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# ASSESSING THE ADAPTIVE CAPACITY OF HOUSEHOLDS TO CLIMATE CHANGE: A CASE STUDY IN QUANG DIEN DISTRICT, THUA THIEN HUE PROVINCE

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**Abstract:** This study aims to identify the adaptation capacity undertaken by households in response to natural disasters and climate changes (CC). A total of 100 households in two communes including Quang Phuoc and Quang Cong, Quang Dien district were interviewed. The findings indicate that in the last few years, these communes have been badly affected by various types of natural hazards, including typhoons, floods, droughts and, and extremely cold weather. The study demonstrates that the adaptive capacity index in Quang Cong is significantly lower than that in Quang Phuoc (0.50 and 0.52). Also, the current adaptation actions of local households in response to natural disasters and CC have focused on short-term actions only. On the basis of the findings, the study proposes key recommendations to local households in Quang Dien district to effectively mitigate and adapt to natural disasters and CC. The recommendations encompass three groups, namely (i) raising awareness and understanding about CC; (ii) improving the infrastructure system; and (iii) diversifying livelihood strategies to increase income.

**Keywords:** climate change, natural disasters, adaptive capacity, index

## 1 Introduction

Climate change (CC) and its impacts have been identified as the most critical challenge in the 21st century. Climate changes heavily affect not only human's living but also production and environment in the world. Climate change issues include temperature increasing and sea level raising that lead to flooding and the increase in intensity and frequency of natural hazards. They affect the social economic development, and this is more vulnerable for developing countries. Recent studies have indicated that in developing countries, there is a shortage of capitals to implement the solutions to adapt and mitigate the impacts of natural hazards and CC. Besides, communities have low awareness of the threats and risks from CC. As a consequence, the respective countries face heavy losses caused by CC year by year [17, 18].

Vietnam is on the list of countries that are the most vulnerable to climate change and a flooding region of Southeast Asia [7, 8]. According to the Scenario at the end of 21st century, the

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average temperature of Vietnam will increase from 20 °C to 30 °C; the days with a temperature higher than 35 °C will increase from 15 to 30 days in many areas in Vietnam. The average rainfall will increase from 2% to 7%. The damage from flooding will be more serious due to the increase in rainfall from 12% to 19% in 2070, affecting the frequency and intensity of flooding [7, 8, 16].

Recently, Vietnam has many possibilities to cope with and mitigate the impacts of natural disasters and CC. Various related projects of upgrading the infrastructure system are implemented, and the activities of raising awareness of CC for citizens and communities are taken into account by local government at all levels. However, the achievements of these activities are still limited. As a result, heavy losses of deaths and capitals occur every year nationwide [1, 2, 6, 9].

In this regard, Vietnam needs to have more attempts in issuing policies, plans, and solutions to raise the awareness and capacity of communities to deal with these issues. In other dimension, communities need to follow the dual activities of mitigating and adapting, and focusing in advance on upgrading CC's awareness as the core action. In reality, households and communities in rural areas still have low capacity in adapting to natural disasters and CC [17]. Thus, evaluating the adaptive capacity at the household level will contribute significantly to the policymakers and policy implementers' work of local government at all levels.

Quang Dien district is located in the coastal areas of Thua Thien Hue province. Its main contribution of GDP is 57.7% of the total GDP. This contribution is based on agricultural activities and strongly dependent on weather conditions [14]. Like other districts, Quang Dien faces with various issues from natural disasters and CC. In 2017, a report from the district indicated that the losses due to natural disasters and CC were over 70 billion VND, of which over 5.4 billion from housing and over 568 billion from agricultural activities. Thus, mitigating the impacts of natural disasters and CC plays vital roles. This study aims to evaluate the adaptive capacity at the household level in Quang Dien district. The outcomes of the study will be rich guidance for sufficiently implementing the policies regarding mitigating and adapting to the impacts of natural disasters and CC.

## 2 Research method

### 2.1 Framework development of indicators to assess the adaptive capacity of households

Adaptive capacity is defined as "the ability of a system to adjust to climate changes (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences" [7, 8]. Assessment of adaptive capacity will provide crucial insights into establishing and developing effective strategies for CC adaptation [10]. Adaptive capacity has been assessed at different levels from households, community,

sectors, regions, to countries and is considered as an important component in the vulnerability and resilience assessment. The adaptive capacity of households can be determined on the basis of economic and social resource indicators. These indicators consist of household income, employment, assets, health, gender, age, education, institution, and science and technique [7, 8, 10, 19].

In order to assess the adaptive capacity of coastal households, the first activity is to develop a framework of indicators for adaptive capacity. The advantage of this method is that it can convert complex information into numerical or simple forms that enable managers or non-professionals to easily understand the adaptive capacity of where they live.

This study mainly adapts the indicators from the study in the rural of Canada [19], the study in Lien Chieu district, Danang city [10], and coastal households in Thua Thien Hue [17]. Besides, it attempts to match other indicators conducted in some relevant studies to support the research framework. The indicator framework includes four major components, including economics, humans, society, and infrastructure with 19 indicators. Table 1 shows the information of each indicator with the function and relevant references.

**Table 1**. Indicators of the adaptive capacity of households to CC in Quang Dien district and scoring methods

| Determinants | Variables | Indicators | Sign | Scoring methods | Relevant references |
|---|---|---|---|---|---|
| *Economics* | *Wealth* | The average income of the household member/ month | AC1 | 0: Poor<br>1/3 : Pro- poor<br>2/3: Moderate<br>1: Rich | [3, 4, 9,10, 19] |
| | *Livelihood diversification* | The number of types of livelihood that members of households participated in | AC2 | Equation (1) | [5, 6, 10, 13, 19] |
| | | The number of members in households working in agriculture and fishery | AC3 | Equation (2) | [5, 10, 13, 19] |
| | *Housing* | Housing conditions | AC4 | 0: Temporary structure<br>1/3: Semi-permanent<br>2/3: Permanent house with one floor<br>1: Permanent house with more than one floor | [3, 4, 6, 10, 19] |

| Determinants | Variables | Indicators | Sign | Scoring methods | Relevant references |
|---|---|---|---|---|---|
| | *Durable assets* | The number of durable assets in households (e.g, refrigerators, electric fans, air conditioning, television, telephones, radios, computers, bicycles, motorcycles, cars, boats, etc.). | AC5 | Equation (1) | [3, 10, 19] |
| *Humans* | *Education* | The number of people having higher education than junior high school | AC6 | Equation (1) | [10, 19] |
| | *Number of dependent* | The number of dependents in households (<5 and >75 age) | AC7 | Equation (2) | [13, 19] |
| | *Skills and experience for CC adaptation and disaster mitigation* | The number of skills and experience for CC adaptation and disaster mitigation (e.g., bracing house, strengthen roof, evacuating to safe areas, adjusting cultivation, etc.); Households accessing disaster information; Awareness of the trend of CC | AC8 | Equation (1) | [10, 19] |
| | | | AC9 | 0: No<br>1: Yes | [10, 13, 19] |
| | | | AC10 | 0: Increase<br>½: Stability<br>1: Decrease | [10, 19] |
| *Society* | *Supports from communities and relatives* | The number of support sources from relatives and communities during and after disasters | AC11 | Equation (1) | [10, 12] |
| | *Participation in training courses about CC* | The number of training courses, social organizations, programs for disaster mitigation and CC adaptation that households participated | AC12 | Equation ( 1) | [10, 13] |

| Determinants | Variables | Indicators | Sign | Scoring methods | Relevant references |
|---|---|---|---|---|---|
| | *Social capital* | Loan from social organizations after natural disasters; | AC13 | 0: No<br>1: Yes | [5, 10] |
| | | Participation of households in community funds | AC14 | 0:no participation<br>1: participation | [19] |
| | *Insurance coverage* | The number of insurance coverage (e.g, the number of health insurance, life insurance, boat insurance, vehicle insurance, etc.) | AC15 | Equation (1) | [19] |
| *Infrastructure* | *Medical* | Quality of health facilities | AC16 | 0: Bad<br>½: Moderate<br>1: Good | [19] |
| | *Electric Supply* | Frequency of blackout | AC17 | 0: Often<br>½: Occasionally<br>1: Seldom | [10, 19] |
| | *Water Supply* | Water contaminated | AC18 | 0: contaminated<br>1:no contaminated | [10, 19] |
| | *Transportation system* | Quality of roads in the village-commune | AC19 | 0: Bad<br>½ : Moderate<br>1: Good | [6, 10] |

The indicators of adaptive capacity combine the qualitative and quantitative measurements with different measuring units. This study applies three functions to transform the measurement units into the same unit with the range from 0 to 1 (Table 1). The standardization is based on the min-max theory.

For the indicators that are positively correlated to the adaptive capacity of households, equation (1) is applied:

$$x_{ij} = \frac{X_{ij} - Min\ X_{ij}}{Max\ X_{ij} - Min\ X_{ij}} \quad (1)$$

For indicators that are negatively correlated to the adaptive capacity of households, equation (2) is applied:

$$x_{ij} = \frac{Max\ X_{ij} - X_{ij}}{Max\ X_{ij} - Min\ X_{ij}} \quad (2)$$

where $x_{ij}$ is the standardized value of indicator $i$ of the household $j$; $X_{ij}$ is the value of the indicator $i$ corresponding to household $j$; *Max* and *Min* denote the maximum and minimum values of indicator $i$ corresponding to the surveyed commune of household $j$.

The conversion to the scale of 0–1 for the semi-quantitative indicators is based on weights for adaptation practices.

The calculated value of 0 or 1 score is based on the qualitative data (yes/no question).

In the cases of qualitative data, the decisions regarding the scores are based on the reference to previous studies, the author' assessment, and experience in the community through the survey.

For the 0–1 scale, if the indicator value is closer to 1, there is a higher adaptive capacity, and vice versa, if that indicator value is closer to 0, there is lower adaptive capacity.

The adaptive capacity index of households ($AC_{\text{Household}}$) and communes ($AC_{\text{Commune}}$) are calculated as the sum of the $AC$ indicators by using Eq. (3) and (4), respectively.

$$AC_{\text{Household}} = \sum_1^n AC_i \quad (3)$$

where $n$ is the number of $AC$ indicators; $i = [1, n]$; $n = 19$.

$$AC_{\text{Commune}} = \frac{\sum_1^m AC_{\text{household j}}}{m \cdot n} \quad (4)$$

where $m$ is the number of interviewed households; $j = [1, m]$.

### 2.2 Data collection

Data were obtained from interviews with households in two communes: Quang Phuoc and Quang Cong (Figure 1), which are considered the most vulnerable communes in Quang Dien district, as proposed by experts. These two communes can represent for Quang Dien district. There, the livelihood's households directly depend on natural and climatic conditions, and there are high risks from natural disasters. Due to the time and budget constraints, 100 households were surveyed, 50 from each commune (The sample size is calculated by using Taro Yamane formula with a 90% confidence level).

This study uses secondary data and primary data. The secondary data were collected from the related reports, studies, and proceedings of climate change, as well as the statistical yearbook at the district. The primary data were collected from historical profiles, two key informant interviews (KII), and two focus group discussions (FGD). The questionnaire was used to collect information at the household level. The head of each household gives information about the socioeconomic and demographic situation of the household and related information on natural disasters and CC.

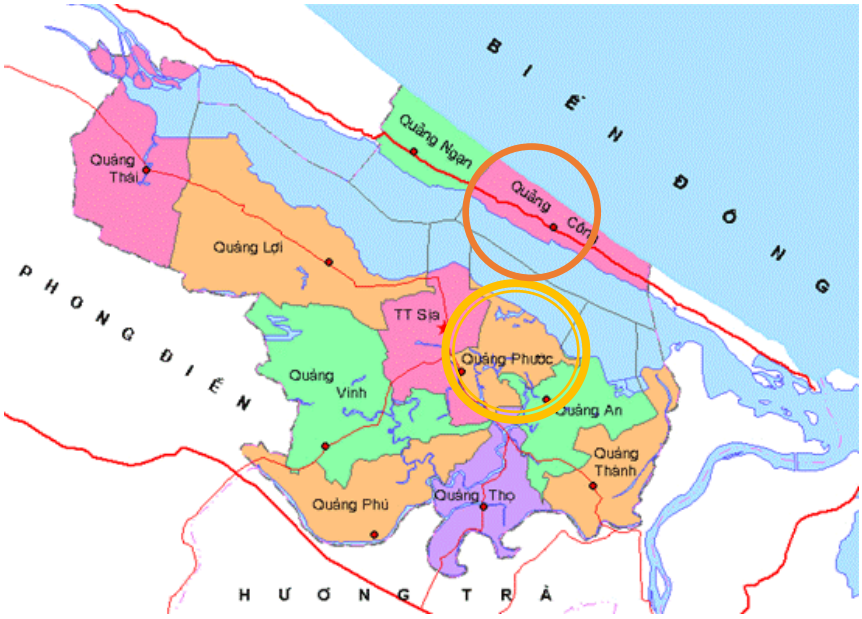


**Figure 1**. Quang Dien district and its communes [20]

## 3 Results and discussions

### 3.1 General information of natural disasters at the study sites

In recent years, the households and communities in Quang Phuoc and Quang Cong have faced various extreme climate events including typhoon, flood, drought, landslide, and extremely cold weather. From 2015 to 2017, the average numbers of typhoon and flood are 5 and 4, respectively. Especially, in 2017, typhoon Damrey caused heavy losses for households. In addition, 3 drought and salinity instructions, 2 landslides, and 3 times of extremely cold weather are recorded. Given issues significantly affected the households with livelihood activities, financial and health conditions.

**Table 2.** The information on natural disasters in 2015–2017 period observed by households

| **Types** (Times) | **Quang Phuoc** | **Quang Cong** | **Average** |
|---|---|---|---|
| Typhoons | 5.3 | 5.1 | 5.2 |
| Floods | 4.48 | 3.94 | 4.21 |
| Droughts and salinity instructions | 3.78 | 4 | 3.89 |
| Landslides | 2.3 | 2.4 | 2.35 |
| Extreme cold weathers | 3.5 | 3.18 | 3.34 |

Source: surveyed households in 2017

### 3.2 Adaptive capacity of households

**Demographics of surveyed households**

The statistical data reveal that on average, 49% of interviewed households are headed by male aged 53 years old with 5 members, 3 of whom are main employees. In particular, the number of employees working in agriculture and fisheries is approximately 3 people. Each surveyed household has two or more high school graduates. The members of this group have a good awareness of the impact of natural disasters and CC, which leads to the best adaptation to CC [19]. The dependency ratio (under 5 and over 75 years old) in the two communes is relatively similar at 22% in Quang Phuoc and 10% in Quang Cong. The highest dependency ratio in a family is 3 members.

**Socioeconomic and livelihood strategy conditions**

The information from table 3 presents that there is still a high percentage of poor and pro-poor households in both communes at 29% and 35%, respectively. For more details, in Quang Phuoc, poor households account for 26% and pro-poor household account for 36%, while in Quang Cong, the figures are 32% and 34%. These households may be more vulnerable than the others because of the shortage of capitals, low capacity to pay debts or borrow new loans. They also suffer from the external impacts of the increase in price for food, and illness issues caused by natural disasters. Given aspects lead to their lower capacity compared with other categories of households [11].

Concerning accommodation, in Quang Phuoc, 42% of households live in semi-permanent houses and 22% in the temporary-structured houses. Meanwhile, in Quang Cong, the numbers are 44% and 24%. Frankly, the sensibility of households with natural disasters and CC depends directly on the structure, number of floors, and stability of the house. Thus, the households living in the semi-permanent and temporary structure are more vulnerable with natural disasters and CC. Regarding the livelihood diversification category, the study found that the highest livelihood activities are larger than 4 with 26% in Quang Phuoc and 24% in Quang Cong. The majority of surveyed households reports that the diversification of livelihood plays a vital role in upgrading their adaptive capacity with natural disasters and CC.

**Table 3.** Wealth ranking and livelihood diversification of households

| Communes | Wealth ranking (%) | | | | Livelihood diversification (%) | | | |
|---|---|---|---|---|---|---|---|---|
| | Poor | Pro-poor | Moderate | Rich | 0-1 | 2 | 3 | Larger than 4 |
| Quang Phuoc | 26 | 36 | 28 | 10 | 22 | 28 | 24 | 26 |
| Quang Cong | 32 | 34 | 20 | 14 | 28 | 24 | 24 | 24 |
| Average | 29 | 35 | 24 | 12 | 25 | 26 | 24 | 25 |

Source: surveyed households in 2017

As for social networks, 100% of surveyed households participate in mass organizations and training courses about CC. Both communes have 12% of the households joining in the 1st group (1 to 2 groups and training courses); 44% and 68% of the households join in the 2nd group (3 to 4 groups and training courses) in Quang Phuoc and Quang Cong, respectively; 44% and 20% of the households join in the 3rd group (more than 5 groups and training courses). The most popular mass organizations in the research sites include the Community party, Farmer association, Women Union, Fisheries Association, Youth Union, and Veterans Association. With the support of various partners, the local government organizes the courses on building the resilience of the households toward natural disasters and CC, first aid, and health safety. By participating in the social networks and events, households can exchange knowledge and skills to increase their capacity of adapting to disasters as well as awareness of the impacts of CC [15].

The households in the study area pay much attention to insurance. 56% and 58% of households in Quang Phuoc and Quang Cong have 1 to 2 types of insurance, respectively. Meanwhile, 32% in Quang Phuoc and 28% in Quang Cong have 3 types of insurance. With the insurance services, the risk from natural disasters and CC for local households reduces significantly. This means that households' adaptive capacity could be enhanced to adapt to natural disasters and CC. Common types of insurance that local household join includes health insurance, life insurance, and motorbike and property insurance. However, some households are not willing to join the insurance service (12% in Quang Phuoc and 14% in Quang Cong). The major reasons are low awareness and poor economic conditions of the households.

**Perception of households about climate changes**

A majority of households report that the frequency and intensity of natural disasters and CC increase. 100% of the households can access the early warning system to follow related information on upcoming climate issues. Television, local radio stations, and news on the internet are the main channels to update the warning information. On the basis of received information, most households implement solutions to mitigate and adapt to natural disasters and CC with various options (Table 4).

**Table 4.** Solutions to mitigate and adapt to natural disasters and CC

| Solution | Quang Phuoc (%) | Quang Cong (%) |
|---|---|---|
| *Infrastructure* | | |
| 1. Protecting house | 90 | 92 |
| 2. Building semi-stair, upgrading floor | 30 | 14 |
| 3. Saving elementary foods and drinks | 40 | 36 |
| 4. Building and upgrading dams, canals | 20 | 18 |
| 5. Dredging of canals and ponds | 16 | 6 |

| Solution | Quang Phuoc (%) | Quang Cong (%) |
|---|---|---|
| *Non-structural* | | |
| 6. Moving to safe places | 50 | 70 |
| 7. Repairing, buying new boats and producing facilities | 32 | 28 |
| 8. Moving boat and vehicle, producing facilities to safe places | 74 | 78 |
| 9. Adjusting crop calendars | 56 | 32 |
| 10. Preparing foods, drinks | 82 | 86 |
| 11. Changing occupation | 8 | 22 |
| 12. Changing the water source | 12 | 42 |

Source: surveyed households in 2017

The data indicate that the most common solutions to mitigate and adapt to natural disasters and CC of the households are house protection, followed by food preparation and moving vehicles and facilities to safe places (Table 4). Besides, households focus on simple and short-term solutions. This is more appropriate in the case of permanent natural disasters. It is still a lack of solutions to adapt to natural disasters and CC in the long term.

**Infrastructure characteristics**

In the domain of health care center quality, a similar opinion trend is in Quang Phuoc and Quang Cong. 42% of the households agree with good quality, 30% with stable quality, and 28% with bad quality (Table 5). Good quality of health care services contributes significantly to reducing the impact of disasters and serves the purpose of caring of the health conditions for citizens. As a result, improving health care centers contributes to upgrading the household's ability to mitigate and adapt to natural disasters and CC.

**Table 5.** Health care center quality and electric source

| Commune | Health care center quality (%) | | | Frequency of electricity outage (%) | | |
|---|---|---|---|---|---|---|
| | Bad | Stable | Good | Frequency | Stable | Rarely |
| Quang Phuoc | 28 | 26 | 46 | 30 | 24 | 46 |
| Quang Cong | 28 | 34 | 38 | 20 | 34 | 46 |
| Average | 28 | 30 | 42 | 25 | 29 | 46 |

Source: surveyed households in 2017

The study findings indicate that there is a little difference in the electricity outages in Quang Cong and Quang Phuoc. 30% of households in Quang Phuoc and 20% in Quang Cong report a high frequency of electricity outage; 24% in Quang Phuoc and 34% in Quang Cong

regard the outage stable. It is interesting that the same percentage of opinions in the two communes is about rare electricity outage (46%). The findings confirm that the power network is still inefficient with a high frequency of electricity outage. More attention to ensuring the stability of electricity supply is necessary to support the households in accessing early warning information. They can, thus, prepare the strategies to mitigate and adapt to natural disasters and CC. It is also the jealous pathway to build the adaptive capacity for the households.

### 3.3 Assessing adaptive capacity of households

The study findings indicate that Quang Dien has a high value of adaptive capacity in terms of assessing related information on natural disasters and CC, quality of the infrastructure system in the rural areas, and dependency ratio of the households. Meanwhile, some major components such as the number of family members having secondary and high school education, the perception of climate change, and the participation in insurance witness the low value of adaptive capacity. The adaptive capacity in Quang Phuoc is higher than that in Quang Cong (0.52 and 0.50) (Table 5). Figure 1 shows the value of 19 indicators of household adaptive capacity in Quang Dien district.

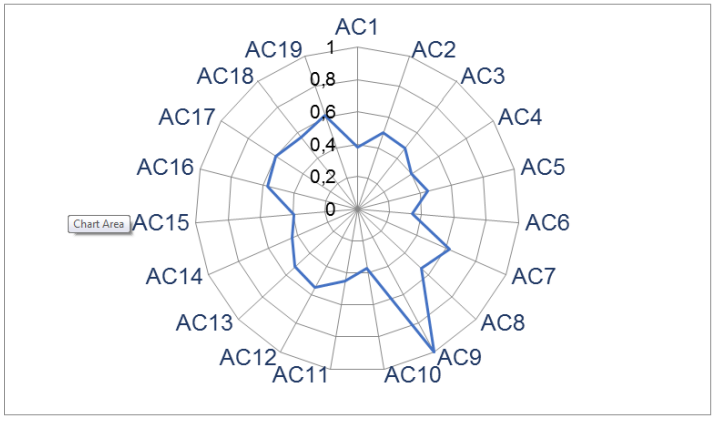


**Figure 2**. Value of each indicator in adaptive capacity index of households

Source: surveyed households in 2017

**Economics components**

The value of these major components is similar between two communes (0,44), but Quang Phuoc has more diversification of livelihood activities than Quang Cong (AC2: 0.51 and 0.48). In the same vein, Quang Phuoc scores a higher value of housing condition than Quang Cong (AC4: 0.41 and 0.39). On the contrary, Quang Cong has a lower number of family members working in the agricultural and aqua-cultural sector than Quang Phuoc (AC3: 0.49 and 0.48)

and a little higher in the number of durable assets (AC5:0.46 and 0.44). The number of poor households is still high in both communes (0.38).

**Human components**

The overall score of the human category of the households in Quang Cong is higher than that in Quang Phuoc (0.58 and 0.56). This is because of the differences in awareness of the natural disasters and CC between Quang Cong and Quang Phuoc (AC10: 0.42 and 0.31), and a lower dependency ratio of family members (AC7: 0.69 and 0.54). It is noticeable that 100% of households access early warning information from TV, local radio stations, and the news on the internet. In the dimension of education, a low educational level in Quang Cong (AC6: 0.27) may affect the adaptive capacity of households to natural disasters and CC. This implies that the local government needs to pay more attention to upgrade their ability to have a well-prepared adaptation in the long term.

**Table 5.** Major component contribution of adaptive capacity of the households

| Major components | Quang Phuoc | Quang Cong |
|---|---|---|
| 1. Economics | 0.44 | 0.44 |
| 2. Humans | 0.56 | 0.58 |
| 3. Society | 0.49 | 0.45 |
| 4. Infrastructure | 0.60 | 0.57 |
| **Adaptive capacity** | **0.52** | **0.50** |
| **Rank** | **1** | **2** |

Source: surveyed households in 2017

**Social components**

The findings reveal that, overall, in terms of social components, Quang Phuoc has a higher adaptive capacity index than Quang Cong (0.49 and 0.45). To be more precise, Quang Phuoc also has a higher value for all dimensions including joining in the mass associations and the training courses on climate change (AC12), borrowing credit from the social providers (AC13), participating in the social funds (AC14), and buying insurances.

**Infrastructure components**

In this domain, the households in Quang Phuoc again has a higher index than those in Quang Cong (0.60 and 0.57). Two indicators have high adaptive capacity, namely quality of infrastructure in rural areas (AC19: 0.70) and health care center quality (AC16: 0.59).

## 5 Conclusions and recommendations

Climate change and its impacts have been considered the most challenging in the 21st century. This study interviewed 100 households in two communes that represent for Quang Dien district to evaluate the adaptive capacity and propose the solutions to adapt to natural disasters and CC at the household level. The findings reveal that the households are heavily affected by natural disasters and CC. The emerging issues are typhoons, floods, droughts, extreme cold weather, and saline instructions. The study also indicates that the households in Quang Dien district have a low educational level, low awareness of the impacts of CC, and the weaknesses of housing constructions. The main factors affecting the adaptive capacity of the household include the ability to access the infrastructure system and early warning system for natural disasters, as well as the diversification of livelihood activities. Of the two communes, Quang Cong has a little lower overall scoring of adaptive capacity than Quang Phuoc (0.50 and 0.52). Last but not least, the households still focus on the short-term strategies to mitigate and adapt to the impacts of natural disasters and CC. They lack the long-term vision strategies.

From the findings, we strongly recommend the following solutions for having a jealous pathway to upgrade the adaptive capacity for the households in Quang Dien district. It includes three groups of solutions, namely (i) raising awareness and understanding about CC, (ii) improving the infrastructure system, and (iii) diversifying livelihood strategies to increase income.

**Raising awareness and understanding about CC**

It is necessary to take into account the campaigns to promote the perceptions and understandings of households regarding the impacts of natural disasters and CC. Providing basic necessary knowledge of how to mitigate, adapt, and solve the damages from natural disasters is of great importance. Especially, the dual plans including the annual economic development and the adaptation strategies to natural disasters and CC should be implemented. Besides, the collaborations with different actors such as NGOs, institutions, and universities in organizing the training courses on mitigating, adapting and building resilience capacity to the impacts of natural disasters and CC are significant for officers, communities, and citizens.

**Improving infrastructure system**

Local government should pay more attention to upgrade the canals systems to reduce the risks from landslide and soil erosion. The funds should come from the local development budgets and contribution from communities. Hence, it is also important to plan and build safe places for communities, their boats, and vehicles when disasters happen. Building the early warning systems, warning tables, warning instructions, and warning levels needs to be focused in advance.

**Diversifying livelihood strategies to increase income**

Regarding livelihood strategies, suitable adjustments for crop and animal distributions, crop calendars, as well as changing the models in raising activities will contribute significantly to reduce the adverse impacts of natural disasters. Moreover, promoting and incentivizing households to access credits with a low rate and flexible durations. Gathering credit policies that need to provide for the households various training courses is necessary to use credits efficiently. Agricultural credits should be paid more attention. In the long-term vision, the households should participate in the insurance for the agricultural sector and the activities facing high possibility of risks such as raising and fishing aquaculture.

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