Assessing Famer Household's Vulnerability in the Red River Basin Vietnam effected Climate Change: A case study in Vinh Phuc Province

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Abstract

Vietnam is identified as one of the countries worst affected by climate change and natural disasters. The impacts of disaster risk will affect households to different degrees. In Vietnam, there is an increasing record of extreme weather events, leading to natural disaster risks such as floods, droughts, and saltwater intrusion. , causing significant damage to people in Vietnam in general and in the Red River Delta (RRB) basin in particular. This study surveyed 420 households in Vinh Phuc, a typical representative province of the Red River Delta provinces affected by climate change. Research shows that vulnerability will be influenced by the geographical location where the household lives, there is a link between vulnerability and poverty. The study also assessed people's perception of the flood risk, as well as the solutions that households can respond to mitigate the risk.

Keywords: *Vulnerability; Natural disaster risk; Agricultural activity; Mitigation strategy*.

1. Introduction

Vietnam has been identified as one of the countries that will be worst affected by natural disasters and climate change in the World. Climate change is a great challenge to most of the national targets of the Government of Vietnam, including poverty reduction and economic development. The loss of assets and other climate change impacts on humans increase the pressure on poverty reduction in rural areas of Vietnam where resides almost 70% of the population and more than 90% of them engaged in agricultural activities so their production depends highly on climatic conditions and natural resources. Therefore famer household' vulnerability and their experiences in adapting to climate change are very important and essential to be assessed thoroughly before making relevant policies.

According to a report by the World Bank (2010) [1], Vietnam is one of the most vulnerable countries in the world to climate change and natural disasters because of its geographical location and characteristic. Besides, Vietnam is also known to already experience adverse impacts resulting from increased inter-annual climate variability, a tendency that will increase in the future (Oxfam 2008 [2]; Phan et al. 2010 [3]). There are gradual changes such as rising sea levels and higher temperatures which are already recorded. Extreme weather events and natural disasters such as storm, flood, drought, and rising tide are most likely to increase both in scale and frequency over the coming years (Oxfam 2008 [2]; MONRE 2007 [4]). These would cause extensive damages to infrastructure, significant losses in the agriculture and fisheries sectors, as well as a large number of fatalities.

According to the assessment, Vietnam is located in the tropical monsoon region, the

terrain is very diverse with over 3,000km of coastline, and three-quarters of the territory is mountainous, along with a dense system of rivers, streams, and canals. In recent years, natural disasters have become more and more complicated, with the appearance of 20/21 types nationwide (except tsunamis) and tend to increase in both frequency, scope and extent danger level. It must be mentioned that major natural disasters increase risks to people, properties and production and business activities, especially vulnerable groups (the poor, the low-income,...), areas at high risk of being affected by natural disasters (low-lying areas along rivers, streams, coastal areas; areas frequently divided by floods, hillsides, mountains, etc.). According to the climate change scenario, in the middle of the 21st century, the average annual temperature nationwide will increase by 1.3 - 2.3 degrees Celsius, in which the northern region will increase from 1.6 - 2.3 degrees Celsius. 2.3 degrees Celsius, the southern region increases from 1.3 to 1.9 degrees Celsius. Annual rainfall tends to increase in most regions of the country. The common increase is from 3÷15%, in which the rainfall in the rainy season increases and the rainfall in the dry season decreases. The increase in temperature and rainfall will make natural disasters in general and floods, droughts, and salinity intrusion in particular increasingly extreme and tend to be larger. Along with that, sea level rise will cause serious flooding to estuaries and coastal areas.

Hence, research on famer households living in areas of RRB is needed to assess the vulnerability of the poor, especially to the impacts of climate change. Illustration of the characteristic of households, especially poor households, would help us have an overall view of households in order to make good policies on reducing the risks and damages they face. Furthermore, poor household's income depends highly on agriculture, forestry and other activities using natural resources. Therefore, it is necessary to focus on the role of livelihoods and income diversification to help them get rid of poverty. Assessment of household's vulnerability is also necessary to realize the strategies and policies to help them cope with impacts of climate change.

2. Methods and Materials

2.1. Vulnerability assessment

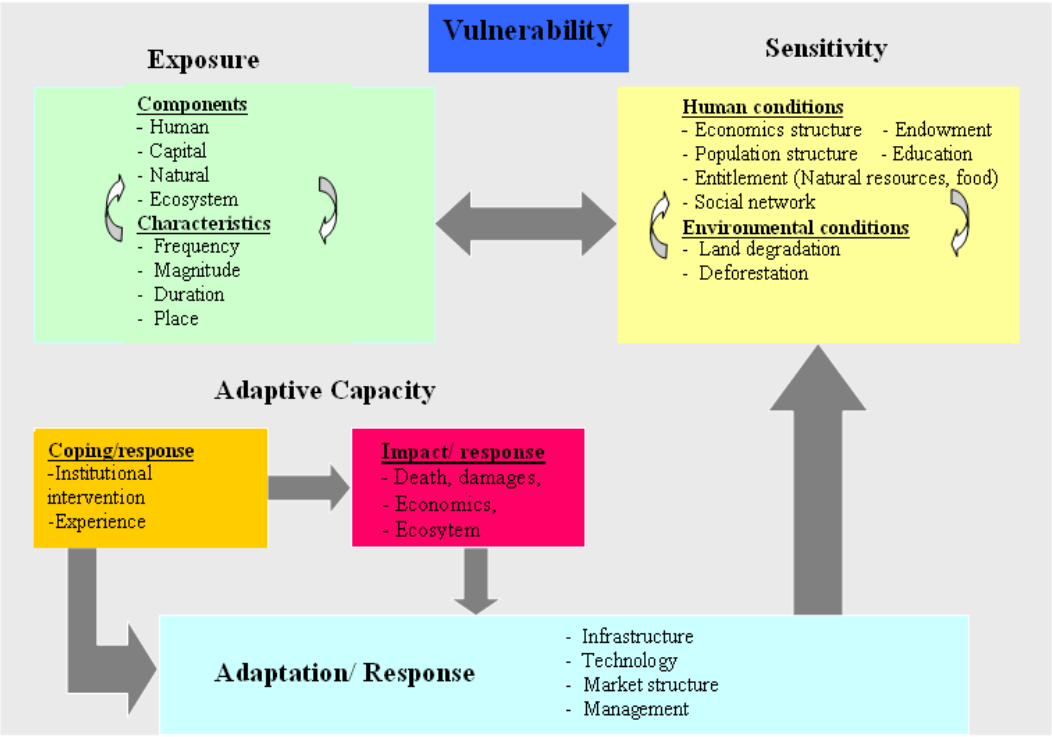
The different views on vulnerability lead to various analytical concept and models of assessing vulnerability since these conceptual models are essential steps towards the development of methods measuring vulnerability and systematic identification of relevant indicators. As Jorn Brikmann's [5] attitude, in discussions of different conceptual and analytical frameworks, there are at least six different schools which can be distinguished: The school of the double structure of vulnerability (Bohle, 2002) [6]; the conceptual frameworks of the disaster risk community (Bollin et all., 2003) [7]; the analytical framework for vulnerability assessment in the global environmental change community (Turner et al., 2003) [8]; the school of political economy, which encompasses the root causes, dynamic pressures and unsafe conditions that determine vulnerability (Brikman, J.; Wisner, B.., 2004) [9]; the holistic approach to risk and vulnerability assessment (Vojinović, Zoran et al. 2016) [10] ; the BBC conceptual framework, (Birkmann, 2006) [11].

For each school having separated approach and systematical analyses, these frameworks have advantages and disadvantages. However, in the framework used by Turner et al. (2003) [8] illustrating a broader definition of

vulnerability, exposure, sensitivity, and response capacity, and addressing adaptation responses are also taken into account.

In this research, a new framework based on Turn et al.'s Framework [8] combined with Sustainable Livelihood Approach [12] has been developed (see figure 1). The framework can be used to assess both individuals' and communities' vulnerability level. However, this research only focuses on assessing vulnerability of individuals and households

Figure 1. Framework to assess vulnerability



(Framework developed bases on Turner et al.'s Vulnerability Framework)

The concerning the famer household's vulnerability in the RRB regarding to climate change, there are three research questions. (i) What are the main characteristics of households living in RRB? (ii) How are their characteristics related to their vulnerability to flood risk? (iii) How does households' vulnerability connect with agricultural activities? The first research question answered is mostly based on data from households by conducting survey. The second research question concerns to assess vulnerability of households, this research only focuses on assessing vulnerability of households as known as individuals' vulnerability (Turn et al., 2003; Oliver 2008) at fixed local is Vinh Phuc province. The third research question, one issue deeply, is illustrated to address more deeply farmers' vulnerability related to agricultural activities such as crop, livestock, and fish. To answer these questions, we will be more understanding on sensitivity and adaptive capacity of farmers through their activities. The regarding mitigation strategies of RRB famer household, the fourth research question, how is mitigation strategy related to agricultural activity? The answer to this question is based on the famer households' perception on risks, they will choose suitable

strategies to risk reduction. I supposed that these mitigation strategies must be in arrange of households' income because in fact some strategies are more significant but households can't afford with high cost of coping by limited in their income.

2.2. Materials

2.2.1. The study area

Vinh Phuc Province is located in the Northern key economic zone; the project area is the central area of the province. The study area is bordered by Thai Nguyen and Tuyen Quang provinces to the North, by Lap Thach district to the West, and by Hanoi capital to the East and South. The study area comprises of 7 administrative units, including the city of Vinh Yen, Phuc Yen Town and 5 districts: Tam Duong, Tam Dao, Binh Xuyen, Vinh Tuong, and Yen Lac. The center of the study area and of Vinh Phuc province is Vinh Yen city, which is located at 50km from the center of Hanoi capital and 25 km from Noi Bai International Airport.

In the project area, topographical conditions are complex, slope direction is from Northwest to Southeast. Most of the northern part is mountains and hills (Tam Duong, Tam Dao, Binh Xuyen) at predominant elevation of 300m to 700m. The southern and southeastern parts are lowlands at frequent elevation of + 10.0m to + 12.0m (Vinh Tuong, Yen Lac, Binh Xuyen, Vinh Yen districts) and the low-lying areas adjacent to the Red River dikes are at elevation of +5.0 ~ 8.0m.

The stuyd area is within the tropical monsoon with hot and humid climate. There are 2 distinguished seasons in a year: the hot season with lots of rains lasts from April to November; the cold, dry season takes place from December to March

In Vinh Phuc Province, rainfall is unevenly distributed in space and time. According to statistics of the period 1962 ÷ 2020, rainfall mainly concentrates from May to October (80% of the annual rainfall). In spatial terms, rainfall is usually higher in the mountains than in the plains and midlands. The average annual rainfall at the Vinh Yen station, which represents the plains and midlands, is 1574.8 mm while the average rainfall at Tam Dao station, which represents the mountains, is 2439.4 mm.

2.2.2. Conducted survey

Data from a household survey conducted in spring, 2017 in Vietnam. Sampling relies on geographical characteristics of Vinh Phuc province. Firstly, The number of household's was identified based on total Vinh Phuc province. As Yamane Taro (1967) method total household of survey was 380 household. Which household was allocated in Districts and city. Households were selected based on a geographical location and density of population.

Then, based on discussions with local representatives of the Provincial Department of Agriculture and Rural Development and local community's stafe. Finally, in districts, households were randomly selected from the village list of registered households. By using this sampling strategy, all types of households in the areas affected by impacts of climate change are represented. The households which are randomly selected will ensure the representation of Vinh Phuc's province population. In general, there are 420 households interviewed in 5 districts include Tam Dao, Binh Xuyen, Yen Lac, Vinh Tuong, Me Linh, and Vinh Yen city and Phuc Yen tower in Vinh Phuc province.

3. Results and Discussion

3.1. Households' vulnerability to impact of climate change

Based on the households' vulnerability, also known as individuals' vulnerability level, the analysis of factors' effect to individuals' vulnerability is necessary to know how the vulnerability of households in general and of farmers in particular is to adverse impacts of climate change. The analysis focuses on analysing socio-economic conditions to reflect more sensitive attitude and examine the adaptive capacity of households in Vinh Phuc province.

3.1.1. Geographical characteristics

The location and place of residence will be examined as a character of exposure in vulnerability concept. In the other words, exposure can be considered as a function of geography. This factor thus defined as spatial manifest related to poverty. Poorer people tend to live in more "marginal" and more hazardous areas. However, the location of households also decides the loss and the stress to each kind of identified hazard. Household living close to the coastal line will be more vulnerable to sea level rising or the salinity intrusion which would lead to loss of agricultural land or threat to household's residence. Meanwhile, people living in plain areas usually get stresses to floods more than to sea level rising issues. Drought and landslide events are main stresses with the ones living in mountainous areas. Loss in economics, threats to healthy and spirits are manifested of stress. To evaluate the stress on healthy and spirits are not easy, however, we can estimate by asking directly households throughout Willingness to Pay (WTP) and the time and effort to recover the initial situation. It will be not illustrated in this research. The target of this research only wants to know if geography could be a factor effect to households' stress. Throughout the response of households when they were asked the Willingness to Accept (WTA) how much money to recover their broken items in an event and flood for instant, the most popular risk, there is obvious evidence to agree that geography is a factor affected to households' vulnerability with household living in plain districts (Loss average of Local_Plain is 101.82 million VND) lose greater than the other ones to flood caused by climate change (average of Local_Mountain is 51.27 million VND).

From the loss estimated of households to flood, it could be considered as the Willingness to Accept (WTA) of flood risks of household will depends on geography. In general, households living in plain areas will be more vulnerable to flood than the other ones whose living in higher areas such as Tam Dao district. In the other words, geography can be considered as a factor to households' vulnerability.

3.1.2. Age and household size

According to the data from survey, the responders' average age is 50.7 years old. Most of the people, who were interviewed, are household head or the oldest persons in their family. The age range of responders is from 22 to 77. It is supposed that interviews with the household head is very important and necessary to get full information on them as well as the other members, total income and their livelihoods. Household size is 4.9 persons per household and there is 16.7% of household said that they have children under 3 years old. The rate of people out of working-age including below 18 and over 60 years old is nearly 39%, especially below 18 years old is

26.3% and over 60 years old is 10.6%. It means that there is high proportion between working-age people and non-working-age people by 1: 0.58; Household size on average is 4.9 is higher nation average household size 3.5 caused increasing pressure on improving living conditions and adaptability to adverse with stresses by natural disasters. There is evidence to express relationship between poverty status and household size, the size of poor household (5.6) is much larger than the non-poor household (4.8). The rate of poor household in Vinh Phuc là 2.9% was low compare with Nation's average level.

Table 1: Regression incomePersonYear and household size (OLS model)

IncomePersonYear (million VND)	Coef.	Std. Err.	t	P>t
HH_size	-2.576	0.430	-5.991	0.00
_constant	41.565	2.482	16.750	0.00

Moreover, the household size declines gradually the higher income following (see table 1 above). It can be considered that poverty increases with household size, in the other words, the vulnerability of households to impacts of climate change is directly proportional to the household size.

3.1.3. Gender of household head

According to the data, 88.17% of total of households head are male and only 11.83% are female. The gender of household leader is quite different. The rate of household head in Vinh Phuc province could be considered if the households are more sensitive to impacts of climate change because household header's role will play important part in influence in their family's sensitivity and adaptability to impacts of climate change. It could be simply understood that male leading households are stronger than female leading households on coping with stresses by extreme weather events such as typhoons, floods etc. A given question is why the proportion of male household lead in the rural areas of Viet Nam in general and Vinh Phuc province in particular is high. It can be understood as a typically agricultural culture from ancient times of Vietnamese households. Especially, this rate is really high with farmer households living in rural areas in Red River Basin, where people must resist to a lot of risks from natural disasters. Moreover, with farmer households, they usually have to work outside on fields and activities related to agriculture require them to be more powerful so that men must do these hard works, which leads to the fact that they have more roles and as key workers in their household. Most of female leading households are often single-family. They are widows without remarriage, divorced women, separating from husbands or frequent absent husbands. These female headed households will be more sensitive with adverse impacts of climate change and there are about 15.09% of female headed households fall in poverty.

There is a relative between rate gender of household headed in Vinh Phuc province with the sensitivity related to agricultural activities. It leads to the rate of male headed households is higher than female ones.

3.1.4. Occupation

There was 59.05% of responders said that their work are related to agricultural activities like as crop, livestock, or fish. Respondents answered that they work as workers in manufacture or own business are by 13.92% and 3.34%. Respondents answered that they are retired by 3.14%. In the Red River Basin, although there have been changes in economic structure, which tends to increase the role of economic parts such as industry, services in recent years, but the rate of people working in agriculture is still high. It is supposed that

people living in rural areas will be more sensitive to impact of climate change than people living in city or central city because farmers' production mainly depends on climatic conditions.

To find out the evidence to express the vulnerability of farmers, Probit test (Maximum Likelihood Estimate) between poor status of households with their occupation situation. Poor households have identified based on the average income person per year after being compared with the poor standard of Vietnam in the rural areas. To make it simple, the status of households has been divided into poor households and non-poor households based on annual average income of members in family. (see table 2).

Table 2: Probit test between poor status and households' occupation

Poor	Coef.	Std. Err.	z	P>z
RespOccFarmer	-1.668	0.468	-3.560	0.000
RespOcOwnbussiness	-1.786	0.293	-6.095	0.000

It is easy to see that the probability of farmer households falling into poverty is quite high F (-1.668) = 0.0246, which means more than 2.46% farmer households are living in poverty. Meanwhile, the proportion with 1.20% with business households. The strange thing is that, business households occupy the second proportion of poor households. It just be explained that, these households must have been running small business cause they don't have enough land to produce and can't find a job. The proportion of farmer households is high in Vinh Phuc province in particular and in the Red River Basin in general. The farmer's production happens mainly outside and highly depends on climatic condition. That is reason why they will be more sensitive than the other households working inside the factories, offices, and housing. The evidence is that farmer households take the highest part of poor ones in Vinh Phuc province. It would be considered that farming households are the most vulnerable among social classes in rural area.

3.1.5. Education

Education, one of elements belongs to human capital, also be seen as an important predictor of adaptability to climate change. In this investigation, the education level of respondents is shown that there is only 40.0% finished high school the viewed reach high school, and over 16% only had finished primary school. Generally, positive correlation has been found between education and positive life outcomes (income, health, well-being etc.) with households with higher education level having the better income (see table 3 below). Improving education level is one of targets to adapt with climate change in near future. When education is improved, the households and farmers will have more opportunity to reach a sustainable livelihood situation. Moreover, households with higher knowledge will be better aware of natural risks and tend to choose suitable strategies to reduce risks.

Table 3: Regression Income Person Year of each household with education level

IncomePersonYear (million VND)	Coef.	Std. Err.	t	P>t
EducPrimary	25.50	3.25	7.83	0.00
EducSecondary	26.10	2.24	11.66	0.00
EducHigh	28.80	3.78	7.61	0.00
EducUniver	31.60	4.56	6.92	0.00

The education level of households is intimately connected with their income, the better their education level is, the higher their income is, which leads to increasing the adaptive capacity of households to impacts of climate change.

3.1.6. Poverty and diversity of income

Poverty can be considered as a great caused lead to vulnerability by impacts of climate change. Poverty is mainly viewed as an indicator of lack of access to resources and to have opportunities on income improvement but it has other aspects of social positions such as geographical location, age, gender, class, ethnicity, community structure, and political issues that determine poor people's vulnerability (Yodmani, 2001) [13]. Poor households often identify vulnerability as a condition that takes into account exposures to serious risks. It is also specific characteristic of Vietnamese household in rural areas in general and farmers in particular. These characters are very different to farmers' coming from developed countries. It is directly associated with access to resources which affect both baseline vulnerability and coping with impacts of extreme events. It relates to entitlements and opportunities to access five sources: social capital, financial capital, natural resources, human capital and physical one. It is argued here that the incidence of poverty, as observed through the quantifiable indicator of income.

The average income of farming households in 2017 was 132.2 million VND while households' average income was 147.7 million VND. In rural Viet Nam, the income of farmers is lower than the other households by nearly 10.5%. In fact, farmer's income coming from off-farm activities occupy the high rate, often around 30% of total income therefore their income is just enough for essential requires. The off-farm activities come from working out of crop time by entering free labour market or doing secondary job like handicraft. Due to high risk and uncertainty in income, both of off-farm and agricultural activities will be addressed to sensitivity and vulnerability of farmers more seriously and a analysis on income diversification of farmer household related to agricultural activities will be done deeply in next part of the third research question. By this way, the number of household runs out of poverty is quite low and difficult to be done. By contrast, in time periods, some households fall into poverty again. It is a great cause threatening the national targets program on poverty reduction in Vietnam in recent years. Moreover, the effect of worldwide economic crisis combining with abnormally extreme climatic events have been threatened seriously to living conditions of households in rural Vietnam, especially farmer households.

There are a lot of criterions to assess one household belongs to poor or not poor household. In fact, it is usually based on international or nation standards, but it is not efficient realities of life. This research has added one question to know the satisfaction of household in using their income to pay for their basic needs such as foods, clothes, care children and fee to pay for education. Only 1.79% household said that they can save money. 23.66% households said that it just be covered the needs and they have no saving. There are 73.88% households said that their income does not cover the needs, especially there are 20.98% households recognized that they get a lot of difficulties in covering the needs. It is an irregular proof that if there a sock from natural disasters, only 1.79% of households can overcome natural hazards, the other ones badly affected by the impacts of climate change.

In conclusion, poverty is the most important factor affecting to adaptive capacity of households. The sensitivity of households in rural Vinh Phuc province is really high due to poverty situation and especially, more serious with farmer household with uncertainty income resources.

3.1.7. Endowments and opportunity to access natural resources

In this part will examine the ability of households general and farmer particular on own property and opportunity to access natural resources. According to data investigated shows that the households on average have 355,5 m2 of residential land it have including garden area. This area can be seen as asset of each household. Natural resources which households can be access such as farm land and forest land, aquaculture land. These resources are very important to define main income sources of each household, it is really important with farmers. Through own land of households we can assess the sensitive level of each households. There is 29,7% household saying that they have own farm land on average 600 m2 equivalent 1,6 sao , 39% household saying that they have own 1800 m2 (5 sao) and 23,6% have own 3000 m2 (equivalent more than 8 sao) and only 7,4% household saying that they have own more than 10.000 m2 however those household usually have aquaculture land with average on 2896.3m2. Land scarcity is generally expressed as one of the major obstacles for a reduction of social vulnerability (Adger.1999; Adger. et al. 2000; Adger.2005; Leary et al. 2008) and a serious constraint for generating sufficient income in Vinh Phuc. There is a general perception that there are too many people and not enough land. With increasing of population then land scarcity is more serious. With youth households when they have more children, they have hard to get more land for production, by land use right is be recognized law in 1993, usually on 20 years for crop and 50 years for forest land. Moreover, few people can sell their land when get too old to manage their land, in fact it is usually inherited by their children or by few young people migrate to the cities. Therefore it is difficult to buy land. There are, however, cases of land traded when people have no one to inherit the land or when the people are very poor.

Beside of owning natural resources, endowment of households in the Red River Basin usually express through their house and these items in their house such as means of transport, televisions, fridges, but the willingness to own a permanent house is a biggest dream of mostly households in the RRB general, Vinh Phuc province in particular. With a permanent house, it can protect people before hazardous events made by climate change. As the survey, farming households have the highest on rate of semi-permanent and temporary housing (see figure 1 below). It is also an evidence to address the more sensitive at least 7.61% total farming households will be the most affected by extreme weather events.

There is another way to know why people more vulnerability or not by expressing their consumption behaviour. With expected people more risk or more vulnerability under risk by natural hazard they usually have more trending saving money or to less consumption today to use on tomorrow. When they consider to risks on tomorrow they will have motivation to save resource today to cope and overcome risks on tomorrow or near future. To have this motivation, they must have seen the consequence of natural risk and the effect of risks to their living. With the question on spending their income, there is evidence said that, farmer and retired are willingness to save money with higher rate, they are more vulnerability, with business households they have trends to consumption more related to motivation to get dividend on tomorrow (see figure 2 below).

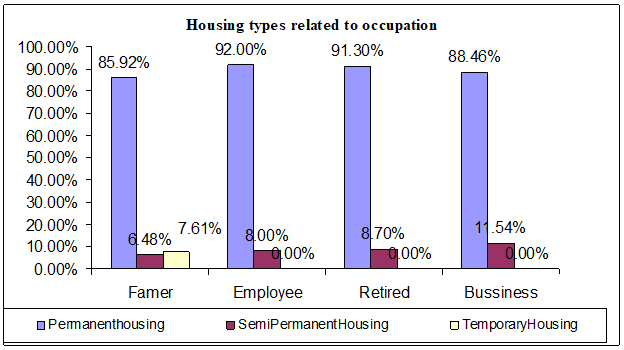


Figure 1: Endowment of households as the types of house

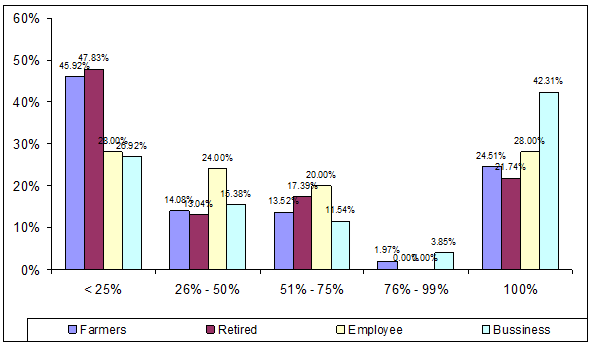


Figure 2: Consumption motivation of households

3.1.8. Access social resources

Access social resources can be seen through access market, services from infrastructure, distance with production location. One other word households have more benefit by dominance on location. For instant households living near market or city central they are easy to trade their products in market, by this way, they get the products' increased vale bigger than households have when coming far from market.

Based on the number agricultural products can be sale into market, (Barahona et al, 2011) [14] indicated that with indicator sales diversification, households selling no products were classified as subsistence, 1-5 products as low market orientation, and 6 or more as high market orientation, we should not mistake with specializing areas attitudes. According investigated data, households in rural Vietnam in general, Vinh Phuc in particular are low market orientation by the low diversification. The size and level is small and not concentrate and is still typically supported themselves. By low market orientation, their products value is low without trading. It still not increases addition value of products to improve their income. This will be more sensitive income to coping with impacts of extreme weather events. The sensitivity of Vietnamese farmers is more than with other countries farmers.

Beside of access the market, Vietnamese households have a psychology want to live close to their production areas. In plain areas, most fields close to big rivers and nearly rivers, so this also reason why households or farmers more vulnerable with natural risks as floods caused by rivers' water lever be over flow.

3.1.9. Access social network

Social network is one of ways to mitigate climate change impacts. In many developing countries informal networks play an important role (Townsend 1994) [15], this might be especially true under the threat of a natural disaster. When responders were asked they become one of member of social organization. To do it will help us know about the role of organization in society and households' sensitivity to adapt with climate change. When a household belongs to social organization, it would be helpful to have more power and advance to approach social capital, natural resources or simply to get more information on experience to adapt with risks in future. Measuring social network participation at the household level is particularly challenging. In this research, two measuring ways will be examined. First, each household was asked to which organization he belongs, with thin a list of twenty organizations. As the data from survey, a household belongs on average to 2.7

different organizations. 14.51% of households report that they don't belong to any organization . On contrast 15.85% of households report a high level of social interactions, they belong to at least 5 organizations. When households asked if he has exchanged experiences or ideas with his neighbours about natural risks then there are 14.51% of households said that they have not exchanged any kind of experience or information; 17.63% rarely; 52.90% occasionally and 14.96% regularly.

Now we want to know, networks of society will play role in the ability of households adverse with stresses and natural risks. How is related to household's income? To do analysis with some big groups above, it is obviously to see that people who joined Communist Party will be more power than the other social groups and have higher income comparing with people who joined other social groups (Coef. = +3.2817), it is true with society in Vietnam when only Leader Communist Party, people who are member of Communist Party they usually have more opportunity to get a good position in society, by caused they have more power and opportunity to get information or supported from governments to overcomes stresses and reproduced after natural risks. It means they have highly adaptive capacity to cope with impacts of climate change.

Now, agricultural organizations will be addressed to examine its role with farmers. It would be important role to improve farmer household situation. With 10.7% of respondents they belong to agricultural organization, however, joining rate for each kind of cooperation is quite different and one farmer can enter many agricultural organizations related to crops or activities on agriculture (see table 4 below). They are not interested in entering organizations. It will lead to limit opportunity to approach technological advances, to increase knowledge and information on their products.

Table 4: Agricultural organization and rate of entering

Cooperation	%	Cooperation	%	Cooperation	%
Irrigation	72.90%	Veterinary	66.70%	Pesticides	72.90%
Field protection	68.80%	Fertilizer	79.20%	Agricultural extension	81.30%
Land preparation	60.40%	Crop variety	64.60%	Marketing	56.30%
		Credit	52.10%		

3.1.10. Access financial resources

To access financial sources of households have really meaningful with households to improve income source by opening production and to help them overcome hazardous risks in the shortest time. Households have more opportunity to access many financial sources then they have more adaptive capacity to coping with natural disasters. They will be less sensitive than other households who are lacking of financial sources. It is true in the fact, individuals' protective motivation stems from two mediating processes: Threat appraisal process in using to evaluate threats; Coping appraisal process in selecting among protective strategies, along with costs of coping. Thus, the access financial resources will help households easily choosing suitable and efficient strategies to adapt with impacts of climate change. When households get more financial resource then they will give less the time and efforts to adapt with impacts of climate change. In this research also find out the evidence of financial organization role in society, there is a positive proportion between income of households and their entering in credit cooperation. It means that income of households will be higher if he joins credit cooperation (see table 5).

Table 5: The role of Credit Organization to Income of farmer households

Income	Coef.	Std. Err.	t	P>t
OrgCredit	4.70	1.64	2.86	0.027
_cons	131.63	11.59	11.35	0.000

3.2. Mitigation strategies related to agricultural activity

In this research, mitigation strategies have been known only focus on micro-strategies, based on individuals' or households' protective motivation. It is supposed that these mitigate strategies of households based on their knowledge and experiences to mitigate consequence of risk. Knowledge and experiences of households are perceived from consequences of historical events. With each mitigated strategy will be along with a cost so having a concerning which mitigated strategy will be choose by household within their limited income and other situation as time, afford conditions. It maybe becomes a new research that should be developed deeply. However, this research just examines strategies the most regarding to choosing by households, and try to find effect of households' situation like as rich or poor household. Through outcome of mitigation strategies of household, it would be meaningful to address more deeply understand on households experience to adverse impacts of climate change. It also explain that why Vietnamese households in general and farmers in particular often have many experiences in advising to natural disasters.

By the various impacts of climate change, adverse each impact of climate change always along with a list of actions will be satisfied by households how to cope with threats from to adverse impacts. With defined strategies, households are willingness to minimize damage on human and poverty, therefore to be at least stresses. For example, before storms or typhoons hits residents usually receive a typhoon warning so they have time to prepare, they can buy something needed such as water, food, batteries, flash-light and keep themselves in house. Beside of activity to protect human, arranging strategies such as managed natural resources, protected their products from agriculture will be done how to adapt with adverse impacts and to minimize the loss of production. For example, with fishing households, they often harvest fish beginning floods or typhoons. With household related to forest they choose plant can stand under high win's speed of typhoons when landing. Household always prepare for their strategies in both short time and long time period. With strategies in long time usually focus on prevention and defending mechanism therefore it is specific importance in risk mitigation, in some cases, it would decide to success or failure of coping with impacts of climate change. Almost self- protect strategies of households are made based on individuals' experiences. What we are interested in these strategies: Can they become popular or apply in spacious areas or copy to other areas? Furthermore, we can promote the movement in risk reduction by applying micro policy at community level to help households in risk proposed. In this research, strategies on flood risk reduction will be addressed and illustrated as the responses of households in general, and farmers particular. Moreover, flood also refers to the most serious impacts of climate change in Vinh Phuc province. Throughout respondents of households we will have assessment on experience and ability to adapt with natural risks. Here a list strategies had suggested based on observations by making sample survey and assessments of experts in agriculture (see table 6 below).

Farmers in Vinh Phuc province, they have experience to choose efficient strategies along with low cost to minimize the loss by impacts of climate change. These strategies always come high on the priority such as: store food, keep food into small bags, keep seeds, and exchange labour with neighbourhood (see figure 3 below). An interesting evidence of household' experiences in here, households often keep food into small bags because they can move easily their food to higher areas when flood coming and it must be done the first to save themselves overcome dangerous periods. Keep the seeds often related to crop, by doing that they can reproduce after getting risks as quickly.

Table 6: Name of mitigate strategies apply for flood risk

No	Short word	Contents	No	Short word	Contents
Str1	StoFood	Store food	Str8	Off-farm	Off-farm activities
Str2	PaddiesBag	Store paddies in bag	Str9	ExchangeLabor	Exchange labor
Str3	SecondFloor	Secondary floor	Str10	SaveCash	Save cash
Str4	HarvesFish	Harvest fish beginning	Str11	SaveKing	Save in king
Str5	ModifiCrop	Modification crop	Str12	HealthInsurance	Health insurance
Str6	DiversifyProduct	Diversify production	Str13	LifeInsurance	Life insurance
Str7	KeepSeeds	Keep seeds	Str14	AgriCooperate	Agricultural cooperation

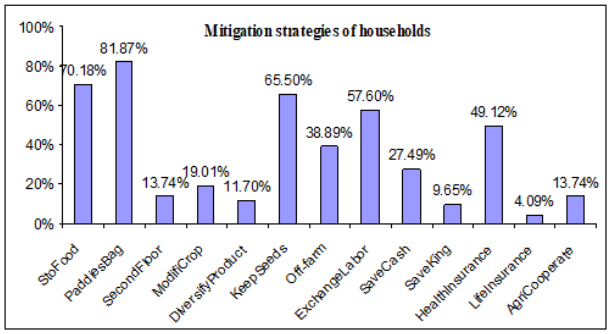


Figure 3: Mitigation strategies of households

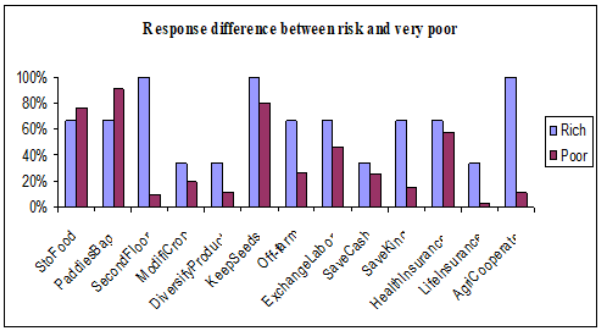


Figure 4: Adaptive strategy depend on status

One specific strategy is exchange labour with neighbourhoods, by character of farmer in rural of the RRB, where almost activity related to agricultural activities made by hand, and need to do in short time, and quickly to keep in crop periods, as known as the social community in rural RRB. These strategies being in long time like to buy health insurance and having more off-farm activities, it helps household can pay hospital fee and improve their income when out of time crop and harvest. The proportion of households using these strategies related to high cost (life insurance, second floor) and needed high knowledge in technology or information on crop (modify crop, diversify products) is low, they, thus, should be helped more in information, advance technology and good policy from government and community.

Most of these strategies chosen by farmers usually relate highly to crop activities. These strategies are really efficiency and suitability by easy doing and low cost.

An argument is given, maybe there a relationship among strategies chosen with household income situation? On the other words, how is the difference on choosing strategies by rich and poor household. As the figure 4, it expresses clearly the differences between rich households and poor households. Rich households are defined only when their income can be covered all of needs without difficulty and they can save money. Meanwhile poor households, they can't pay for their needed and of course they have no saving money. With rich households, they pay the highest attention to have secondary floor because it really keep them out of serious situation with impacts typhoons and floods. In contrast, poor households, they can't afford to do that because of lacking money. However,

rich households, they usually aware of the role of agricultural organization better than the poor driven they care entering agricultural cooperation. In long time period, risk households choose saving kings and buying life insurance to overcome risk in future. Here, saving kings is prefer than saving money by uncertainty in financial policy of government and high inflation. So we can say that strategy chosen highly depends on income situation, with rich households, they have more opportunity in choices to enable them less vulnerability with impacts of climate change in general, flood risk particular.

3.3. The difference mitigation strategy related to agricultural activities

Beside of specific strategies related to activity in agriculture, now some strategies will be examined by using the same in households, the idea here wants to find out the differences among several strategies by household referring different activity like crop, livestock, and fish in Vinh Phuc. Firstly, with mostly strategies, there is no differences between household related to crop and livestock. It is simple to understand, when most of farmer in this study areas are small farm and they have both of crop and livestock. It is also evidence to talk that no difference household related to crop and related to livestock. Secondly, Fish households are less need to exchange labour with their neighbour than with farmers related to crop and livestock. But they mostly like to save cash and other kind of cash like as gold, it is supposed that it depends on the time period of fish harvest, they need to keep money thus easily to buy the breeding fish and food of fish in production process. Moreover, household related to fish are more sensitive than the other household by flood impact therefore they always need to save money or kings to quickly reproduce after floods. The mitigation strategies of farmers related to crops and livestock is the same, because the attitude of farming households in this study areas does not separate in their activity, one household can have both of activities crop and livestock. Meanwhile, fishing household prefer keep money and king to easy reproduce and related to time periods of fishing harvest.

4. Conclusions

This research has been identified that households, in the RRB and local in Vinh Phuc province, are more vulnerability to impacts of climate change, especially, farmer as a people class the most in rural Vinh Phuc particular and Vietnam in general has been recognized the most vulnerable to risks by impacts of climate change. Research has been indicated that vulnerability is a function of physical vulnerability, sensitivity and adaptive capacity of households. Households' vulnerability level is quite significant effect by poverty situation, low education, increase population and lack of natural resources. Meanwhile, households in general and farmers in particular have little opportunity to improve own natural resources such as agricultural land. The lack of agricultural land is meanly reason leads to farmers are more vulnerability. There is not enough diversification in income sources due to household and farmer usually living in poor or nearly poor situation. With impacts of climate change, some households can't run out of poverty, they always live in the cycle of poverty without opportunity. The aware of this reason, government and local government should increase social investments to improve infrastructure, application advance technology and mechanization in agriculture to improve household's income, specially, with farmer. Beside of improvement on agriculture, households must be help more than in market

of outcome products to increase income person per years.

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