronger basis for participation in related activities. Stigma did not have a statistically significant correlation with willingness to pay or to participate. This finding suggests that although perceived risk and stigma share the same attributes such as being risky and negative, they have some limits in inducing citizens’ cooperation by invoking fear and negative images.

Among resource variables, health status was positively correlated to willingness to pay and to participate, with a higher coefficient for the latter than for the former. This finding was expected because health status is the basic premise for activity and participation. Economic affordability was positively correlated with both intentions, but the correlation with willingness to pay was higher than that with intention to participate. Again, this finding was expected because willingness to pay requires adequate economic capacity. Social networks were positively correlated to willingness to pay and to participate. From a social perspective, this suggests that citizens’ human capital could be a resource for inducing collaborative action. Particularly, as the correlation was stronger for intention to

participate as compared to willingness to pay, it is suggested that social networks, such as social cohesion and solidarity, could be the basis of participation in disaster management. Similarly, social capital had a statistically significant correlation with payment and participation intentions, with a stronger correlation with the latter as compared to that with the former. This finding shows the importance of human resources to elicit cooperation during disaster management. The correlation of neighborhood environment with willingness to pay was higher than that with participation intention. This may be because the neighborhood environment reflects the respondents' economic level directly or indirectly.

When examining the overall structure of the correlations, it was evident that the perceived risk and stigma variables did not have a significant relationship with the two intentions, and that all other variables had a significant relationship with them. Further, willingness to pay was highly correlated with trust, economic affordability, and neighborhood environment, while participation intention was highly correlated with knowledge, health status, social network, and social capital. This suggests that different factors may induce willingness to pay for and participate in disaster management. Furthermore, trust, social capital, economic affordability, and neighborhood environment were correlated with willingness to pay, respectively. On the other hand, the order of the variables that were the most highly correlated with intention to participate was as follows: social capital, knowledge, social network, and trust. This difference in the structure and order of coefficients suggests that different levels of managerial emphasis should be placed on these factors when inducing payments toward and participation in disaster management.

**Table 2.** Simple correlations.

Variables	1	2	3	4	5	6	7	8	9	10
1. Intention to pay	1									
2. Intention to participate	0.374 ***	1								
3. Perceived risk	0.045	0.006	1							
4. Knowledge	0.188 ***	0.309 ***	-0.018	1						
5. Trust	0.466 ***	0.248 ***	-0.082 **	0.261 ***	1					
6. Stigma	-0.022	0.05	0.160 ***	-0.024	-0.197 ***	1				
7. Health status	0.125 ***	0.198 ***	-0.018	0.304 ***	0.154 ***	-0.02	1			
8. Economic affordability	0.257 ***	0.222 ***	-0.04	0.311 ***	0.207 ***	0.002	0.452 ***	1		
9. Social network	0.223 ***	0.284 ***	-0.046	0.357 ***	0.131 ***	0.017	0.343 ***	0.476 ***	1	
10. Social capital	0.324 ***	0.341 ***	-0.077 **	0.284 ***	0.307 ***	-0.011	0.313 ***	0.347 ***	0.540 ***	1
11. Neighborhood environment	0.246 ***	0.166 ***	-0.130 ***	0.239 ***	0.238 ***	-0.045	0.253 ***	0.448 ***	0.426 ***	0.362 ***

Note: \*, \*\*, and \*\*\* represent 10%, 5%, and 1% significance levels, respectively.

#### 4.2. Regression Analysis

To analyze the causal structure of willingness to pay and to participate, a regression analysis was conducted by setting these two variables as dependent variables. Demographic variables such as gender, age, education level, and income were entered as dummy variables. The reference groups were male, aged under 30 years, high school graduates, and those with a household income of below 5 million won.

As evident from Table 3, women were more willing to pay than men, and so were high-household income groups (with more than 5 million won) as compared to low-income groups. On the other hand, those in their 30s and 60s exhibited poorer payment intentions as compared to those in their 20s.

High school degree holders showed a lower willingness to pay than those who had a college degree or higher. Finally, those with more experiences of disasters exhibited a higher willingness to pay as compared to their less experienced counterparts. However, except for gender and disaster experience, the regression coefficients were not statistically significant for any other demographic variable.

Among variables in the risk perception paradigm, perceived risk, trust, and stigma had a positive impact on willingness to pay, whereas knowledge had a negative impact on it. Among the four variables, perceived risk and trust showed significant regression coefficient values. Particularly, trust had the largest standardized regression coefficient, suggesting that increasing trust in the government may be a critical factor in inducing individuals' cooperation.

Regarding resource variables, health status had a negative effect on payment intention, whereas economic affordability, social network, social capital, and neighborhood environment had a positive impact on it. However, only economic affordability, social capital, and neighborhood environment had statistically significant regression coefficients. Specifically, the standardized regression coefficient for social capital was the largest among the three predictors, suggesting that willingness to pay may not merely be a matter of economic capacity to pay.

When looking at the overall model for willingness to pay, trust had the strongest explanatory power, as evidenced by the standardized regression coefficient, followed by social capital, economic affordability, perceived risk, and disaster experience. This order suggests that willingness to pay is influenced not only by psychological but also by economic and empirical factors. The overall explanatory power of the model was 27.9%, suggesting that additional variables need to be factored in to create a better model.

**Table 3.** Results of the linear regression analysis for willingness to pay for disaster management.

Factor	Variable	B	S.E.	Beta	T-Value	Sig.
Socio-demographic factor	Constant	−0.146	0.258		−0.564	0.573
	Gender	0.091	0.052	0.053	1.750	0.080
	Age 30–40	−0.062	0.071	−0.035	−0.872	0.384
	Age 50–60	−0.062	0.072	−0.035	−0.857	0.392
	Income	0.078	0.063	0.038	1.242	0.215
	Education	−0.005	0.072	−0.002	−0.069	0.945
	Experience	0.068 *	0.032	0.067	2.136	0.033
Psychometric paradigm factor	Perceived risk	0.084 **	0.032	0.082	2.636	0.009
	Knowledge	−0.006	0.044	−0.005	−0.139	0.889
	Trust	0.442 ***	0.035	0.405	12.494	0.000
	Stigma	0.047	0.036	0.039	1.296	0.195
Resource factor	Health status	−0.061	0.040	−0.054	−1.544	0.123
	Economic affordability	0.094 *	0.043	0.083	2.182	0.029
	Social network	0.050	0.050	0.039	0.996	0.319
	Social capital	0.198 ***	0.050	0.146	3.951	0.000
	Neighborhood environment	0.068	0.040	0.058	1.682	0.093
F-Value/R2/Ad. R <sup>2</sup>				23.100 ***/0.291/0.279		

Note: \*, \*\*, and \*\*\* represent 10%, 5%, and 1% significance levels, respectively.

Table 4 shows the determinants of participation intention. First, the significant demographic variables were gender and age. Women were more willing to participate than men, and those in their 30s or older were more likely to exhibit participation intention than those in their 20s. Further, the 50s and above groups showed the largest standardized coefficients for willingness to participate. Further, it is worth noting that, in terms of statistical significance, older respondents expressed the willingness to participate but did not have the willingness to pay.

In the psychometric paradigm, knowledge, trust, and perceived risk had a significant positive impact on participation intention. Specifically, the high coefficient for knowledge and trust suggested that these two factors should be considered when developing efforts to induce participation.

Regarding resource variables, social network and social capital had a statistically significant positive impact on participation intention. The large coefficient for social capital suggests the importance of strengthening social cohesion and solidarity to facilitate citizens' participation.

In the overall model for participation intention, knowledge had the largest regression coefficient, followed by social capital, age, trust, and social network. These findings suggest that psychological and social factors should be considered simultaneously in order to induce participation in disaster management.

The following commonalities and differences emerged when the two models of willingness to pay and to participate were compared. Gender, trust, and social capital had a common influence on willingness to pay and to participate. However, while experience, perceived risk, economic affordability, and neighborhood environment affected willingness to pay, age, knowledge, stigma, and social network affected intention to participate. In terms of the explanatory power based on standard regression coefficients, willingness to pay was explained by trust, social capital, economic affordability, perceived risk, and disaster experience, respectively, while participation was explained by knowledge, social capital, age, trust, and social network, respectively. These findings suggest that, while a strategic approach that emphasizes trust and social capital could facilitate both intentions, that which emphasizes economic affordability, perceived risk, and experiences would facilitate willingness to pay, while that which emphasizes knowledge and social network would aid participation intention. Finally, the explanatory power of the model for willingness to pay was 27.9%, and that of the model for participation intention was 20.2%. These low values indicate the need to include additional explanatory variables in these models.

**Table 4.** Results of the linear regression analysis for intention to participate in disaster management.

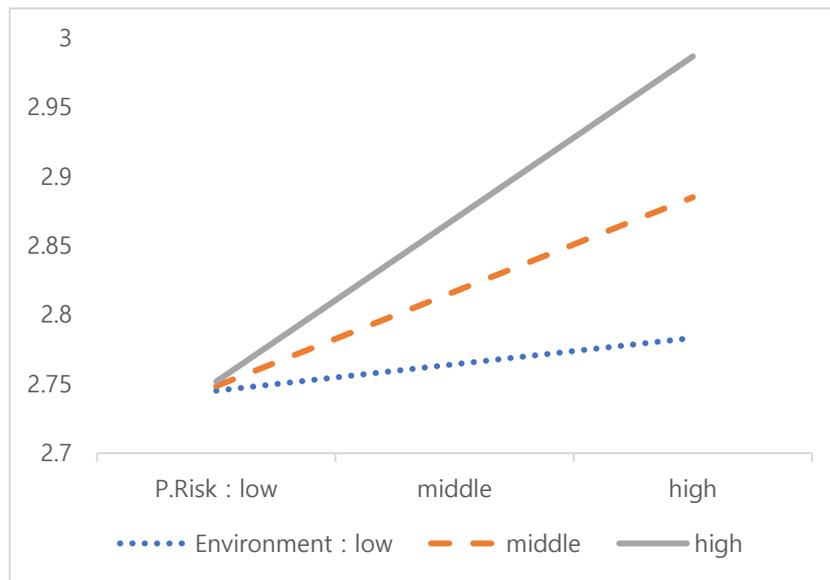
Factor	Variable	B	S.E.	Beta	T-Value	Sig.
Socio-demographic factor	Constant	0.477 *	0.231		2.065	0.039
	Gender	0.148 *	0.047	0.101	3.168	0.002
	Age 30–40	0.116	0.064	0.077	1.821	0.069
	Age 50–60	0.231 ***	0.065	0.155	3.569	0.000
	Income	−0.073	0.056	−0.042	−1.294	0.196
	Education	0.052	0.064	0.026	0.801	0.423
	Experience	0.031	0.029	0.036	1.093	0.275
Psychometric paradigm factor	Perceived Risk	0.031	0.029	0.036	1.098	0.272
	Knowledge	0.192 ***	0.039	0.176	4.896	0.000
	Trust	0.123 ***	0.032	0.133	3.894	0.000
	Stigma	0.061	0.032	0.060	1.881	0.060
Resource factor	Health status	0.049	0.036	0.050	1.367	0.172
	Economic affordability	0.035	0.039	0.036	0.900	0.368
	Social network	0.117 *	0.045	0.108	2.620	0.009
	Social capital	0.197 ***	0.045	0.171	4.391	0.000
	Neighborhood environment	−0.033	0.036	−0.034	−0.927	0.354
F-Value/R <sup>2</sup> /Ad. R <sup>2</sup>				15.505 ***/0.216/0.202		

Note: \*, \*\*, and \*\*\* represent 10%, 5%, and 1% significance levels, respectively.

#### 4.3. Moderation Analysis

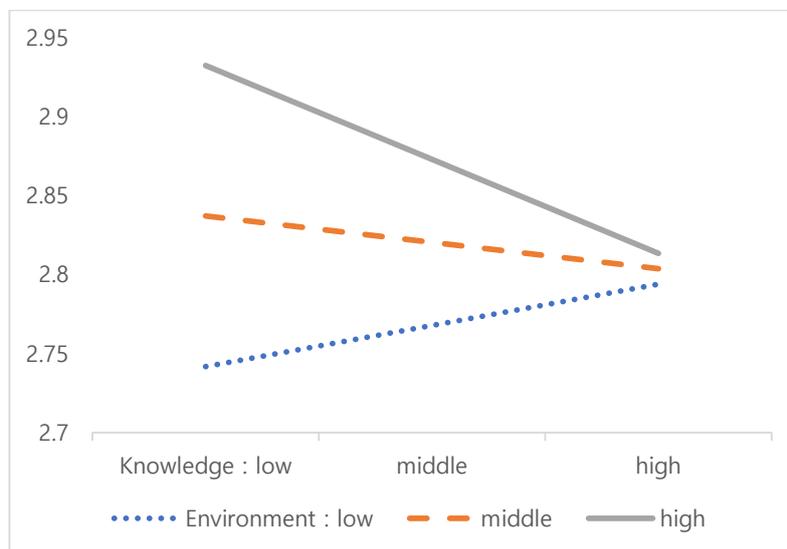
We examined if the resource factors played a moderating role in the effects of the psychometric paradigm variables on willingness to pay and to participate. Among 40 interaction terms, 6 of them showed statistical significance (see Appendix A Table A1), as displayed below in simple slope graphs.

Figure 3 shows that willingness to pay was higher when the perceived risk was higher, but this effect depended on the neighborhood environment. When the score for neighborhood environment increased, the perceived risk increased the willingness to pay. Especially in high-risk situations, the effect of the neighborhood environment on promoting payment intentions was stronger.



**Figure 3.** Perceived risk (IV) × Neighborhood environment (M) = Willingness to pay (DV). **Note:** IV (Independent Variable); M (Moderation); DV (Dependent Variable).

Figure 4 shows that the effect of knowledge on willingness to pay depended on the neighborhood environment. When the perceived quality of the neighborhood environment was high, the willingness to pay was lower when the level of knowledge was high. However, if the perceived quality of the residential environment was low, the willingness to pay increased with the increase in knowledge. These findings suggest that the perceived quality of the neighborhood environment can serve as a substitute for knowledge.



**Figure 4.** Knowledge (IV) × Neighborhood environment (M) = Willingness to pay (DV).

Figure 5 shows that the effect of trust on willingness to pay depended on the neighborhood environment. An increase in trust led to an increase in willingness to pay, but this effect was stronger when the perceived quality of the neighborhood environment was high. However, under high levels of trust, the effect of high- and low-quality neighborhood environments on the willingness to pay converged. Evidently, the role of trust was determined by the quality of the neighborhood environment, especially in the case of an environment with poor perceived quality.

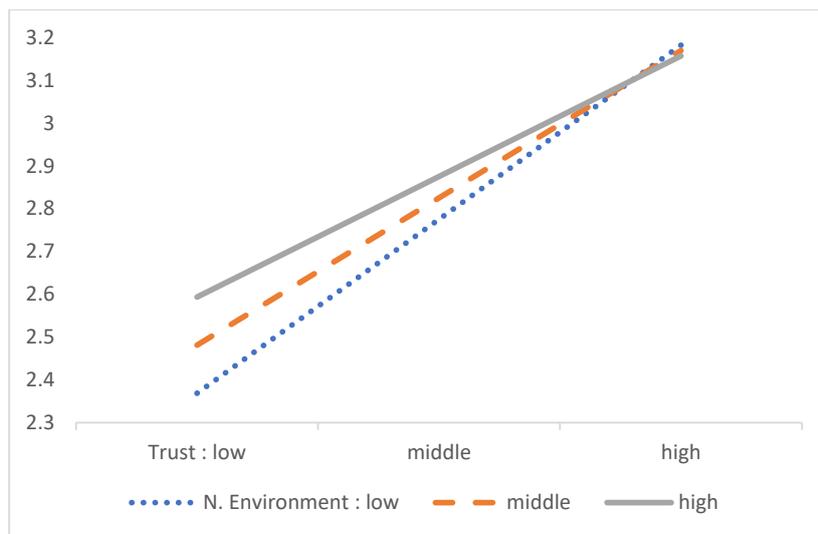


Figure 5. Trust (IV) × Neighborhood environment (M) = Willingness to pay (DV).

Figure 6 shows that social capital moderated the effect of trust on participation intention. Higher levels of trust increased willingness to participate, and this effect was strong when social trust levels were higher. Further, the higher the level of trust, the stronger the effect on participation intention was under low social capital situations. However, the effect of social capital tended to converge when trust increased. This is because the characteristics of social trust and social capital are similar, and one’s effect on participation intention may be offset by the other.

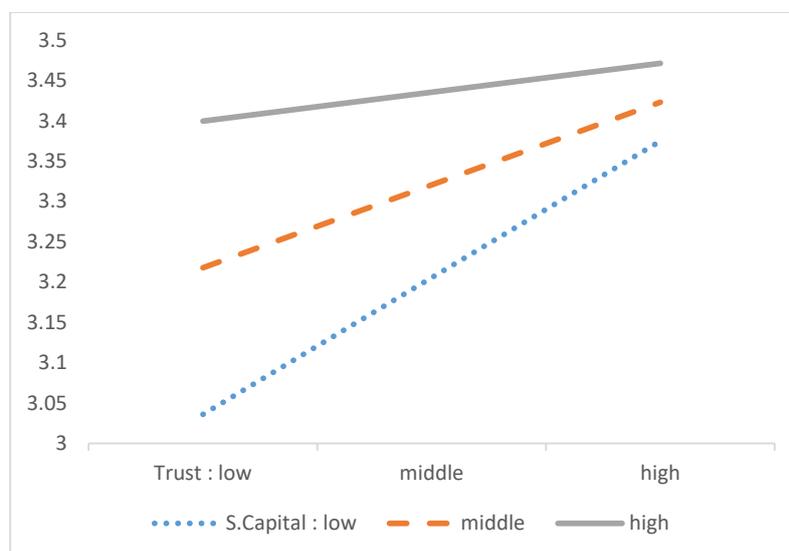


Figure 6. Trust (IV) × Social capital (M) = Intention to participate (DV).

Figure 7 shows that, as knowledge increased, the willingness to participate increased, but this relationship depended on the perceived quality of the neighborhood environment. Participation intention was more pronounced as knowledge increased when the neighborhood environment was considered to be of poor quality, as compared to when it was considered to be of high quality. Specifically, there was a wide gap in the intention to participate between high- and low-quality housing environment groups.

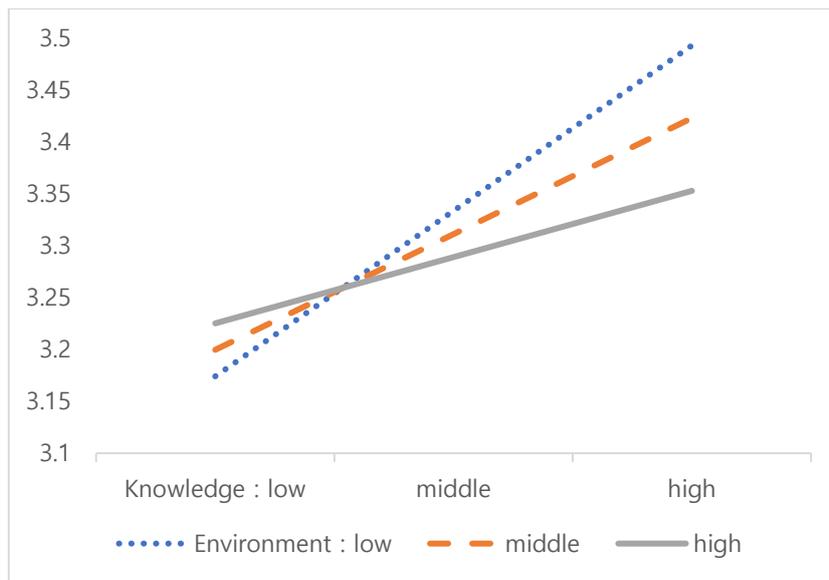


Figure 7. Knowledge (IV) × Neighborhood environment (M) = Intention to participate (DV).

Figure 8 shows that the effects of stigma depended on the perceived quality of the neighborhood environment. When the perceived quality of the neighborhood environment was low, participation increased with an increase in stigma. However, when the perceived quality of the living environment was high, participation did not increase even when the stigma increased.

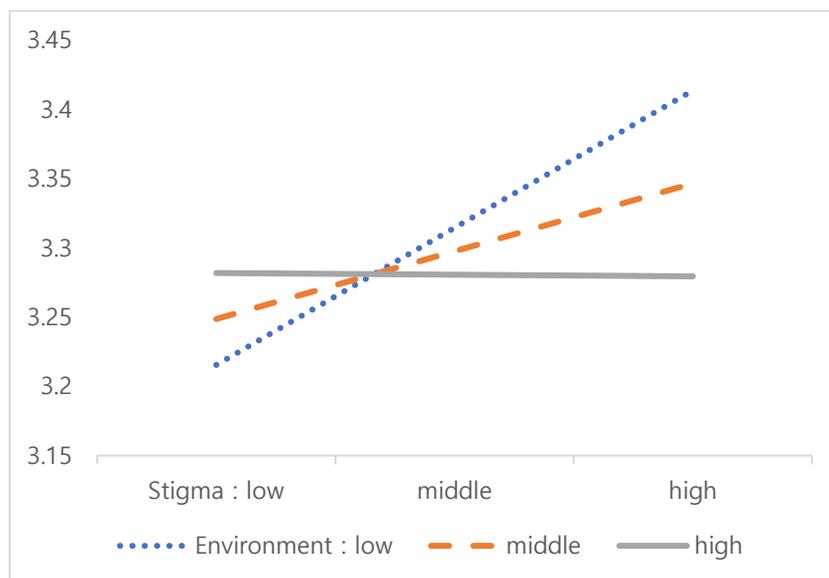


Figure 8. Stigma (IV) × Neighborhood environment (M) = Intention to participate (DV).

### 5. Conclusions and Implications

This study examined the influence of resource factors (health status, economic affordability, social network, social capital, and neighborhood environment) on willingness to pay for and participate in disaster management. Based on survey data, this study compared four variables in the psychometric paradigm with resource factors, to in turn explain variations in willingness to pay and to participate. Additionally, it highlighted the moderating role of five resource variables in the effects of the four psychometric paradigm variables on willingness to pay for and participate in disaster management. The main findings are summarized below.

First, in the case of willingness to pay the cost of disaster management, the regression analysis showed that women were more willing to pay than men, while individuals who had experienced more disasters were more willing to pay as compared to their less experienced counterparts. The psychometric paradigm variables of perceived risk and trust, and the resource variables of economic affordability, social capital, and neighborhood environment had a positive impact on willingness to pay. With reference to participation intention, women were more willing to participate than men, and those in their 30s or older were more likely to be involved than those in their 20s. In the psychometric paradigm, knowledge, trust, and perceived risk had a significant positive impact on participation intention, whereas, among resource variables, social network and social capital had a statistically significant positive impact on participation intention. Evidently, gender, trust, and social capital influenced both intentions.

Our findings show that willingness to pay is influenced not only by psychological but also by resource factors. These findings suggest that psychological and social-structural factors should be considered simultaneously when devising efforts to induce payment toward and participation in disaster management.

Second, in terms of the explanatory power based on standardized regression coefficients, willingness to pay was explained by trust > social capital > economic affordability > perceived risk > disaster experience, while participation intention was explained by knowledge > social capital > age > trust > social network. These findings suggest that a strategic approach that emphasizes trust and social capital, economic affordability, perceived risk, and disaster experiences could facilitate willingness to pay, while that which emphasizes knowledge and social network could aid participation intention.

Third, based on the F-values, the statistical significance of the two models was confirmed. However, the explanatory power of the two models was 27.9% and 20.2%, respectively, suggesting that additional variables need to be considered to increase the explanatory power of these models.

Fourth, we analyzed whether the resource factors played a moderating role in the effects of variables in the psychometric paradigm on willingness to pay and to participate. Perceived risk, knowledge, and trust affected willingness to pay, but this effect depended on the perceived quality of the neighborhood environment. When risk perceptions were high, willingness to pay increased, which was further facilitated by the perception of a good neighborhood environment. Knowledge affected willingness to pay more strongly when the quality of the neighborhood environment was considered poor. Trust increased willingness to pay, but when trust increased, the impact of neighborhood conditions converged. Trust, knowledge, and stigma affected participation intention, but these effects depended on social capital and neighborhood environment. Participation was higher when trust in the government was strong, but this effect was stronger when social capital was high. Knowledge and stigma increased participation intention, but this effect was stronger when the quality of the neighborhood was considered to be low.

In short, this study identified the structural determinants of willingness to pay for and participate in disaster management. The practical implications of this study are as follows.

First, trust in the government and social capital are the most important factors that promote willingness to pay for and participate in disaster management. Restoring trust in the government requires transparent disclosure of information, control of corruption, fast responsiveness to citizens, and strengthened government competence. Social capital, on the other hand, can be improved by conducting more community activities and programs for citizens or local organizations [78–83].

Second, different approaches need to be implemented to increase willingness to pay and to participate. While perceived risk, economic affordability, and neighborhood environment should be emphasized to induce payment intention, on the other hand, knowledge, stigma, and social network should be stressed to increase participation. However, it is important to consider that there is a limit to the extent to which all these variables could be improved. For example, it is difficult to adopt measures to increase economic affordability through government expenditure considering financial limitations.

Moreover, based on the payment amount, there is also a limit in terms of whether or not payment intention would be influenced by the amount of payment being requested from the participants.

Third, policy mixes are needed to increase the willingness to pay and to promote participation. For example, willingness to pay could be increased by implementing a strategy that enhances the quality of the neighborhood environment while simultaneously emphasizing perceived risk, knowledge, and trust. To induce participation, a strategy that combines social capital and neighborhood environment with trust, knowledge, and stigma could be effective. Therefore, it is necessary to develop a strategy to combine several policy instruments.

One of the limitations of this study is that some measures have low reliability; stigma showed a reliability in the Cronbach's alpha test of lower than 0.7. Second, since we focused only on perceptions and attitudes, sets of values were dismissed. Since there are various values and cultures [84–86], the role of values in payment and action intentions needs to be examined. Third, we did not analyze the contextual or communicational dimensions or the relationships between various perceptions [87–94].

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**Conflicts of Interest:** The authors declare no conflicts of interest.

## Appendix A

Table A1. The eight significant interaction terms in regression analysis.

Figure 1. N. Environment × Perceived risk = Willingness to pay							Figure 2. N. Environment × Knowledge = Willingness to pay						
	B	SE	beta	B	SE	beta		B	SE	beta	B	SE	beta
N. Environment	0.068	0.040	0.058	0.070	0.040	0.061	N.Environment	0.068	0.040	0.058	0.071	0.040	0.061
Perceived Risk	0.084 **	0.032	0.082	0.080*	0.032	0.079	Knowledge	−0.060	0.044	−0.050	−0.025	0.043	−0.019
Interaction Term				0.079*	0.039	0.061	Interaction Term				−0.085 *	0.043	−0.058
F-value	23.100 ***			23.195 ***			F-value	23.100 ***			23.183 ***		
R <sup>2</sup> square	0.291			0.292			R <sup>2</sup> square	0.291			0.292		
R <sup>2</sup> square Change				0.001			R <sup>2</sup> square Change				0.001		
Simple Slope Test	Low	B = 0.0227 se = 0.0431 t = 0.5275					Simple Slope Test	Low	B = 0.0387 se = 0.0517 t = 0.7480				
	Middle	B = 0.0814 ** se = 0.0319 t = 2.5514						Middle	B = −0.0247 se = 0.0434 t = −0.5701				
	High	B = 0.1400 ** se = 0.0431 t = 3.2458						High	B = −0.0881 se = 0.0559 t = −1.5769				
Effect Size	0.002					Effect Size	0.002						
Figure 3. N. Environment × Trust = Willingness to pay							Figure 4. Social capital × Trust = Intention to participate						
	B	SE	beta	B	SE	beta		B	SE	beta	B	SE	beta
N. Environment	0.068	0.040	0.058	0.067	0.040	0.058	Social Capital	0.197 ***	0.045	0.171	0.180 ***	0.045	0.156
Trust	0.442 ***	0.035	0.405	0.435 ***	0.035	0.399	Trust	0.123 ***	0.032	0.133	0.129 ***	0.032	0.139
Interaction Term				−0.106 *	0.041	−0.076	Interaction Term				−0.133 **	0.039	−0.106
F-value	23.100 ***			23.442 ***			F-value	15.505 ***			15.615 ***		
R <sup>2</sup> square	0.291			0.294			R <sup>2</sup> square	0.216			0.217		
R <sup>2</sup> square Change				0.003			R <sup>2</sup> square Change				0.001		
Simple Slope Test	Low	B = 0.5137 *** se = 0.0446 t = 11.5192					Simple Slope Test	Low	B = 0.2139 *** se = 0.0413 t = 5.1855				
	Middle	B = 0.3438 *** se = 0.0355 t = 12.2539						Middle	B = 0.1296 *** se = 0.0317 t = 4.0867				
	High	B = 0.3558 *** se = 0.0489 t = 7.2812						High	B = 0.3452 se = 0.0395 t = 1.1438				
Effect Size	0.005					Effect Size	0.003						

Table A1. Cont.

Figure 5. N. Environment × Knowledge = Intention to participate							Figure 6. N. Environment × Stigma = Intention to participate						
	B	SE	beta	B	SE	beta		B	SE	beta	B	SE	beta
N. Environment	0.068	0.040	0.0580	−0.030	0.036	−0.030	N. Environment	0.068	0.040	0.058	−0.023	0.036	−0.023
Knowledge	−0.006	0.044	−0.050	0.165 ***	0.039	0.152	Stigma	−0.088**	0.036	0.039	0.068*	0.032	0.067
Interaction Term				−0.095*	0.039	−0.076	Interaction Term				−0.083*	0.038	−0.078
F-value	23.100 ***			15.172 ***			F-value	23.100 ***			15.176 ***		
R <sup>2</sup> square	0.291			0.213			R <sup>2</sup> square	0.291			0.213		
R <sup>2</sup> square Change				−0.078			R <sup>2</sup> square Change				−0.078		
Simple Slope Test	Low	B = 0.2358 *** se = 0.0464 t = 5.0797					Simple Slope Test	Low	B = 0.1372 ** se = 0.0416 t = 3.2974				
	Middle	B = 0.1652*** se = 0.389 t = 4.2415						Middle	B = 0.0678 * se = 0.323 t = 2.0952				
	High	B = 0.0945 se = 0.0502 t = 1.8832						High	B = 0.0016 se = 0.0440 t = −0.0373				
Effect Size				−0.26			Effect Size				−0.26		

Note: \*, \*\*, and \*\*\* represent 10%, 5%, and 1% significance levels, respectively.

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