Questionnaire Survey on Flood Risk Perception In Lampung Timur Regency, Lampung Province, Indonesia

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Abstract: Flood is the most common natural disaster in Lampung Timur regency. The Local Government has applied several structural workings to decrease flooding in Lampung Timur Regency. Those structural methods need some additional non-structural methods, because flood is multidimensional problem that associated with many sectors such as social, economic, physical, and environmental. Therefore, the role of risk perception is needed to reduce of disaster risk and to improve hazard mitigation. The situational factors and cognitive factors of the respondents are used to identify the influenced factors of risk perception in Lampung Timur regency. The result shows that the flood risk perception of resident in Lampung Timur regency is influenced by the following factors; age, gender, building material, length of stay, distance, risk area, and flood depth.

Keywords : *risk perception, flood, coping mechanism, government flood management*

1. INTRODUCTION

Indonesia is a hazard prone country. Indonesia is also affected by big disasters that happened nearly every year and incurred significant losses. Lampung is one of the provinces that have a high level of Disaster Prone Index. There are some types of disaster in Lampung, such as land slide, social conflicts, drought, typhoon, land fire and flood. Especially floods are the most common natural disaster because it has the highest occurrence in Lampung. In Lampung Timur which is one of the regency in Lampung Province, floods have the highest disaster risk index according to Indonesian National Board for Disaster Management's data[1].

The local government has applied several structural workings to decrease flooding in Lampung Timur Regency[2]. Those structural methods need some additional non-structural methods because floods are a multidimensional problem that associated with many sectors such as social, economic, physical, and environmental. Therefore, the role of risk perception is needed to reduce disaster risks and to improve hazard mitigations [3]

The local government of Lampung Timur Regency has applied physical developments to deal with floods in Lampung Timur Regency, such as drainage channels improvement and hazard mitigation formulating plan on their Spatial Planning on 2011-2031[2], but physical workings and structural mitigations still dominated the flood risk management.

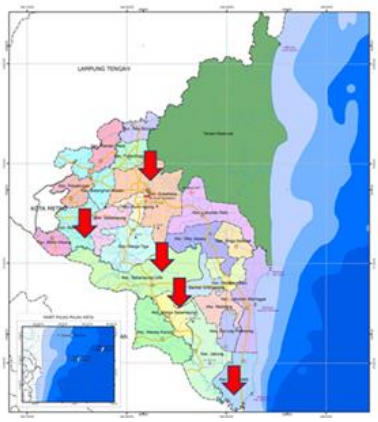

Figure 1: Study Area

It is necessary to make a disaster risk assessment in the community in Lampung Timur Regency. The assessment of the flood risk perception of residents, including the coping mechanism of the residents, has not been done yet in the study area. Therefore, this research is addressed to assess residents' perception on floods and identify the coping mechanism applied in the study area.

2. RESEARCH OBJECTIVE

The main objective of this study is to propose mitigation strategies based on the condition in the flood area. The objectives of this study are as follows:

1) To assess the resident's perception of flood disaster
2) To identify resident's coping mechanism in

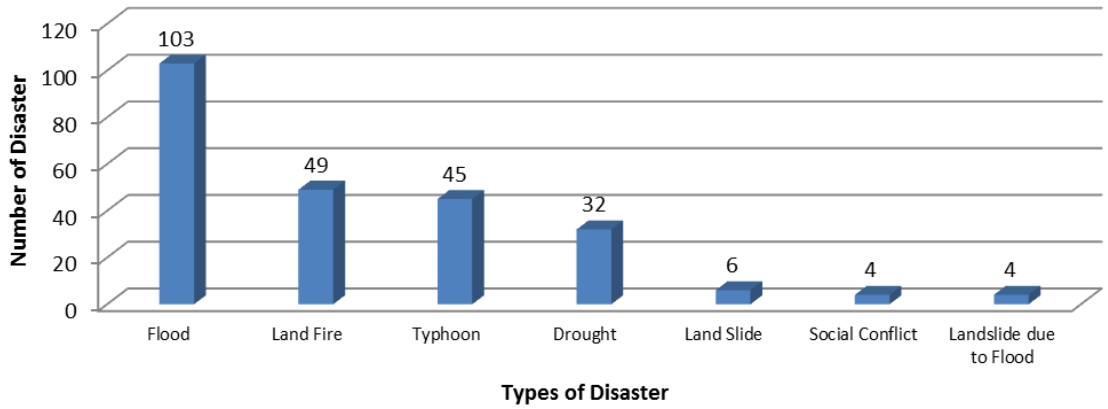

Figure 2 Information Related to The Disasters in Lampung Province

handling flood disaster.

3) To identify flood management of government in study area.

3. RESEARCH METHODOLOGY

3.1 Research Study Area

This research was conducted in Lampung Timur Regency, Lampung Province, Indonesia. From total 24 sub-districts in Lampung Timur Regency, 5 sub-districts were chosen based on the flood level of risk. For each level of flood risk was presented by one sub-district, namely Pasir Sakti sub-district (very high level), Sekampung Udik sub-district (high level), Marga Sekampung sub district (moderate level), Batanghari sub-district (low level), and Sukadana sub-district (very low level). Map of the study area can be seen in Figure 1.

3.2 Data Collection

The primary data and the secondary data were used in this research. The primary data was obtained by conducted questionnaire survey, field observation and interview. The questionnaire survey was conducted to 100 respondents who lived in the study area. Moreover, there were 20 respondents for each sub-district and the number of male and female respondents is evenly distributed. The secondary data was obtained from comprehensive literatures, relevant previous study, data from government institutions, documents and reports from the local government.

3.3 Data Analysis

The quantitative analysis was made with data obtained by the questionnaire survey. The cross tabulation, the chi square test and the correlation model are used to assess the resident's perception of the flood disaster and to identify resident's coping mechanism in handling flood disaster. The multiple regressions are used to identify the relationship between contributing factors and flood risk perception. The data were analyzed by using SPSS (Statistical Product and Service Solutions). This regression formula put the respondent's perception as the dependent variable and the contributing factors as independents variables.

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + \ldots + b_nX_n$$

Y	=	Dependent Variable (Respondent's perception)
a	=	Constants
b1, b2, b3, bn	=	coefficient of regression
X1, X2, X3, Xn	=	Independent variables (Contributing factors)

4. RESULT AND DISCUSSION

4.1. Resident's perception of flood risk disaster

The flood risk perception were measured based on the perception of threat or perception of future flooding. The chi-square test was used to determine association and difference between variables [4].

The chi-square was used to determine the difference of risk perception among the residents within five different risk level areas, but the result of the analysis could not fulfill the requirement of analysis. Therefore, in the analysis process, measurement of risk level area was divided into three areas. For the very high level risk area was assigned as high risk area and for the very low level risk area was appointed as low risk

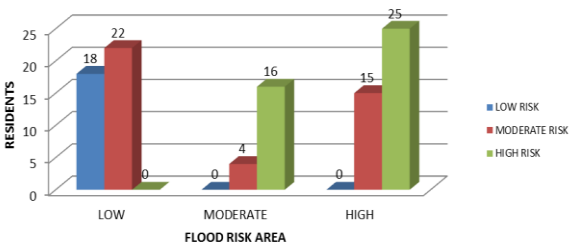

Figure 3 Distribution of Resident's Perception

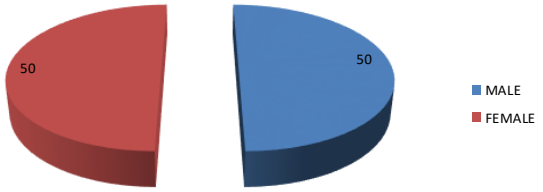

Figure 4. Distribution of respondents based on gender

area.

From the result of chi-square test, it can be inferred that the difference in the perception of the flood risk within the flood risk areas was statistically significant (X2=59.512; df=4; p=.000). The result of statistical test is probability (p)<0.05. It means that there are differences between residents' risk perceptions in each level of flood risk. Figure 3 shows the distribution of residents' perceptions for each flood risk area. Residents who live in low risk area have a perception that they have moderate risk of flood and residents' perceptions in moderate area have a high risk of flood perception. Therefore, each flood risk area is dominated by higher flood risk perception of residents.

Two categories of components that influence the residents' perceptions were situational factors and a cognitive factor[5]. The situational factor includes variables of socio-economic, location, and experience. Moreover, the cognitive factor includes knowledge as the variable.

The socio-economic environment has been explored based on gender, age, education, length of stay as well as economic condition of the respondents. The economic condition can be determined by the respondents' building wall material.

The gender of the respondents is considered as one of variables influencing the variation of flood risk perception. The proportion of male and female respondents was same, there were 50 respondents for each gender. It was showed in Figure 4.

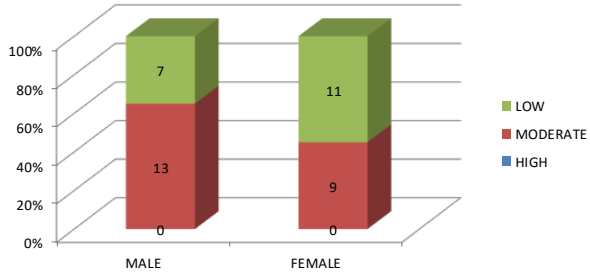

Figure 5. Resident's Perception Based on Gender in Low Risk Area

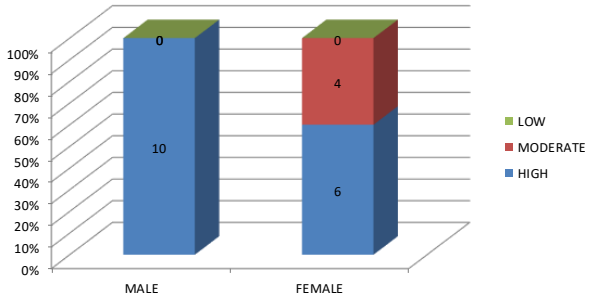

Figure 6. Resident's Perception Based on Gender in Moderate Risk Area

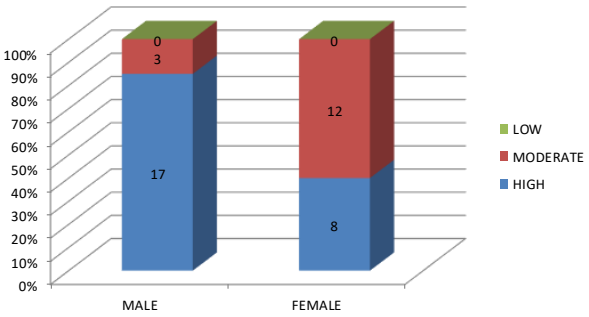

Figure 7. Resident's Perception Based on Gender in High Risk Area

The regression analysis method was applied to identify the relationship between contributing factor and the flood risk perception,

Figures 5, 6 and 7 show the percentages of risk opinion based on gender in Low Risk Area, Moderate Risk Area and High Risk Area, respectively. These Figures indicate that the residents recognize how much their living place have the flood risk. For example, the residents living in the high risk area should answer we are living the high risk area, but some residents have the different recognition. These figures show that males have the higher risk opinion than females. Males need to act for a flood directly when the flood occurs and they conduct the coping

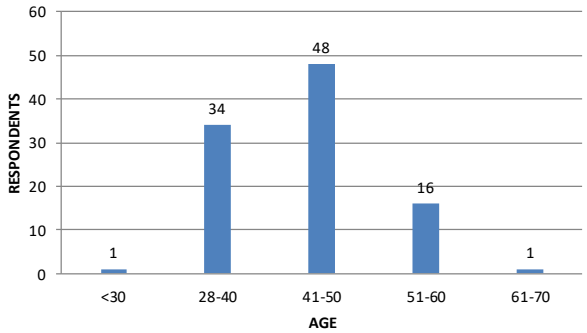

Figure 8. Distribution of respondents based on age

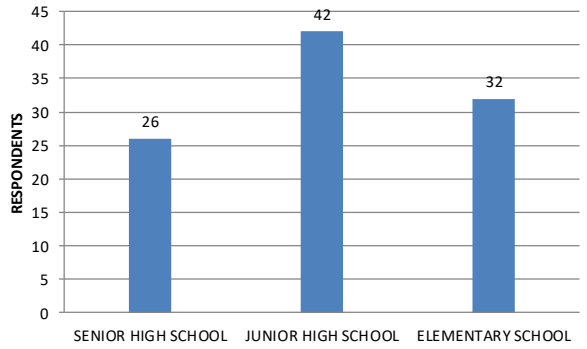

Figure 9. Distribution of respondents based on education level

mechanism hand in hand with the community. This would be why the males have the higher risk opinion.

The age of respondents is considered as one of the variables influencing the variation of the flood risk perception. Figure 8 shows that the age is ranging from 28 to 65 years old and the average of age is 45 years old. The lowest age bracket is less than 30 years old. Most of respondents are at productive age which is 31-50 years old.

The assumption that the educational level has a correlation with the way resident assess their own risk perception is introduced. Figure 9 shows the educational level of respondents in the study area. Almost respondents have the education level of the junior high school.

Figure 10 shows the relationship between the perception of the risk and the education level in the low risk area. The vertical axis indicates the portion and the horizontal axis indicates the education level. 87% residents having the junior high school educational levels and 71% residents having the elementary school educational level have the moderate perception, whereas the low risk perception accounts for 100% in the category of the senior high school level.

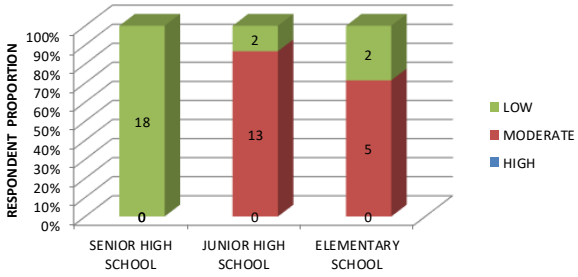

Figure 10. Perception Based on Education Level in Low Risk Area

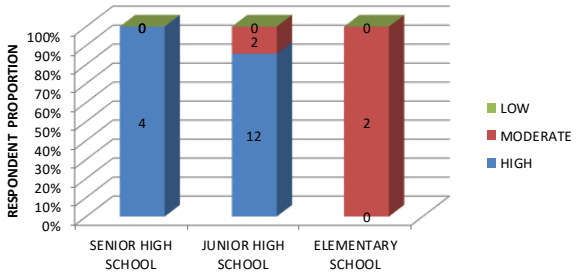

Figure 11. Perception Based on Education Level in Moderate Risk Area

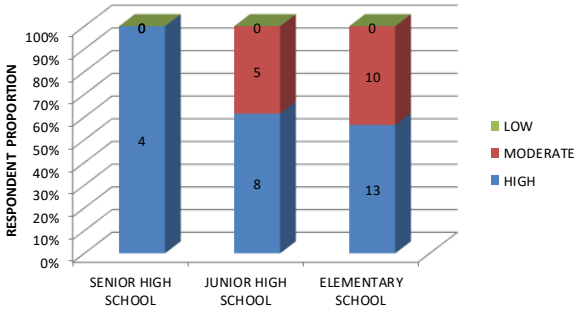

Figure 12. Perception Based on Education Level in High Risk Area

Figure 11 shows the risk perception in moderate area was indicated by high risk perception for all high school education level that consisted of 100% of resident who graduates from senior high school and 86% of junior high school graduates. However, 100% of elementary school graduates have moderate risk perception.

Figure 12 shows the results of the perception in the high risk area. There are both perceptions, moderate and high levels in the categories of junior and elementary schools. Meanwhile, there is only high level of perception in the category of senior high school. There is no low level of the perception in high risk area based on the education level.

Figure 13 shows the proportion of the respondent's

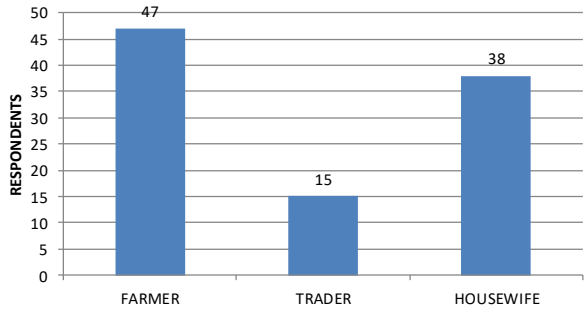

Figure 13. Distribution of Respondents based on Occupation

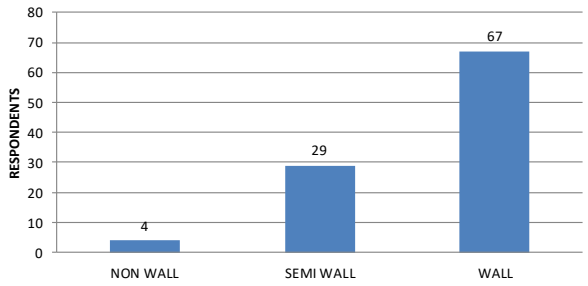

Figure 14. Distribution of Respondents based on Building Material

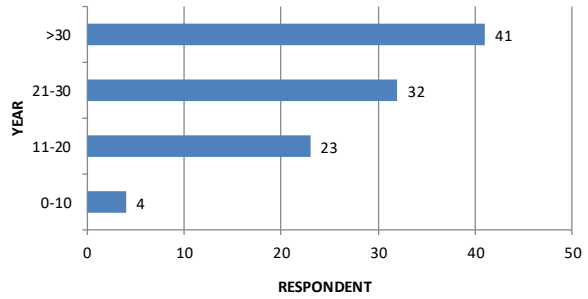

Figure 15. Length of stay

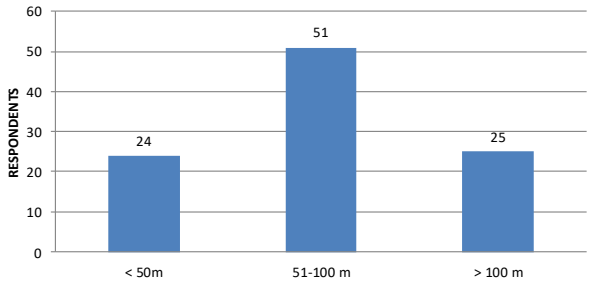

Figure 16. Distance from River

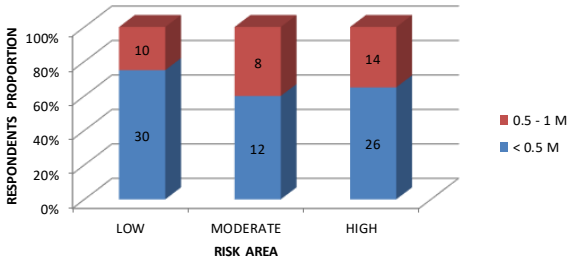

Figure 17. Distribution of Flood Depth based on Resident's Memories

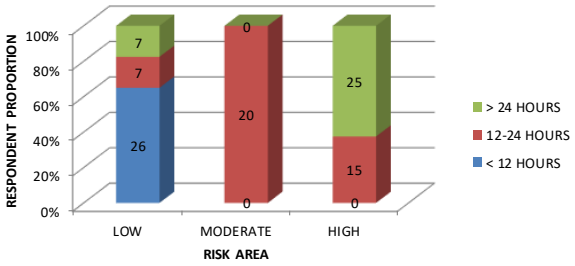

Figure 18. Distribution of Flood Duration based on Resident's Memories

occupation. It is found that 47 respondents are farmers, 38 respondents are housewife and 15 respondents were traders.

The economic condition can be evaluated by the wall building materials. In this study, walls mean the wall materials which are bricks, sand and cement. In Indonesia houses are often made of partially the walls and partially pleated bamboos or woods. The semi wall indicated such a house here. The respondent's economic condition can be evaluated as the medium-high economic condition if their answer is wall. Similarly, their economic condition is low if their answer is the semi wall or non-wall. Near the 70% responder's economic condition is medium-high as shown in Figure 14.

Figure 15 shows the length of stay of the respondents. Most of respondents has been living in the study area for more than 30 years (41%), 21-30 years (32%), 11-20 years (23%) and less than 10 years (4%).

The distance of the respondent's houses or paddy field from the river is one of important factors. Figure 16 shows that more than 50% of respondent's house or paddy field located 50 to 100 meters from the rivers.

Figure 17 shows the flood depth based on the residents' memories. The flood depth in the study area is from 0.5 meter to 1 meter. Almost 70% respondents lived in low risk area answered that the experienced flood depth is less than 0.5 meter.

Figure 18 shows the flood duration based on the residents' memories. The duration of floods in the study area in high risk area is more than 24 hours. All the respondents in the moderate risk area answered

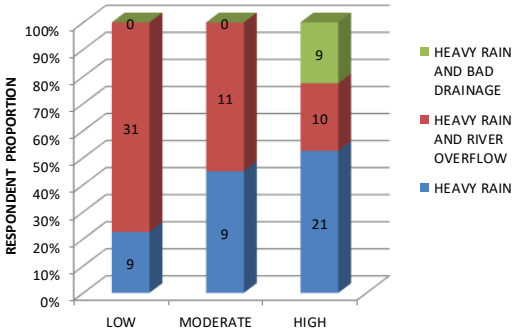

Figure 19. Distribution of Flood Causes

Table 1. Statistical Analysis Result of Contributing Factors and Flood Risk Perception

F-output value	F-table value	R Square	Result	Sig.
14.100	1.939	.613	F-output > F-table	.000

that the duration time was 12-24 hours. However, 60% respondents lived in the low risk area answered that the duration time is less than 12 hours

The variable of cognitive factors used in this study is a resident's knowledge. This variable is subsequently devoted to knowledge related to the causes of the flood as shown in Figure 19. The horizontal axis indicates the risk area. The cause of flood based on the resident's knowledge in the high risk area is dominated more than 50% by heavy rain. Moreover, heavy rain and river overflow are the causes of flood in the low risk area and the moderate risk area.

Based on the value of F in Table 1, it is shown that the F-output value is bigger than the F-table value. The significance value is 0.000 which is less than 0.05. It can be concluded that the independent factors variables (age, gender, education, occupation, building material, length of stay, distance, flood duration, flood depth and flood causes) together give significant influence on the dependent variable (flood risk perception).

The R square value shows that the independent variables influence on dependent variable in the research about 61.3% and the rest 38.7% is influenced by other random factors which are not surveyed in this research.

Table 2 shows that seven predictor variables have a relationship with the variation of flood risk perception ($p \leq 0.05$). Three of them have negative correlation: age,

Table 2. Regression coefficients and p values

Predictor Variables	Dependent Variables	
	Beta	Sig. (p)
Age	-.038	.000*
Gender	-.425	.040*
Education	-.007	.924
Occupation	-.041	.689
Building Material	.199	.030*
Length of Stay	.161	.038*
Distance	-.300	.001*
Risk Area	.497	.000*
Flood Depth	.201	.040*
Flood Duration	.038	.630
Flood Causes	-.170	.121

*$p \leq 0.05$

gender and distance. However, others variables have positive correlation with perception of flood risk: building material, length of stay, risk area status, and flood depth.

Most of the socio economic factors analyzed in this study indicated significant influence on risk perception. There are four of social-economic characteristics which play a role of the variability of resident perception towards flood risk.

Age and gender variables have a negative correlation, meaning that risk perception is higher in younger age and male respondents. It is because young productive ages and male respondents dominated to do the flood prevention and directly involved when the flood occurred, so they are more aware of the flood conditions in their area.

Lengths of stay and building materials have positive correlation. This means that longer-term resident living in flood-affected location have higher perception of flood risk. It is caused by the flood disaster happens every year in some areas, especially in agricultural areas. In that case, building material describes the economic level of the respondents. The higher economics level the higher the perception of flood risk. It indicates that respondents who are in the middle to upper economic level affected by floods are higher than lower economic level hence they have a higher risk perception.

The respondents agreed with the status of their area based on the level of flood risk. This can be seen from the positive correlation between the respondents' perceptions with the status of the area based on the flood hazard map owned by the public works agency

Table 3. Cross Tabulation of Flood Risk Area and Type of Coping Mechanism

Zone	Technology		Economy		Social	
	Yes	No	Yes	No	Yes	No
High	25.8	7.5	12.5	20.8	25	8.3
Moderate	25	8.3	0	33.3	25	8.3
Low	10	23.3	10	23.3	8.3	25
% of Total	60.8	39.2	22.5	77.5	58.3	41.7

of Lampung Timur Regency.

Distance between respondent's house or paddy field to the river has a negative correlation with perception. The closer distance between house or paddy field to the river, the higher resident perceived the level of flood risk.

Many studies have indicated that the flood risk perception depends on the place of residence [6]. This study also shows the same result, i.e., the distance between respondent's house and paddy field from the river have influenced the variation of risk perception.

Flood depth appeared to be positively related to perception of threat. Therefore the higher inundation the higher perception of flood risk in that is owned by the respondents.

4.2. Coping Mechanism in Handling Flood Disaster

Coping mechanism terminology based on Collins English Dictionary can be explained as something a person does to deal with a difficult situation. Moreover, there are three coping mechanism in the range of disaster perspective, such as technology, economy and social [7]

As shown in table 3, the percentage of the technological coping mechanism is relatively higher (60.8%) comparing to the economical coping mechanism (22.5%) and the social coping mechanism (58.3%).

To identify the relationship between the contributing factors and certain coping mechanisms (technology, economy, social), the regressions analysis was applied on the coping mechanism behavior for all respondents. There are seven contributing factors derived from the regression analysis that identify a relationship with the variation of flood risk perception. The results of the regression analysis are summarized in Table 4.

Table 4. Regression Coefficients and p Values for Contributing Factors Influence on Coping Mechanism

1. Technology	
Predictor variables	**Dependent variables (Coping Mechanism)**
Gender	-.350* (.000)
Risk Area	.307* (.000)
2. Economy	
Predictor variables	**Dependent variables (Coping Mechanism)**
Gender	-.540* (.000)
Buiding Material	-.180* (.008)
Flood Depth	-.271* (.000)
3. Social	
Predictor variables	**Dependent variables (Coping Mechanism)**
Gender	-.198* (.044)
Risk Area	.285* (.001)
Flood Depth	.198* (.042)

*significant (5%)

It can be concluded that gender influenced the resident to do all coping mechanism: technology, economy, and social. Having negative relationship with the coping mechanism, it means that male respondents have higher chance to apply some technological, economical, and social coping mechanism.

In the conceptual framework, it is shown that there is a correlation between risk perception and behavior. It is assumed that risk influences resident's attitude to flood risk. Regression analysis is used to identify the correlation between risk perception and coping mechanism. The results from regression analysis are described in Table 5.

The result above indicated that perception of flood risk has significant correlation with two coping mechanisms. In the case of flood risk perception of resident in Lampung Timur Regency can be concluded that the way they apply some type of coping

mechanism is affected by the way they perceived of flood threat in their area.

4.3. Local Government Flood Management

In order to cope with flood, the local government of Lampung Timur and the province government have developed mitigation activities and applied them to the society. Structural and non-structural methods were used as the flood controlling. The structural and non-structural methods are shown in table 6.

Environmental agency and community work together for mangrove planting to reduce disaster risk in coastal area. Flood forecasting, disaster training, and preparing evacuation shelter are provided by Disaster Management Agency (BPBD) collaborated with Disaster Responsive Cadet (Tagana) of Social Agency. Those non-structural methods are very helpful for the resident affected by the flood. However, flood hazard map has still to be improved and distributed to the lower level of organization, because recently it is still distributed in the top level of institution.

5. CONCLUSIONS

The main results of this study are shown below.

1) The flood risk perception of resident in Lampung Timur regency is influenced by the following factors; age, gender, building material, length of stay, distance, risk area, and flood depth.
2) All of the coping mechanism is affected by gender. The gender and risk area give impact to the technological coping mechanisms. However, the gender and the flood depth are meant to induce residents to do the economic and social coping mechanism.
3) Mitigation activities have been applied to the society by the local government of Lampung Timur, such as structural and non-structural methods. River normalization, raising river dike, and improvement of drainage system as a structural method to control and reduce impact of the flood. Non-structural methods are applied by mangrove planting; flood forecasting, disaster training, preparing evacuation shelter and making flood hazard map. However, the flood hazard map has still to be improved and distributed to the lower level of organization, because recently it is still distributed in the top level of institution.

Table 5. Regression coefficients and p values for Relationship between risk perception and coping mechanism

	Technology	Economy	Social
Perception	.437*	-.132	.541*
	.002	.381	.000

*significant (5%)

Table 6 Structural and Non-Structural Methods

Structural	River normalization
	Raising river dike
	Improvement of drainage system
Non-structural	Mangrove planting
	Flood forecasting
	Disaster training
	Preparing evacuation shelter
	Making flood hazard map

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(Received January 10, 2018)