Influencing Factors on Community Resilience Toward Flooding in Thailand –Focusing on withstanding and response-

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The paper proposes to explore the influencing factors of resilience focusing on the inundation of flooding circumstance at the community level in Thailand. Initially, pre-survey and in-depth interview are inquired to conduct in several adverse effect areas because this study attempts to explore the actual existing principles of community resilience indicators. Consequently, the damage level of the house and smooth evacuation of household reveal as the measurement of withstanding and response principle of community resilienceerespectively. Following the initial findings, the questionnaire survey of household package is developed, distributed and then met face to face with the head of the family.
Firstly, the period approaching of inundation in the community presents a strong relation to damage level. Meanwhile, house characters such as construction material, number of story is not depicted directly to cause of level damage but it shows negative rigorous value of the flood situation. Secondly, social capital is not thoroughly affected by the smooth evacuation, it needs to transfer evacuation's information from the external assistances such as the neighbour, local municipality and community organization in advance. Furthermore, household character is slightly involved to encourage the smooth evacuation of a household.

Key Words : *community resilience, factor, withstanding, adaption, flooding,, Thailand*

1. INTRODUCTION

During the past decades, natural disasters have significantly affected human life. How can people reduce the magnitude of impacts and response effectively when natural disaster hits their area? Recently, 'resilience' is considered as one key term regarding with this question.

Several previous study pointed out importance of resilience at community level. For example, Bruckle et al. (2001) pointed out community resilience as communities manifest their existence in common networks, exchange systems, common values, plans for the future, shared methods for resolving problems as well as agreements to work together for the future. Therefore, this study focuses on resilience at community level.

This study defines resilience as the ability of community to 'withstand' and 'respond' with perturbation and 'recover' rapidly into a normal function.

Holling originated the definition of resilience in 1973 which observed ecological dynamics. Equilibrium assumes a predominant stability for every ecosystem, and it eventually returned after disturbance (Liao, 2012). Later, the notion of resilience was notable in several disciplines such as economic resilience, social resilience and community resilience.

Regarding with community resilience, some of studies that examines community resilience and its factors conceptually. For example, Bruckle et al.(2001) pointed out that the relevant factors of community resilience are the population growth or decline, appropriate leadership skills, adequate infrastructures and resources, active communities and social groups, active and effective social networks and information exchanges, skills as well as effective skill exchanges and sharing. Furthermore, Cutter et

al. (2008) established the new conceptualization model as the disaster resilience of place (DROP) model to show the critical contributions and community resilience indicators. The study presented several dimensions of community resilience such as ecological, social, economic, institutional, and community competence. Moreover, the study also explained the measurement variables of community resilience in each dimension. For example, the social dimension indicated by demographics, social networks and faith-based organizations.

On the other hand, only a few previous study examines the factors of community resilience experimentally. For example, Plyer and Bonagura (2007) applied 'postal counts' as an indicator of population recovery from evacuation after disaster and examine factors of population recovery in New Orleans after the Hurricane Katrina.

As Cutter et al. (2008) emphasized community resilience is a place specific multiscalar process that occurs within and between social, natural, and built environment systems, the examining community resilience empirically is essential to understand it. Therefore, this research aims to explore the factors that influence community resilience.

In this study, the mega flooding in 2011 in Thailand is case studied, focusing on especially 'withstanding' and 'response' as the aspects of resilience.

2. RESERCH METHODOLOGY

Field surveys were conducted twice for this research. First, in August 2013, in-depth interview with key stakeholders such as community leaders and residents were conducted to understand the overall situation of the target community. Second, in March 2014, face-to-face questionnaire survey in household level was conducted.

As case studied communities, five adjacent communities in Bangkok and four adjacent communities in Pathumthani province were selected (see Table1). All of communities located in flood prone area and seriously damaged. The face-to-face questionnaire survey in household level was conducted in the nine communities.

The questionnaire targets head of household or his/her spouse. The range of respondents' age is from 23 to 79 years old, and the average is 52 years old. Female respondents are 58 % and male are 42%. Majority of household income showed less than 35,000 baht (67.6 %). Following the report of National Statistic Office of Thailand, average monthly of household income in Bangkok and vicinity is 37,732 baht in 2011, so the most of respondents are low- income people.

Table 1 Number of household in each community

Name of community	Number of household
Pathumthani province	
1. Klong 1 Pattana	254
2. Soi 40	178
3. Klong sawan	55
4. Jaroensin	47
Bangkok metropolis	
5. Prachsamakkhi	56
6. Mapraw koo	200
7. Klong Bangbumru	238
8. Fahmei	107
9. Klong Manow	214
Total	**1,349**

3. ANALYSIS OF DATA

(1) Indicator

As above mention, this study focuses on 'withstanding' and 'response' as some aspects of community resilience.

An indicator of 'withstanding,' government compensation is applied because amount of money of government compensation in each household is paid according to damage level of the house and furniture. And as an indicator of the 'response,' 5 scales evaluation of smooth escape (1. not smoothly at all, 2. not smoothly, 3. moderate, 4. smoothly and 5. very smoothly) is applied.

As showed in Table 2, people in communities in Pathumthani province, received higher amount of government compensation than in Bangkok. Regarding with evacuation, 39 % of respondents did not evacuate to the safety zones in Bangkok, and in Pathumthani province 41% did not evacuate respectively. 'Not smooth at all' and 'not smooth' illustrated the large part of evacuation activity in the both areas.

Table 2 Descriptive data of the government compensation and smooth evacuation.

Category	Area	
	Bangkok	**Pathumthani**
1.Average of government compensation (Baht)	11,742	20,372
2. Smoothness of evacuation (%)		
• Not smoothly at all	23.5	35.8
• Not smoothly	49.4	39.6
• Moderate	10.6	11.3
• Smoothly	9.4	9.4
• Very smoothly	7.1	3.8

(2) Influencing factors on 'withstanding' and 'response'

Structure Equation Modelling (SEM) is implemented to examine factors influencing the two dimensions. SEM was manipulated by SPSS AMOS 20. The variables that are used in the analysis is shown in Table 3.

a) 'Withstanding' dimension model

The established path of the model is shown in Fig.1. AGFI is 0.957 > 0.90, GFI is 0.980 and RMSEA is 0.012 < 0.05 in which prove the good fit model. Comparing between standardized path coefficient, 'period of flooding in the house (Time_Houseflood)' is the strongest (standardized path cofficient= 0.45). The second strongest one is 'evacuation (Evaculation_HH)', which is dummy valuable, and its standardized path coefficient is negative (standardized

Table 3 List of influencing factors on the damage level of a house (DH) and smooth evacuation (SE)

No	Code	Definition	DH	SE
1	Experience	A respondent had an experience to flood. (D)	✓	✓
2	Prepare_HH	A respondent prepared for flooding such as buying sand bag. (D)	✓	✓
3	Knowledge	Before the flooding in 2011, a respondent you had knowledge about protecting a house such as moving an essential item up. (D)	✓	
4	Protect_HHmember	Total number of a household member worked to prevent a house. (people)	✓	
5	Protect_Numberexternal	Total number of labor from external assistance who worked to prevent a house. (people)	✓	
6	Protect_Supplymaterial	External assistance to supply materials to protect a house (D)	✓	
7	Protect_Info	External assistance to provide information to protect a house (D)	✓	
8	Evacuate_HH	A household member had an evacuation.(D)	✓	
9	Shift_Furniture	A household shifted furniture/electronic devices to avoid flooding. (D)	✓	
10	Evacuate_Assitinfo	A household received an information of evacuation from external assistances. (D)		✓
11	Evacuate_Assistlabour	Total number of labour from external assistance who worked to help for evacuation.(people)		✓
12	Evacuate_Assistitems	Getting some relief materials/tools from external assistance (D)		✓
13	Social_Knowneigh	Number of household neighbors that respondent know in this community (Family) (1: < 10 , 2: 11- 20 , 3: 21-30, 3: 31-40 and 4: > 40)	✓	✓
14	Social_Meeting	Frequency of attending a public meeting on a community issue (1: never, 2: rarely, 3: sometimes, 4: often)	✓	✓
15	Social_Participation	Frequency of participating in local activities or events (e.g., children's day, religious activities) (1: never, 2: rarely, 3: sometimes, 4: often)	✓	✓
16	Social_Volunteer	Frequency of involving in volunteers activities intended to benefit my community (1: never, 2: rarely, 3: sometimes, 4: often)	✓	✓
17	Social_Savingroup	A resident is a member of saving group. (D)	✓	✓
18	Time_Comflood	Period of flooding in the community.(day)	✓	✓
19	Time_Houseflood	Period of flooding inside the house. (day)	✓	
20	Waterdepth_Outside	The maximum depth of water outside the house. (centimeter)	✓	
21	Waterdepth_Inside	The maximum depth of water inside the house.(centimeter)	✓	
22	HHmember_Children	Numbers of children in the family. (people)		✓
23	HHmember_Aged	Numbers of aged people in the family. (people)		✓
24	Household_Numbermember	Numbers of the household member who live together. (people)		✓
25	Money_HHincome	Average monthly household income (Baht) (1: <10,000, 2: 10,000-15,000, 3:15,001- 20,000, 4: 20,001- 25,000, 5:25,001- 30,000 , 6: 30,001- 35,000, 7: 35,001- 40,000, 8: > 40,000.)	✓	
26	HHmember_Income	Numbers of income earner.(people)	✓	
27	Time_Livecom	Length of living in this community. (year)		✓
28	Cons_Material	Construction materials of the house (1: wood, 2:wood and brick 3:brick)	✓	
29	Number_Story	Number of stories	✓	
30	Type_House	Type of House (Raised and non- raised). (D)	✓	
31	Damage_level	Amount of government compensation. (baht)	✓	
32	Evacuate_Smooth	Smooth evacuation (1. not smoothly at all, 2. not smoothly, 3. moderate, 4. smoothly and 5. very smoothly)		✓

Note: D: Dummy variable, ✓: Factor of community resilience

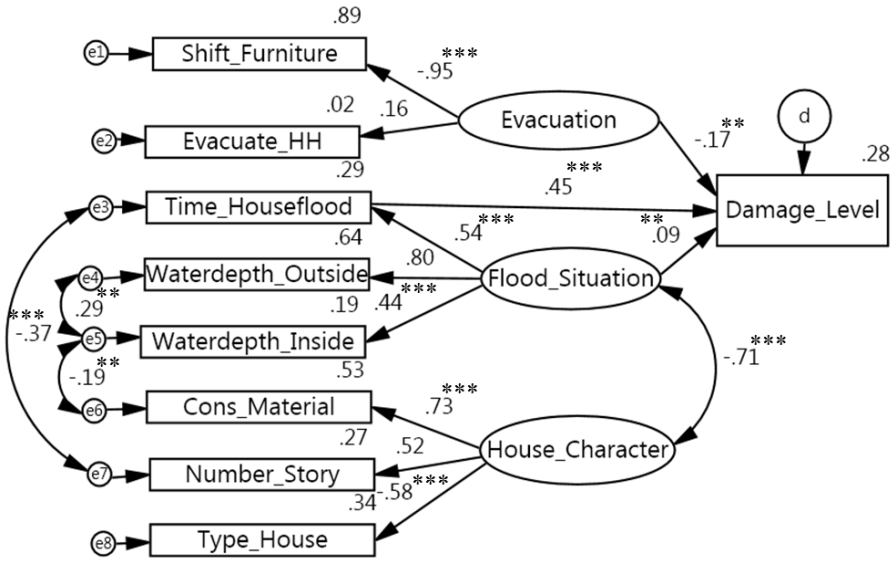

Fig. 1 Path analysis of 'withstanding' model. *** P< 0.001 level, ** P< 0.05 level

path coefficient= -0.17). The third factor is 'flood situation,' that consists of flooding situation in community and flooding situation in the house. Furthermore, 'characteristics of house (House_Character)' has a strong correlation with the flood situation. 'Characteristics of the house (House_Character)' consists of three variables, 'construction material of the house (Cons_Material),' 'number of story of a house (Number_Story)' and 'raised or non-raised house (Type_House).' It means the stronger structure a house has, the less severe situation of flooding they have

b) 'Response' dimension model

The established path of the model is shown in Fig.2. AGFI is 0.929 > 0.90, GFI is 0.959 and RMSEA is 0.05 in which prove the good fit model. Comparing between standardized path coefficient, 'household character (Household_Character)' is the strongest one of smooth evacuation and is stronger than 're-ceiving information about evacuation from the external organization (Evacuate_Assistinfo)'. As 'social capital (Social_capital)', five factors, 'involving in the volunteer activities (Social_Volunteer)' (standardized path cofficient= 0.81), 'attending a community's meeting (Social_Meeting(' (standardized path cofficient= 0.63), 'being a saving member of the community (Social_Savingroup)' (standardized path cofficient= 0.42), 'number of knowing the household neighbour (Social_Knowneigh)' (standardized path cofficient= 0.41), and 'participation community activities (Social_Participation)' (standardized path cofficient= 0.58), has a strong correlation with 'receiving information of 'evacuation from external assistances (Evacuate_Assistinfo)'. Furthermore, 'numbers of aged people in the family (HHmember_Aged)'has a strong correlation and shows standardized in negative with 'smooth evacuation (Evacuate_Smooth)'. It means low- income communities with the aged member of the family should have a special assistance during an evacuation.

4. DISCUSSION

This study explored influencing factors on some aspects of community resilience, 'withstanding' and 'response,' by case study of the mega flooding in 2011 in Thailand.

For the 'withstanding,' the results found 'period of flooding in the house is a predominant factor, and it is correlated with 'number of story of a house' This result is consistent with Finch et al. (2010) which made the case study of New Orleans, the Hurricane Katrin. The study found the housing characteristic, such as construction materials of the house, number of stories, and raised or non-raised building, affect on the flooding situation.

For 'response,' the findings showed that the receiving information from the external assistances is the predominant factor of smooth evacuation. It means communication about evacuation information between residents and external assistances such as the local authority, neighbour, community leader and so forth is more important. For example, some communities have community broadcasting, so community leader can share the flood situation any time. Therefore, improving communication is one

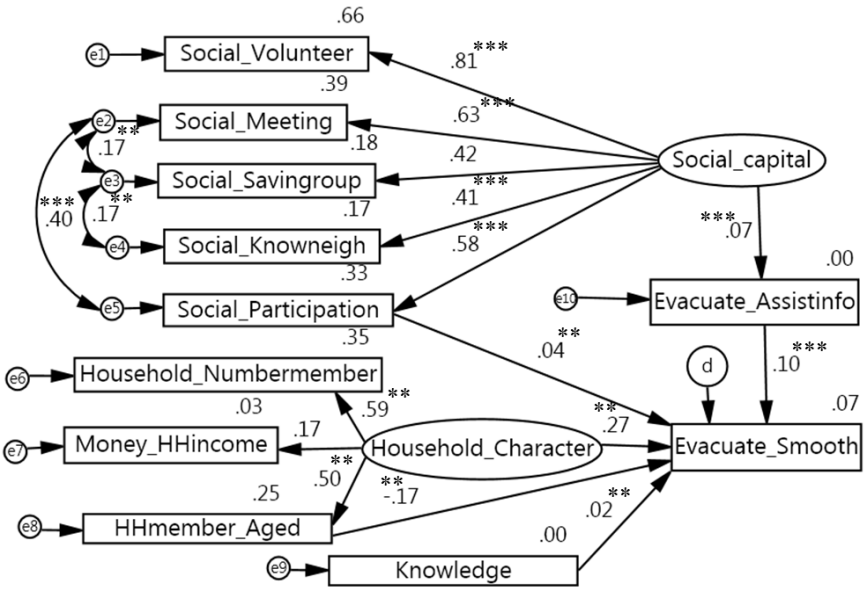

Fig. 2 Path analysis 'response' model. *** P< 0.001 level, ** P< 0.05 level

way to enhance response aspect as well. Additionally an external assistance perspective showed in the study of Shaw (2006) which depicted Asian countries local institutions both formal and informal such as locally elected leader, teacher and local government played a critical role in sustaining the effort to mitigate the impacts of flooding. The aged member of a household plays a critical negative role in the smooth evacuation. It might extend the time of evacuation. Therefore, during evacuation age member of the family should have a special support. However, in a study of King (2001) presented before disaster many elderly people were extremely aware of the hazard and were capable of looking after themselves.

The result depicts the majority of respondent were low-income people. Chatterjee (2010) pointed out in megacities of developing countries, low-income group showed a geographical inertia because safeguarding, so their livelihood was more important for their survival in transforming societies. Thus, development of an emergency plan against flooding may be difficult in the future.

The results presented the obvious details and facilitated a better understanding on the influencing factors of community resilience. However, there were several limitations in this study influencing a number of respondents issue. First, the respondent was head of family or his/her spouse who typically worked in the day time. Thus, during a field survey, it was difficult to meet target group on the site. Second, the character of an urban area that slightly be closed with strengthen people. The knocking door to door and dealing face to face were not completely succeeded.

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