



## **Community Participation at Household Level on Flooding and Drought Management Due to Climate Change Impacts: A Case Study of Svay Rompear Commune Locate in the Chinit River Basin, Cambodia**

Pisal Keo<sup>1</sup>, Kittiwet Kuntiyawichai<sup>2</sup>

<sup>1</sup> Program Master of Rural Development Management, Graduate School,

<sup>2</sup> Department of Civil Engineering, Faculty of Engineering

<sup>1,2</sup> Khon Kaen University, Thailand

<sup>1</sup> E-mail: pisalkeo@kkumail.com, <sup>2</sup> Corresponding author. E-mail: kkitti@kku.ac.th

### **Abstract**

The climate change impacts have increasingly intensified on the hydrological regime over the last century in terms of seasonal temperature, rainfall and streamflow patterns, and more frequent occurrences of droughts and floods. In Cambodia, flooding and drought are main natural disasters which were occurring and destroying on many infrastructures, people's assets, and lives almost every year. Prompting the natural disaster management and planning, the legal frameworks for preparedness, response and recovery from disasters were developed in which the structure of disaster management was also included for the sub-national and local level of natural disaster management. The characteristics of households and households' participation of Svay Rompear Commune were considered in this research to investigate the community participation at household level on the flooding and drought management due to climate change impacts. Stata version 13.1 software, which is the statistical program, was applied in this research. The results proved that most of respondents are highly participated in helping to search missed or displaced people (92.2%), managing and storing information related to disaster (73.5%), collaborating and facilitating to the relevant Water, Sanitation, and Hygiene (WASH) authorities (68.6%), and gathering information and reports from various operating groups for checking the availability of relief (66.7%). From the results of multivariate analysis, only membership factor associated with the high participation at the household level ( $p < 0.05$ ) at 0.05 of significance level, in which members of Village Disaster Management Groups (VDMG) has a higher participation than non-members about 4.85 of Odds Ratio (OR). However, this community should be promoted more participation of non-members who are the volunteers, social workers, monks, etc., who are not willing to be permanent members.

**Keywords:** Climate change impacts, community participation, flooding and drought management



## 1. Introduction

Climate change is movement trends of weather that is corresponded both directly and indirectly with activities of human and environment which adjust the components of atmosphere in global and is in natural condition changing by period of time (MRC, 2013). Climate change also mention about different in precipitation, temperature, wind speed and direction; and other climatic weather classification which occurring over separate time by time. The climate change impacts have increasingly intensity on the hydrological regime in over the last century in seasonal temperature, rainfall and streamflow patterns, and more frequent occurrences of droughts and flooding (Khoi & Suetsugi, 2014). Moreover, the temperature and rainfall changes typically will effect on the cycle of hydrology system and also direction, location, flow of stream. Meanwhile, the change of climatic weather is a critical aspect which mostly effect on the available water and occurring the extremely impacts such as flooding, drought, and so on. It is a world complexity issues that link with many problems effecting on socio-economic impacts, environmental degradation, poverty and health issues (IPCC, 2007b).

The Kingdom of Cambodia has a highly vulnerable with natural disasters and was indicated as a country which is relatively affected by climate change impacts. It is the likely suffer country of natural disasters which affect people and their assets almost every year (NCDM, 2015). Cambodia's monsoon climate gives two seasons having dry season, during November and April, which can occur the drought because of water lacking; and a rainy season, during May and October, occurring the flooding in some extreme months and mostly in central part of country (NCCC, 2013). Otherwise, the Lower Mekong Basin (LMB) is the vulnerable area of many different natural disasters which mostly occurs flood, drought and storm (MRC, 2012). Nowadays, climate change is the majority issues which all people interacting against and solving these impacts; and one among other hot topics around the world both national and international meeting. Based on the United Nations Development Program (UNDP), Cambodia is at the higher point where having seriously climate change impacts and lower ability to adapt and adopt these situations.

The main natural disasters, are flooding and drought which global warming, was occurring and dangerously hazards causing on many infrastructures and killing people almost every year. For example, the big storm raining used to destroy this country, the water level of river rapidly increased with high pressure and strong flooding covering around 22 provinces of total 24 provinces in year 2000. However, drought event is also the vulnerable impact which had damaged on the assets of amount 2,047,340 people and costly of this hazard is exceed \$21.5 million in year 2002 (Chhinh, Cheb, & Heng, 2014). Regarding to the Asian Development Bank (ADB), in 2015, 10% of GDP was lost about \$1.5 billion in Cambodia which is affected by climate change impacts. Moreover, \$96 million was approved by ADB to help Cambodia cope in which of livelihood and income loss in terms of extremely weather occurred, in year 2016. Otherwise, Cambodia might be happened the natural disaster in large scales by climate change impacts, whether these issues are not addressed in further (ADB, 2012). These past experience of those natural disaster events that highly caused by global warming impacts affecting on the water availability and it was influent on many sectors having infrastructure, social, agriculture, health, and so on. Therefore, it is very important to assess climate change impact on hydrological regime to promote and planning the water management and sustain water supply with well health.

In Cambodia, prompting the development and promoting the legal frameworks for prevention, recovery, and response from natural disasters are the main occurring factors due to majority natural disasters. The project of natural disaster risk reduction, especially flooding and drought, is mainly implemented by cooperating of both international, regional, and local

organization (MRC, 2009). The project has a goal to improve the cooperation between the National Committee for Disaster Management (NCDM), local government, and local Non-Government Organizations (NGOs) to improve facilitating more on the operating responses and prevention effectiveness, also as the strengthening a connection of government with NGOs, or can called the Cambodian Humanitarian Forum (CHF) (USAID, 2016). Moreover, in year 2014, government of Cambodia planned and officially improved on the National Action Plan for Disaster Risk Reduction (2014-2018). The national action plan was accepted the policy requirements and legally processing to make Disaster Risk Management (DRM) to be stronger. Building the resources and capacity at national and sub-national levels, and providing resources in terms of improving the NCDM and also natural disaster management at sub-national committees are focused. Meanwhile, NCDM is the top government agency for providing the prevention on emergency and relief in Cambodia. It was overall provided strengthening the ability to leaders of the Plan of Action for Disaster Risk Reduction (DRR) (CGDA, 2013). The natural disaster management's structure was included the sub-national and also local level. There are having Provincial Committees for Disaster Management (PCDM), District Committees for Disaster Management (DCDM), Commune Committees for Disaster Management (CCDM), and also Village Disaster Management Groups (VDMG). Recently, Cambodia has adopted the Cambodia Red Cross (CRC) is the main authority to cooperate with the government and relevant sectors implementing on the operating relief (Sok, 2017). Furthermore, Cambodia has an approval to use and improve the Early Warning System (EWS) which is supported by the United Nations Development Program (UNDP) and controlled by the Ministry of Water Resources and Meteorology (MOWRAM) (Leng, 2014). In Cambodia, the administrative divisions are divided into 4 levels such as village, commune, district/city, and province and one capital. In figure 1 was shown about the administration divisions of Kampong Chhnang Province where was studied in the research.

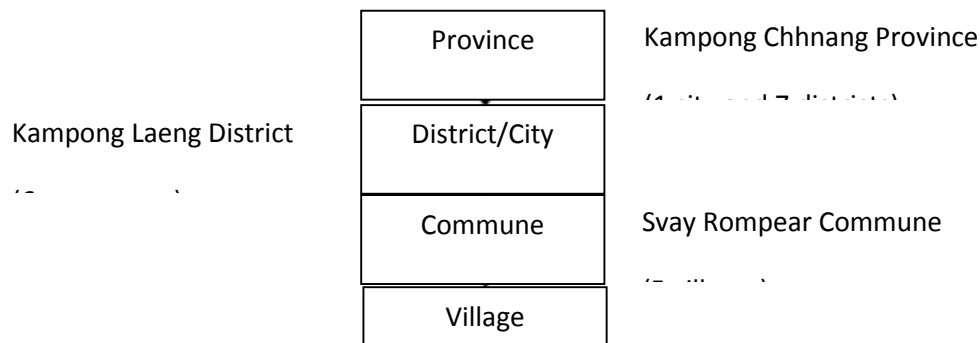


Figure 1: *The administrative divisions of Cambodia*

Therefore, the main objective of study is to investigate the community participation at household level on flooding and drought management due to climate change impacts in Svay Rompear Commune, Kampong Laeng District, Kampong Chhnang Province, Cambodia.



## 2. Method

### 2.1. Study Area

Svay Rompear Commune, which is one of the vulnerable commune in Kampong Laeng District, Kampong Chhnang Province, is affected almost every year by natural disasters. It composes 5 villages with the total population of around 5,941 people. Of these, there are 1,360 households and 3,136 females among the entire population in this targeted commune. Moreover, Svay Rompear Commune is also the nearest outlet of Chinit River Basin to Tonle Sap Basin and close to the Tonle Sap River. From own research study's result in the second objective of Independence Study (IS) report, the streamflow along the Chinit River Basin will be slightly increase from the baseline year (2000-2017) until by the end of 2100 and occurring the flooding at lowland and extremely drought at upland in term of land use change and population increased. They may be impacted on the local people's livelihood along the Chinit River especially in Svay Rompear Commune.

### 2.2. Sample Size

The study which is related to the investigation of the participation at household level on flooding and drought management due to climate change impacts: a case study of Svay Rompear Commune located in the Chinit River Basin, Cambodia, relies on the use of quantitative research approach by focusing on the field survey research. The study will be conducted by administering structured questionnaire interview and in-depth interview, in order to understand general characteristics and identify the participation on the community implementation at household level in the study area. The unit of analysis for this study is targeted on the members and non-members of Village Disaster Management Group (VDMG) who live in Svay Rompear Commune. The households were considered as key respondents who were interviewed based on variables for studying the participation level on the implementation and finding the general characteristic factors associated with the level of community participation on the flooding and drought management in the Svay Rompear Commune.

In addition, a sample size is also required to be targeted for the research study on flooding and drought management in Svay Rompear Commune, the sample size will be a representative of total households in the study area. The targeted sample size and the proportion of households as mentioned before is required for detailed study, whether how is the relationship of associated factors with community participation at household level. As sample, required formula of Taro Yamane's principle equation as following like below:

$$n = \frac{N}{1 + N \times e^2} \quad (\text{Equation 1})$$

Where: n= sample size; N= number of population

e= level of precision (selected e = 10% = 0.1) (Glenn, 1992; Kuntiyawichai, Dau, & Inthavong, 2017)

Therefore, the sample size of respondents for interviewing is 93 samples and adjust 10% to reach at 102 samples for substituting any problems of the questionnaires. The sample size was selected



from one commune and selected the level of precision is 10% because of limited self-budget and short time period of interview.

For sampling the sample, the Simple Random Sampling was used to select samples from Svay Rompear Commune which respondents was selected from all households in the study area because all households could have impacts by climate change for the entire community and the samples that have age equal 18 and up were interviewed. The study area is divided into 5 villages such as Chombok Khpous, Khnong, Cheung Kros, Lvea, and Talat. After that, the sample size was selected from households and took 20 samples from each 5 villages, respectively; And other two samples were selected from the biggest among of households in the villages like showing in Table 1.

Meanwhile, distributed samples were randomly selected from the sample frameworks of villages from the villagers. From the Table 1, the total household was divided with the samples in each village to get the interval number of each households, and then starting to select the sample for the first targeted household and add the interval number for the next targeted household due to interview conducted. However, the interviewed was done to the next household if the target household weren't available and missed.

Table 1: *Number of population, households, sample sizes in Svay Rompear Commune*

No.	Villages	Population	Households	Samples
1	Chombok Khpous	1,233	275	20
2	Khnong	1,371	327	20
3	Cheung Kros	508	108	20
4	Lvea	1,564	346	22
5	Talat	1,265	304	20
<b>Total</b>		<b>5,941</b>	<b>1,360</b>	<b>102</b>

### 2.3. Data Analysis

As mentioned above, the raw data of 102 respondents will be recorded into MS Excel in term of database management before doing the statistical analysis. Subsequently, the statistical consideration for data analysis of this research will use Stata version 13.1 software to indicate descriptive statistics to express the frequencies and percentages of respondents to find the high participation at household level on the community implementation in the flooding and drought management due to climate change impacts in Svay Rompear Commune. Moreover, the bivariate analysis was used to study and analyse the relationship between the respondents' general characteristics with the high participation of household level on the flooding and drought management, by adjusted with 95% of confidence interval (CI). Then, the multivariate analysis was applied to find the factors associated with the outcome and was been raised up key factors associated.

### 3. Results

According to the result analysis among 102 respondents both members and non-members in Table 2, most of them are having the age ranking from group of age 41-45 (24.5%), then 46-50 (23%) and 51-55 (21.6%) are highly participating in the community; in contrary, the group of age 18-24 (2.9%) followed by 25-30 (2.0%) have a low participation. Furthermore, females, 61 (59.8%), are more participated than males, 41 (40.2%). Regarding to the education level of respondents, most of respondents have finished and equivalence in primary school (44.1%) followed by secondary



school (29.4%), illiterate (17.6%), high school (5.9%), and bachelor (2.9%). Otherwise, the main occupation of respondents mostly works as farmers (32.4%) and government officials (28.4%) and the least is worker (2.9%) and vender (3.9%). For the poverty card, respondents who have, 25 (24.5%), are less than people who don't have poverty card, 77 (75.5%). However, respondents are mostly living in the study area more than 30 years about 72.5% and living around 6 to 15 years are the less responds (4.9%). In term of family member, about 20.6% are having 4 and 5 members in the family, respectively; and only 2.9% of respondents are having 1 member in the family.

Table 2: *General characteristics of respondents*

Characteristics	Number (n=102)	Percent (%)
<b>Membership</b>		
Yes	51	50.0
No	51	50.0
<b>Sex</b>		
Male	41	40.2
Female	61	59.8
<b>Age (years)</b>		
18-24	3	2.9
25-30	2	2.0
31-35	6	5.9
36-40	13	12.7
41-45	25	24.5
46-50	24	23.5
51-55	22	21.6
> 55	7	6.9
<b>Living duration (years)</b>		
Less and equal 5	10	9.8
6 to 15	5	4.9
16 to 30	13	12.7
More than 30	74	72.5
<b>Poverty card</b>		
Have	25	24.5
Don't have	77	75.5
<b>Education level</b>		
Illiterate	18	17.6
Primary school	45	44.1
Secondary school	30	29.4
High school	6	5.9
Bachelor	3	2.9
<b>Main occupation</b>		
Farmer	33	32.4
Worker	3	2.9
Govt. official	29	28.4
Fisherman	22	21.6
Vender	4	3.9





Teacher	11	10.8
<b>Family member</b>		
1	3	2.9
2	10	9.8
3	16	15.7
4	21	20.6
5	21	20.6
6	16	15.7
≥7	15	14.7

Referring to the data analysis of participation level of respondents, it was derived into five levels for responding to the participation in the implementation on the flooding and drought management by showing in Table 3, and further grouping the participation level into two scales, having high (combined the participation level of “very high” and “high”) and low (combined of “moderate”, “low”, and “very low”), to find the factors associated with the outcome as the high participation of household level.

Table 3: *The range of participation level of respondents in the implementation on the flooding and drought management*

Participation level	Range
Very high	5
High	4
Moderate	3
Low	2
Very low	1

Regarding to the field interview, the main implementation of household level on the flooding and drought management in Svay Rompear Commune were stated into four key parts which the first part is search, rescue, and security implementation, which is created for preparation management for flooding and drought prevention that may occurred by human and environment, emergency operations, liberate the people from danger, evacuated people, security guards, search and rescue victims by stating the activities below:

- Helping in searching missed or displaced people
- Identifying missed or displaced people
- Securing the security and guarding the asset of victims at safe places
- Managing and assisting in the construction of temporary shelters in safe places
- Regularly sharing relevant information to relevant entities
- Collaborating and facilitating transportation of materials
- Evacuation and relief facilities and equipment.

The second part is health and sanitation implementation, which providing health care, finding out sources of diseases and epidemic prevention, evacuating patients to hospital, and emergency having:

- Providing education, outreach and advice on health care, sanitation and access to clean water and prevent other epidemics



- Providing First Aid training
- Emergency and medical operations for victims
- Monitoring health, hygiene, water and other health problems
- Reporting to the committee for disaster management
- Collaborating and facilitating relevant Water Sanitation and Hygiene (WASH) authorities.

The third part is the information and contact implementation, which is to provide and share the information about disaster by nature and human in the community related to victims' needs and show reasons by stating below:

- Monitoring information and reporting on situations and effects
- Publishing forecasts and announcements
- Managing and storing information related to disaster
- Collaborating and facilitating organizations to evaluate and estimate impact and needs of victims
- Gathering and compiling information regarding vulnerable groups and areas of risk
- Disseminating and educating the public on the media regarding disaster risk reduction
- Leading and attending meetings to share experiences and news to the committee and relevant authorities.

Lastly, emergency responses and rehabilitation implementation, are also transaction to provide aid to victims, implement and propose projects, and find the help from other main sources both government and non-government such as:

- Gathering information and reports from various operating groups to check the availability of relief
- Assessing and estimating impact and needs
- Conducting statistics on affected people in safe places to provide emergency assistance and to identify relief recipients
- Managing the storage of relief supplies
- Dividing and transporting relief to victims
- Contacting and calling on humanitarian organizations, charities and organizations to seek help and support
- Keeping to monitor the situation and needs of victims
- Evaluating project estimated for rehabilitation.

Based on the interview data, the Table 4 was illustrated about the respondents' responses for activity statements of four each implementation above of households' participation on the flooding and drought management due to climate change impacts in their community.



Table 4: *Respondents' responses of households' participation on flooding and drought management*

Statement	Response						Level of Particip- ation
	Very High	High	Mode- rate	Low	Very Low	Total	
	n (%)	n (%)	n (%)	n (%)	n (%)	∑n (%)	
Search, Rescue, and Security Implementation							
Helping in searching missed or displaced people	4 (3.9)	94 (92.2)	4 (3.9)	-	-	102 (100)	High
Identifying missed or displaced people	-	43 (42.2)	59 (57.8)	-	-	102 (100)	Moderate
Securing the security and guarding the asset of victims at safe places	1 (1.0)	60 (58.8)	41 (40.2)	-	-	102 (100)	High
Managing and assisting in the construction of temporary shelters in safe places	19 (18.6)	77 (75.5)	6 (5.9)	-	-	102 (100)	High
Regularly sharing relevant information to relevant entities	-	28 (27.5)	61 (59.8)	13 (12.7)	-	102 (100)	Moderate
Collaborating and facilitating transportation of materials	12 (11.8)	64 (62.7)	26 (25.5)	-	-	102 (100)	High
Evacuation and relief facilities and equipment	8 (7.8)	63 (61.8)	30 (29.4)	1 (1.0)	-	102 (100)	High
Health and Sanitation Implementation							
Providing education, outreach and advice on health care, sanitation and access to clean water and prevent other epidemics	-	49 (48.0)	47 (46.1)	6 (5.9)	-	102 (100)	High
Providing First Aid training	-	-	52 (51.0)	50 (49.0)	-	102 (100)	Moderate
Emergency and medical operations for victims	14 (13.7)	64 (62.7)	24 (23.5)	-	-	102 (100)	High
Monitoring health, hygiene, water and other health problems	-	-	49 (48.0)	53 (52.0)	-	102 (100)	Low
Reporting to the committee for disaster management	-	36 (35.3)	49 (48.0)	17 (16.7)	-	102 (100)	Moderate

Collaborating and facilitating relevant WASH authorities	16 (15.7)	70 (68.6)	16 (15.7)	-	-	102 (100)	High
<b>Information and Contact Implementation</b>							
Monitoring information and reporting on situations and effects	-	44 (43.1)	52 (51.0)	6 (5.9)	-	102 (100)	Moderate
Publishing forecasts and announcements	21 (20.6)	48 (47.1)	31 (30.4)	2 (2.0)	-	102 (100)	High
Managing and storing information related to disaster	18 (17.6)	75 (73.5)	9 (8.8)	-	-	102 (100)	High
Collaborating and facilitating organizations to evaluate and estimate impact and needs of victims	9 (8.8)	50 (49.0)	43 (42.2)	-	-	102 (100)	High
Gathering and compiling information regarding vulnerable groups and areas of risk	7 (6.9)	35 (34.3)	59 (57.8)	1 (1.0)	-	102 (100)	Moderate
Disseminating and educating the public on the media regarding disaster risk reduction	21 (20.6)	56 (54.9)	19 (18.6)	6 (5.9)	-	102 (100)	High
Leading and attending meetings to share experiences and news to the committee and relevant authorities	-	11 (10.8)	67 (65.7)	24 (23.5)	-	102 (100)	Moderate
<b>Emergency Response and Rehabilitation Implementation</b>							
Gathering information and reports from various operating groups to check the availability of relief	10 (9.8)	68 (66.7)	24 (23.5)	-	-	102 (100)	High
Assessing and estimating impact and needs	-	19 (18.6)	67 (65.7)	16 (15.7)	-	102 (100)	Moderate
Conducting statistics on affected people in safe places to provide emergency assistance and to identify relief recipients	7 (6.9)	39 (38.2)	44 (43.1)	12 (11.8)	-	102 (100)	Moderate
Managing the storage of relief supplies	44 (43.1)	47 (46.1)	11 (10.8)	-	-	102 (100)	High
Dividing and transporting relief to victims	13 (12.7)	51 (50.0)	34 (33.3)	4 (3.9)	-	102 (100)	High



Contacting and calling on humanitarian organizations, charities and organizations to seek help and support	22 (21.6)	62 (60.8)	18 (17.6)	-	-	102 (100)	High
Keeping to monitor the situation and needs of victims	-	22 (21.6)	64 (62.7)	16 (15.7)	-	102 (100)	Moderate
Evaluating project estimated for rehabilitation	-	-	29 (28.4)	60 (58.8)	13 (12.7)	102 (100)	Low

Referring to find the correlation of general characteristic factors with the participation level of households (high and low), the bivariate analysis was applied to find the relationship between the factors with the high participation of household level. From the result in Table 5, respondents who are members are higher to participate in the community than non-members (Crude OR=5.02, 95% CI=1.69 to 14.88, p-value=0.002). Furthermore, the main occupation was classified into two groups as the government official (combined of government official and teacher) and non-government official (combined of farmer, worker, vender, and fisherman), the result is (Crude OR=5.87, 95% CI=1.61-21.36, p-value=0.002). Meanwhile, membership and main occupation have relationship with the high participatory of household level on the flooding and drought management in the community. However, sex (OR=1.19, 95% CI=0.47-3.05, p-value=0.716), age (OR=1.78, 95% CI=0.58-5.09; and OR=3.13, 95% CI= 0.81-12.11, p-value=0.237), living duration (Crude OR=1.09, 95% CI=0.38 to 3.13, p-value=0.867), poverty card (Crude OR=2.57, 95% CI=0.69-9.53, p-value=0.126), education level (OR=1.67, 95% CI=0.65-4.27, p-value=0.286), and family member (OR=1.17, 95% CI=0.46-2.98, p-value=0.731) haven't significantly relationship with high participation of household level on the flooding and drought management (p>0.05).

Table 5: *Bivariate analysis factors relationship with High Participation of Household level (HPH)*

Factors	n (% HPH)	Crude OR	95% CI	p-value
<b>Membership</b>				0.002
No	51 (64.71)	1		
Yes	51 (90.20)	5.02	1.69-14.88	
<b>Sex</b>				0.716
Male	41 (75.61)	1		
Female	61 (78.69)	1.19	0.47-3.05	
<b>Age (years)</b>				0.237
18-40	24 (66.67)	1		
41-50	49 (77.55)	1.78	0.58-5.09	
>51	29 (86.21)	3.13	0.81-12.11	
<b>Living duration (years)</b>				0.867
> 30	74 (77.03)	1		
18-30	28 (78.57)	1.09	0.38-3.13	
<b>Poverty card</b>				0.126
Don't have	77 (74.03)	1		
Have	25 (88.00)	2.57	0.69-9.53	
<b>Education level</b>				0.286



Secondary and higher	39 (71.79)	1		
Lower and equal primary	63 (80.95)	1.67	0.65-4.27	
<b>Main occupation</b>				0.002
Non-govt. official	62 (67.74)	1		
Govt. official	40 (92.50)	5.87	1.61-21.36	
<b>Family member</b>				0.731
<5	50 (76.00)	1		
≥5	52 (78.85)	1.17	0.46-2.98	

According to the result from the bivariate analysis in Table 5, the factors such as membership ( $p=0.002<0.05$ ) and main occupation ( $p=0.002<0.05$ ) had p-value less than 0.05. These factors were used to find key factors associated with outcome, which is the high participation of household level. However, although age and poverty factors don't have significantly relationship with the high participation of household level, these two factors were also can used and put as an initial model for multivariate analysis, which p-value is less than 0.25, as the p-value of age ( $0.05<p=0.237<0.25$ ) and poverty card ( $0.05<p=0.126<0.25$ ). Therefore, these four factors (membership, main occupation, age, and poverty card) were combination used for multivariate analysis in the Stata statistical program, by applied the Backward Elimination Method, to find the factors associated with the high participation of household level on flood and drought management. For using this method, each factors were had to adjust all together in the model and omitted the factor one by one which doesn't have associated with the outcome; then, factors were removed until they have the significantly associated with the outcome ( $p<0.05$ ). Hence, the result of multivariate analysis got only membership factor had an association with high participation of household level (Adjust OR=4.85, 95% CI=1.00 to 23.41, p-value=0.05) like showing in Table 6.

Table 6: *Multivariate analysis factors associated with High Participation of Household level (HPH)*

Factors	n (% HPH)	Crude OR	Adjust OR	95% CI	p-value
<b>Membership</b>					0.05
No	51 (64.71)	1	1		
Yes	51 (90.20)	5.02	4.85	1.00-23.41	

#### 4. Discussion and Conclusion

According to respondents' response of the households' participation on flooding and drought management, the result was showed that households have a high participation in searching missed and displaced people (92.2%), securing the security and guarding the asset of victims at safe places (58.8%), managing and assisting in the construction of temporary shelters in safe places (75.5%), collaborating and facilitating transportation of materials (62.7%), and evacuation and relief facilities and equipment (61.8%). Moreover, households have a high participation in education, outreach and advice on health care, sanitation and access to clean water and prevent other epidemics (48.0%), whereas moderate participation was found for 46.1% of respondents. The participation on emergency and medical operations for victims (62.7%) is also found to be high, as well as collaborating and facilitating relevant Water, Sanitation, and Hygiene (WASH) authorities (68.6%).



Nevertheless, publishing forecasts and announcements (47.1%), managing and storing information related to disaster (73.5%), collaborating and facilitating organizations to evaluate and estimate impact and needs of victims (49.0%), disseminating and educating the public on the media regarding disaster risk reduction (54.9%) have a high participation by households. The statements such as gathering information and reports from various operating groups to check the availability of relief (66.7%), managing the storage of relief supplies (46.1%), dividing and transporting relief to the victims (50.0%), contacting and calling on humanitarian organizations, charities and organizations to seek help and support (60.8%) also have a high participation, too.

From the previous research study, capacity building due to climate change adaptation and flooding or drought planning are the main implementing identification for the community participation (Adger, Arnell, & Tompkins, 2005). Plus, providing education, participating in training, preparing the provisional resources, developing the human capacity, and increasing the quantity of human capital are needed to raising the awareness of the community management (Klein, Midgley, Preston, Alam, Berkhout, Dow, & Shaw, 2014). Otherwise, the study was carried out the further preparedness for the climate change impacts which are to convergence respond on the flooding and drought due to climate change impacts, safe places and resources preparedness, and facility transportation (Holly, 2017).

In conclusion, the investigation of the community participation at household level on flooding and drought management due to climate change impact in Svay Rompear Commune was carried out in the research study. Based on the study's outcomes, the results were proved most of respondents have the high participation in searching, rescuing, and security implementation which the most activities are help in searching missed or displaced people, followed by the information and contact implementation which is managing and storing information related to disaster. Nevertheless, both health and sanitation implementation on collaborating and facilitating relevant WASH authorities, and emergency response and rehabilitation implementation on gathering information and reports from various operating groups to check the availability of relief, are also having the high participation on flooding and drought management activities; but, monitoring health, hygiene, water, and other health problems activities, and evaluating project estimation for rehabilitation activities are still low participation of respondents. Meanwhile, they'd rather gradually improve keeping to monitor the situation and needs of victims and evaluating project estimated for rehabilitation on the households' participation in purposed to increase the people's livelihood and to ensure the long-term sustainability on flooding and drought management due to climate change impacts as mentioned from other research.

From the result of bivariate analysis factors associated with high participation of household level, only membership and main occupation have relationship with the outcomes ( $p < 0.05$ ) where p-value has a significant level at 0.01. In addition, respondents as members of Village Disaster Management Groups (VDMG) (90.20%) are higher participatory than non-members (64.71%) approximately 5.02. In addition, the respondents who have the main occupation as a government official (92.50%) are also higher participatory than non-government official (67.74%) about 5.87. In contrary, sex, age, living duration, poverty card, education level, and family member show no significance with high participation level of household on the flooding and drought management ( $p > 0.05$ ).

Regarding to the result of multivariate analysis in Table 6, only membership factor had associated with the high participation of household level ( $p = 0.05$ ) at 0.05 of significance level, which members are higher participated than non-members about 4.85 in the 95% confidence interval from 1.00 to 23.41.





Finally, the household level as members of VDMG have a higher participated than non-members managing flooding and drought where membership factor associated with the outcome. However, the Svay Rompear Commune should increase more participation of non-members who are the volunteers, social workers, and also monks in the community, otherwise, they are not willing to be permanent members of groups; and if natural disasters occur. From the results, participants with the ages between 18-40 years are still having a lower participation comparing to the elderly people. They should be involved in participating and implementing on the natural disaster management as they are younger, more powerful, clever, high aspiration, and sustainable generation.

## 5. References

- ADB. (2012). Flood damage emergency reconstruction project reported by Asian Development Bank.
- Adger, W. N., Arnell, N. W., & Tompkins, E. L. (2005). Successful adaptation to climate change across scales. *Global Environmental Change*, 15(2), 77–86.
- CGDA. (2013). Plan of action for disaster risk reduction in agriculture 2014-2018 reported by Cambodia General Directorate of Agriculture.
- Chhinh, N., Cheb, H., Heng, N. (2014). Drought risk in Cambodia: Assessing costs and a potential solution. *Asian Journal of Agriculture and Development*, 11(2).
- Glenn, D. Israel. (1992). Determining sample size. Florida Cooperative Extension Service, University of Florida. (November).
- Holly, M. (2017). Examining decision-makers' perspectives on climate change and climate preparedness in the Lake Superior Basin of Minnesota.
- IPCC. (2007b). The physical science basis: Contribution of working group I to the fourth assessment report of the Intergovernmental Panel on Climate Change. *Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA*.
- Khoi, D. N., Suetsugi, T. (2014). The responses of hydrological processes and sediment yield to land-use and climate change in the Be River Catchment, Vietnam. *Hydrological Processes*, 28(3), 640-652.
- Klein, R. J. T., Midgley, G. F., Preston, B. L., Alam, M., Berkhout, F. G. H., Dow, K., & Shaw, M. R. (2014). 16. Adaptation Opportunities, Constraints, and Limits. In Assessment Report 5-Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects (pp. 899–943). *Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press*.
- Kuntiyawichai, K., Dau, Q. V., Inthavong, S. (2017). Community engagement for irrigation water management in Lao PDR. *Journal of Water and Land Development*. No. 35 p. 121-128. Doi: 10.1515/jwld-2017-0075.
- Leng, H. A. (2014). Country report of Cambodia disaster management.
- MRC. (2009). Adaptation to climate change in the countries of the Lower Mekong Basin: Regional synthesis report of Mekong River Commission.
- MRC. (2012). The impact and management of floods and droughts in the Lower Mekong Basin and the implications of possible climate change reported by Mekong River Commission.
- MRC. (2013). Glossary of terms and definitions on climate change and adaptation reported by Mekong River Commission. (January).
- NCCC. (2013). Cambodia climate change strategic plan 2014-2023 reported by National Climate Change Committee.





- NCDM. (2015). Cambodia disaster loss and damage information system report of National Committee for Disaster Management.
- Sok, P. (2017). contingency plan. *Asia Disaster Pacific Center*. (August).
- USAID. (2016). East Asia and the Pacific disaster risk reduction reported by the United States Agency for International Development.