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Effects of Disaster Inequality on Disaster Anxiety of Citizens and Trust in the National Disaster Management System

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Abstract

Background/Objectives: The COVID-19 situation has changed the perception of the people regarding the cause of the disaster and the national management system. The purpose of this study is to analyze quantitatively the effects of disaster inequality on disaster anxiety of citizens and trust in the national disaster management system through structural equation model (SEM).

Methods/Statistical analysis: For this purpose, we collected input data for observed variables explaining 3 latent ones (Disaster Inequality, Disaster anxiety, Trust in the national disaster management system) in SEM from questionnaire of 951 adults and did the model building and analysis by using AMOS 21. Based on the research model, three hypotheses were established and verified with SEM.

Findings: As a result of the CFA (Confirmatory Factor Analysis) of the SEM, the fitness index was found to be suitable as TLI=0.814, GFI=0.922, and CFI=0.876, and the validity index was valid as AVE=0.53 and CR=0.76. As a result of this study, it was proved that the higher the disaster inequality, the higher the disaster anxiety and the lower the trust in the national disaster management system. On the other hand, the higher the trust in the national disaster management system, the lower the disaster anxiety.

Improvements/Applications: In order to reduce disaster anxiety, it is necessary to manage disaster inequality at the government level, and it is necessary to instill faith in disaster management in the people. In the future, it will be more meaningful study if you get and use new data after the end of COVID-19.

Keywords: COVID-19, Disaster Inequality, Disaster Management System, Disaster Anxiety, Structural Equation Modelling (SEM).

1. Introduction

COVID-19, which occurred in Wuhan, China in 2019, was prevalent around the world and the WHO (World Health Organization) declared pandemic. Each country is responding to COVID-19, and many people are still dead or under treatment. Article 34 of the Constitution of the Republic of Korea stipulates as the state the entity that should strive to prevent disasters and protect the people from threats, and accordingly, Disaster Management is the primary responsibility of the government and local governments. Academically, the general characteristics of disasters are uncertainty, accumulation, and complexity [1]. Among them, uncertainty is considered to represent the characteristics of disasters. Historically, in the case of national disasters such as droughts, floods, and infectious diseases, states are primarily responsible for such national disasters, and failure to adequately respond to them can severely damage national management. In 2014, the poor response of government to the Sewol ferry accident had a huge impact on the government's trust. In addition, disasters affect all people in a country, but the degree to which they are stabilized by coping with them has inequality depending on income and class. This phenomenon, described as Disaster Inequality, requires efforts to resolve in the financial or institutional direction of the state and local governments. To prevent the spread of COVID-19,

restrictions on assembly, infringement of religious freedom and business are becoming issues. In particular, the issue of the emergency relief grant for revitalization of the economy caused a lot of controversy in terms of selecting recipients. Like this, the COVID-19 situation has changed the perception of the people regarding the cause of the disaster and the national management system, disaster inequality became an important issue to be solved in the disaster stabilization stage. The purpose of this study is to verify that the effect of disaster inequality on the people's disaster anxiety and trust in the disaster management system through the structural equation model.

2. Literature Review

2.1. *Disaster and Disaster Management*

Disasters are defined as those that can damage or harm the lives, bodies, property of the people, and the country. Disasters are classified into natural disasters such as typhoons and floods, and social disasters such as fires, explosions, and traffic accidents [2]. Social disasters include infectious diseases, livestock infectious diseases, and particulate matter. The characteristics of these disasters are difficult to define accurately because they change quantitatively and qualitatively with the passage of time and environment [3]. However, as explained in the introduction, disasters have basic characteristics of uncertainty, accumulation, and complexity. And from the perspective of disaster management, it includes the possibility of proactive prevention and management before the occurrence of a disaster. There is Heinrich's Law as a theory related to proactive prevention. The theory is that fatal errors or disasters in a system or organization arise from small errors or signs in advance, and damage can be reduced or eliminated if appropriately taken in advance [4]. In addition, there is a 1:10:100 rule applied by FedEx in the USA. If an accident or error sign is initially recognized and corrected, it incurs a cost of 1, but if action is taken later, it can cost 10 to 100.

Disaster management is defined as a series of processes that prevent and prepare for damage to people's lives, bodies, property and countries, and reduce damage through rapid response and recovery for disasters that have already occurred [5]. In general, disaster management consists of three basic steps expressed as “prevention and preparation-response-recovery”, of which the follow-up management is “response-recovery”. Most countries, including Korea, have the following basic concepts of disaster management and apply them [6]. First, disaster management have to be carried out at the level of the entire national organization, not only the national central government but also local governments. Second, centralized response is more effective than decentralized management. Third, participation and cooperation from not only the public sector but also the private sector is required.

2.2. *Disaster Inequality*

Disaster inequality is the concept that disasters are given equally to everyone, but are not fair at the stage of responding and stabilizing them [7]. In general, when responding to and recovering from a disaster, benefits are mainly given to a small number of powerful and wealthy people, so most of the people have no choice but to have an antipathy on the national policy and doubt the leadership of the leader [8]. As shown in Table 1, after a national disaster occurred, it was found that the vulnerable groups are receiving more damage in the process of responding or normalization at the national level, and precautionary measures were insufficient [7, 9].

Table 1: Korea and foreign cases of disaster inequality

Category	Year	Disaster	Contents of inequality

Korea	2014	Sewol ferry incident	-Pursuing business interests rather than passenger safety -Transfer of responsibility to part of the country and the company's fault rather than the responsibility of the entire country
	2018	MERS	-Lack of consideration for the socially weak -Differences in awareness of disaster situations due to the income gap and the resulting informatization level difference
Foreign	2005	Hurricane Katrina, USA	-Relatively, black and poor residents suffer more serious damage than wealthy people -In the process of overcoming a disaster, the social recovery of the vulnerable is slow
	2011	Sendai earthquake and tsunami, Japan	-Disaster information and information on the use of shelters are disadvantageous to the vulnerable -The medical system is operated mainly for the wealthy and urban areas

3. Research Design and Method

As shown in Figure 1, it is assumed that since the state has the primary responsibility for national disasters, if the disaster inequality (A) increases, the trust in the national disaster management system (B) will decrease (H1). In addition, since disaster inequality (A) is directly related to citizens' anxiety about disaster (C), the relationship between the two can be assumed to have a positive correlation (H2). On the other hand, it may be assumed that if the trust in the national disaster management system (B) increases, the anxiety that people feel about a disaster (C) decreases (H3).

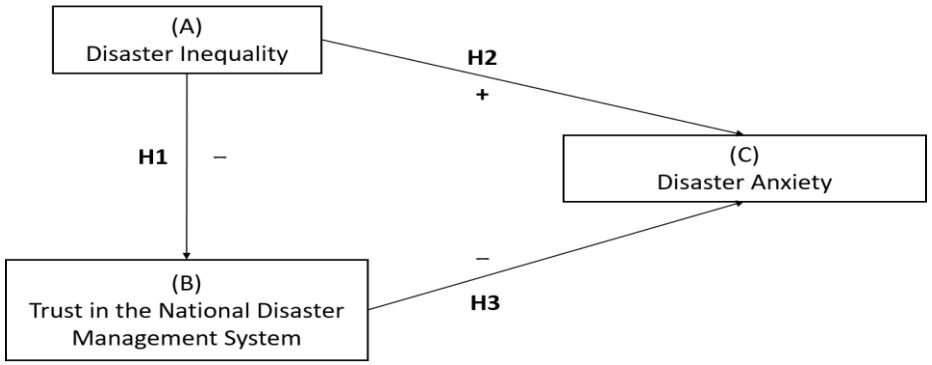

Figure 1. Basic research model and hypotheses

The structural equation model is one of the statistical techniques that statistically identifies the causal relationship between variables related to the research purpose in non-experimental environments (e. g. surveys, etc.) [10]. In Figure 1, A, B, and C are latent variables, and each latent variable is composed of several observed variables. In general, there is a top-down study for setting the lower observed variable after the latent variable is defined, and a bottom-up study for setting the latent variable by grouping them in a similar concept when the observed variables are investigated in advance.

In this study, the bottom-up study was used. SPSS 25 and AMOS 21 were used to create a path diagram of the SEM (Structural Equation Modeling), connect with numerical observed variables, and perform statistical analysis. Observed variables in this study were the results of the survey of "Solutions for Unfairness of Disasters and Social Integration Strategy" conducted by the KIPA (Korea Institute of Public Administration) in 2018 for 951 adults in their 20s or older as shown in Table 2, and three for each latent variable were selected. Data was surveyed on a 6-point Likert scale, and the closer to 6 points, the higher the level of positivity for the observed variable question is interpreted. After receiving approval from the relevant institution, raw data of the survey for input into SPSS was used.

Table 2: Subjects for questionnaire

Category		Numbers
Gender	Male	520
	Female	431
Age	20s	149
	30s	197
	40s	245
	50s	209
	60s or older	151

4. The Descriptive Statistics and Correlation Analysis

The descriptive statistics of the latent and observed variables are shown in Table 3. Examining the mean of the observed variables, the independent variables A1, A2, and A3 items of disaster inequality (A) showed an average of 4.231 ~ 4.285 (SD = 0.993 ~ 1.300) out of 6 points. The dependent variable, C1, C2, and C3 questions of disaster anxiety (C) showed an average of 3.117 ~ 4.660 (SD = 0.849 ~ 1.071) out of 6 points. The parameters B1, B2, and B3 of the trust in the national disaster management system (B) showed an average of 2.853 ~ 3.630 (SD = 0.933 ~ 1.033) out of 6 points. As shown in Table 3, Korean recognize that disaster inequality is high (B < C < A) and that it has overall disaster vulnerability in society (C3). There is no abnormality in multivariate normality because both skewness and kurtosis are within acceptable levels (skewness: within absolute value 2, kurtosis: within absolute value 7) [11]. Therefore, it was confirmed that it is not unreasonable to use the structural equation model.

Table 3: Descriptive statistics of latent and observed variables

Latent Var.	Observed Var.	Ave. (SD)	Skew.	Kurt.
Disaster Inequality **(A)**	Disaster frequency is unevenly occurring according to income level, class, group, and region **(A1)**	4.262 (1.300)	-0.494	0.324
	Disaster damage is unevenly occurring according to income level, class, group, and region **(A2)**	4.231 (0.993)	-0.450	0.508

	Distribution of resources is based on regionalism, school relations, and kinship **(A3)**	4.285 (1.128)	-0.474	0.085
Trust in the National Disaster Management System **(B)**	Disaster management level in the public sector **(B1)**	2.853 (1.033)	0.246	-0.208
	Reliability of disaster information provided by the public sector **(B2)**	3.630 (0.970)	-0.424	0.472
	Communication between the government and localities **(B3)**	3.092 (0.933)	-0.073	0.231
Disaster Anxiety **(C)**	The possibility of a natural disaster occurring in you **(C1)**	3.117 (1.071)	0.328	-0.126
	The possibility of social disaster occurring in you **(C2)**	3.356 (1.033)	0.138	-0.096
	Degree of overall disaster vulnerability in society **(C3)**	4.660 (0.849)	-0.426	0.353

Also, in the structural equation model, the thing to check before executing the model is the correlation of the observed variables within the latent variable. In other words, several observed variables included in one latent variable must have a significant positive correlation to explain the latent variable. Note that the observed variable does not necessarily have a positive correlation with other latent variables. The results of the correlation analysis of the observed variables are shown in Table 4. The three observed variables within each latent variable had a statistically significant positive correlation at the significance level of 0.01.

Table 4: Correlation analysis between observed variables in latent variables

Observed Var.	A1	A2	A3	B1	B2	B3	C1	C2	C3
A1	1	0.777**	0.437**	-0.114**	-0.129**	-0.130**	0.120**	0.174**	0.374**
A2		1	0.467**	-0.138**	-0.135**	-0.160**	0.097**	0.156**	0.363**
A3			1	-0.272**	-0.274**	-0.195**	0.091**	0.113**	0.412**
B1				1	0.562**	0.509**	-0.106**	-0.118**	-0.404**
B2					1	0.487**	-0.122**	-0.146**	-0.294**
B3						1	-.111**	-0.095**	-0.260**
C1							1	0.611**	0.255**
C2								1	0.273**
C3									1

* p < .05, ** p < .01

5. Research Results

5.1. *Confirmatory Factor Analysis*

Since the collected data are suitable to be applied to the structural equation model, a measurement model for confirmatory factor analysis (CFA) was constructed as shown in Figure 2 using AMOS 21. In the structural equation, before examining the influence between variables through the analysis of the structural model, it is necessary to evaluate whether the concepts included in the research

model are properly estimated. This is to examine whether the measurement model is suitable for constructing a structural model through measurement model analysis. Therefore, the variables of disaster inequality (A), disaster anxiety (C), and trust in the national disaster management system (B) were analyzed through a measurement model. Through this analysis, it was confirmed whether one or more coefficients showed very large errors, negative values such as negative error variance, excessively irrational estimates, or very high correlations (± more than 0.9) between the estimated coefficients [12]. As a result, no estimates were found that violated the assumptions, and all assumptions were satisfied. The statistical values representing the fit of the measurement model were GFI=0.922, CFI=0.876, and TLI=0.814. GFI (Goodness of Fit Index), CFI (Comparative Fit Index), and TLI (Tucker-Lewis Index) all have values between 0 and 1, and if it is 0.9 or higher, it is judged that the model fit is excellent, but it is judged that it is at an acceptable level even if it approaches 0.9 [13]. Therefore, the measurement model can be judged as suitable.

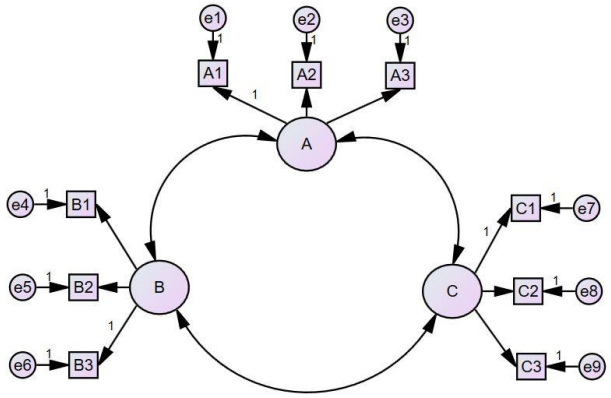

Figure 2. Measurement Model for CFA

As a result of the CFA (Confirmatory Factor Analysis), it was verified that the paths from the latent variables of disaster inequality (A), disaster anxiety (C), and trust in the national disaster management system (B) to the observed variables were all significant at the significance level of 0.05 as shown in Table 5.

Table 5: The Results of Confirmatory Factor Analysis

Latent Var.	Observed Var.	Estimate(B) * Regression Weights	S.E.	C.R.
A	A1	1.000	-	-
	A2	1.008	0.045	22.590*
	A3	0.663	0.041	16.030*
B	B1	1.222	0.074	16.413*
	B2	1.102	0.067	16.415*
	B3	1.000	-	-
C	C1	1.000	-	-
	C2	1.033	0.084	12.301*

	C3	0.413	0.041	9.954*

* p < .05, ** p < .01

5.2. *Path Analysis*

The verified measurement model was modified into a structural model and the relationship between each variable was analyzed. The fitness of the structural model was the same as that of the measurement model because there was no model change such as adding a covariance or adding a variable in the final measurement model. The validity of the structural model is judged to be valid if the AVE (Average Variance Extracted) is greater than 0.5 or the CR (Composite Reliability) is greater than 0.7 [14]. The validity of this structural model was analyzed with AVE=0.53 (>0.5) and CR=0.76 (>0.7). Figure 3 shows the final structural equation model obtained using AMOS 21. The values above the arrows represent the path coefficient (regression weights) and statistical significance.

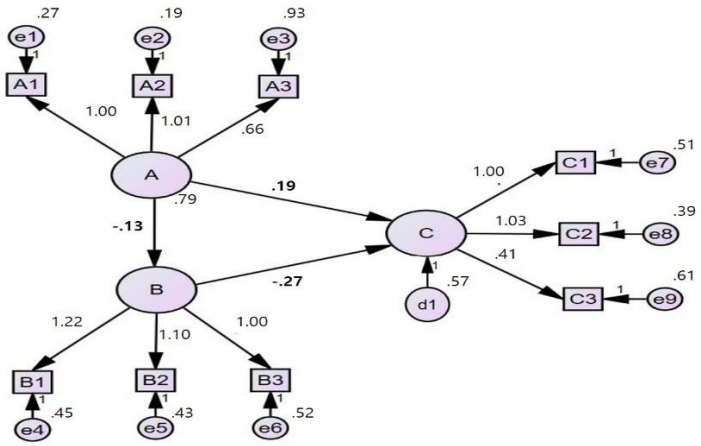

Figure 3. The Final SEM and Results

Table 6 shows the results of path analysis. Disaster inequality (A) was analyzed to have a negative (-) effect on trust in the national disaster management system (B). In other words, it was verified that the higher the disaster inequality, the lower the trust in the national disaster management system. Disaster inequality (A) has a positive (+) effect on disaster anxiety (C), while trust in the national disaster management system (B) has a negative (-) effect on disaster anxiety (C).

Table 6: The Results of Path Analysis

Path	Estimate	S.E.	C.R.
Disaster Inequality (A) → Trust in the national disaster management system (B)	-0.129	0.038	-18.854**
Disaster Inequality (A) → Disaster Anxiety (C)	0.192	0.028	-17.962**
Trust in the national disaster management system (B) → Disaster Anxiety (C)	-0.271	0.034	9.976**

* p < .05, ** p < .01

6. Conclusion

This study analyzed the effect of disaster inequality on the public's disaster anxiety and trust in the national disaster management system using a structural equation model. As a result of the study, it was verified that the higher the disaster inequality, the higher the disaster anxiety and the lower the trust in the national disaster management system. On the other hand, the higher the trust in the national disaster management system, the lower the disaster anxiety. The COVID-19 pandemic, which has been prevalent around the world since 2019, has been an opportunity for the general public as well as the government level of each country to greatly recognize the existence of disaster inequality. Therefore, to reduce disaster anxiety, it is necessary to manage disaster inequality at the government level, and it is necessary to instill faith in disaster management in the people. This study is meaningful in finding out through quantitative analysis that disaster inequality adversely affects citizen safety consciousness, but it will be more meaningful in terms of policy and academic use if the following research is conducted later. The research is needed that reflects new disaster response and changes in public consciousness using data after the COVID-19. In the future, it will be more meaningful study if you get and use new data after the end of COVID-19. In addition, it is necessary to study the causes of disaster inequality (education, region, income, age etc.).

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