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Livelihood strategies of fishery household group to respond to the marine environmental incident (Formosa): The case study in Hai An commune, Hai Lang district, Quang Tri province, Vietnam

Le Thi Hong Phuong, Tran Ngo Thuy Tien, Tran Cao Uy, and Truong Van Tuyen

University of Agriculture and Forestry, Hue University, 102 Phung Hung St., Hue, Vietnam

ABSTRACT: The marine environmental incident has seriously affected the material and spiritual life of people in Hai An commune, Hai Lang district, Quang Tri province. The incident that caused mining operations seemed to be completely stalled. Therefore, the study not only focuses on assessing the impact of the Formosa incident on physical and mental life, but also understand response solutions for fishing households to deal with the event. The research results show that the marine environmental incident has led many labourers in the fishing industry to be underemployed, out of work and reduced income significantly. At the same time, we also find response solutions to overcome difficult times due to this incident. More specifically, it is clear that no changes in livelihoods have occurred in this group. Most fishing households do not want to change their jobs but continue to maintain the old livelihood strategy.

KEYWORDS: Response, impact, fisheries, Formosa, environmental incident.

1 INTRODUCTION

The environmental incident (Formosa, 2016) started from the phenomenon of abnormal dead seafood, a series occurred on 6th, April, 2016 in Ha Tinh, then continued in other provinces including Quang Binh on 10th, April, 2016, Thua Thien Hue on 15th, April, 2016 and Quang Tri on 16th, April, 2016 (Chau & Sun, 2016). The phenomenon of dead fish with increasing number and frequency over time in each province until 4th, May, 2016. Results of the survey of Vietnamese government indicated that the toxins were from waste sources of Formosa Ha Tinh Company, moving along the current from the North (Ha Tinh Sea) to the South (Thua Thien Hue Sea) that were leading to a mass dead fishes, particular the benthonic fishes. According to the Government report (2018), dead fishes washed ashore about 100 tons; directly affecting more than 17,600 fishing boats and 217,000 people. Coastal fishing production declined about 1,600 tons per month at the time of the incident.

The Hai An is a coastal commune that located in the east of Hai Lang district, Quang Tri province. The livelihoods of local people were seriously affected when Formosa incident happened, because their livelihood mainly based on near-shore capture fisheries. After the Formosa incident, most of the households found different ways to cope with their livelihoods. However, up to now, there have not been any researches or assessments on the implementation of post-response measures and understanding the contribution of those responses to the recovery process plans of local people (Lê Hiệp et al., 2019; Lê, 2017; Phục & Quý). Basing on the above practices, the study *"Livelihood strategies of fishery household group to respond to the marine environmental incident (Formosa): The case study in Hai An commune, Hai Lang district, Quang Tri province"* was conducted to provide a full range of scientific information to the above research. The research objectives include (1) understanding the characteristics and current status of fishing exploitation of fishery household group in Hai An commune; (2) assessing the impact of Formosa's marine environmental incident on the livelihood of fishery household group; and (3) understanding the response solutions of the fishery household group after the marine environment incident. The results of the study will provide an overall response solution that can be applied, as well as provide the necessary information for local authorities and policy makers to suggest appropriate and effective supports for resident's areas affected by the Formosa incident.

Corresponding Author: Le Thi Hong Phuong

2 LITERATURE REVIEW FOR THE STUDY

Assessing the impact of shocks on the environment, markets or climate change has been widely used in many previous studies (Folke et al., 2003; Leach et al., 1999; Maldonado & Moreno-Sánchez, 2014; Plummer & Armitage, 2007; Speranza et al., 2014). Impact assessment can be considered before and after performing activities that affect people, society and the environment (Speranza et al., 2014). In this study, impact assessment was applied after the occurrence of the Formosa marine environment incident (2016). Therefore, impact assessment is understood as assessing the positive as well as negative impacts of incidents or shocks on the livelihood, life, environment, society activities of households as well as the community (Rosa & Sánchez, 2015). Impact assessment is critical in planning and identifying solutions to the environmental incident or shock impacts (Somers, 2009; Speranza et al., 2014). Coping solutions are remedial actions that are taken by people who have harmed or threatened livelihoods (Klein et al., 2003). Therefore, coping strategies focus on different designs to reduce the impact of environmental risks or shocks if they have happened (Vaitla et al., 2012). Based on the implemented coping measures, the livelihoods, life, environment and society of households and communities are increasingly improved, overcomed shocks and recovered livelihoods. In this study, livelihood resilience is understood as the ability of an individual, a household, a community or an organization to experience and overcome shocks or failures to return to the previous livelihoods (Béné et al., 2016). At the present, livelihood resilience has become an important concept in food insecurity areas of the world (Constas et al., 2014). Therefore, the results of livelihood resilience are understood as the capacity of individuals, households, or communities in implementing coping strategies to overcome and gradually return to previous life and livelihood activities.

3 THE METHODOLOGY

3.1 SELECTION OF STUDY AREA

The study was conducted in Hai An commune, Hai Lang district, Quang Tri Province. The reasons to selected Hai An for this study because (1) this is the coastal commune that have had the largest number of fishery households; (2) Hai An commune also was seriously impacted by the marine environmental incident in Quang Tri provine; and (3) this commune had the recovery time faster than other communes in the Hai Lang district. The survey was conducted in three villages of Hai An commune including Dong Tan An, Tay Tan An, and My Thuy.

3.2 SELECTION OF SURVEYED HOUSEHOLDS

Sample size and inconsistency of sample size depend on the purpose of the study, the research design and the timeframe of collecting data (Kofinas & Chapin, 2009). Therefore, in this study we applied a non-stratified random sampling method. The interview respondents must ensure the following three criteria: fishery households in the Hai An commune; the households were affected by the Formosa incident; and households have partially or fully recovered their livelihoods after the incident. The total number of selected sample size was 55 households.

3.3 DATA COLLECTION AND ANALYSIS

Secondary data included information about the structure of agriculture, aquaculture and fishery; information about the impacts and damages caused by Formosa incident on the fishery sector. Therefore, the reports on (1) agriculture-forestry-fishery; (2) the economic-society of Hai An commune, Hai Lang District, Quang Tri Province; (3) the damages caused by Formosa, and (4) the compensation and supports of the government to the affected households. In addition, the scientific studies have been published relating to the incident of Formosa Ha Tinh were collected to understand the overall picture of the study site before collecting primary data.

Primary data was collected through in-depth interviews (n = 7) and semi-structure interviews (n = 55). The contents for in-depth interviews focused on fishery exploitation status in the commune before and after the marine environmental incidents, the supports of government in damage compensation for fishermen after the Formosa incident and the participation in community activities of fishermen to revoery after the Formosa incident. The semi-structure interviews focused on the following main topics: labor of household, scale, intensity, seasonality, and facilities in fishing activities; household income before and after the incident, the catches of households before and after the incident, and the response strategies to recovery the Formosa marine environmental incident.

Data from in-depth interviews and semi-structure interviews were code and further analyzed using the Excel. Descriptive statistics were used to analyze and present the rates and percentages of fishermen's answers.

4 FINDINGS

4.1 CHARACTERISTICS OF THE FISHING HOUSEHOLD GROUP

The fishery activities depend greatly on natural and socio-economic conditions. For each household, indicators about age, education, experiences of household head, the number of members and labor in household have critically influenced on efficiency and capacity production.

Table 1. Characteristics of the fishing household group (n=55)

Criteria	Unit	Average
Total population	People	289
Average of household size	People	5.26 ± 1.39
Average number of labor/ households	People	3.20 ± 1.24
Average of fishing workers/ household	People	1.04 ± 0.19
Average age of the household head	Age	47.72 ± 0.19
Average education of the household head	Grade	6.80 ± 2.02

(Source: household survey, 2019)

The data in table 1 shows that there were 289 people in total 55 surveyed households. The average of household size was 5.26 persions, higher than the number of persons per household in the North Central Coast and Central Coast and higher than the whole country (3.7 persons per household in 2015). The average of labor per household was 3.2±1.24 (persons) and the average of labor in the fishing households was 2.01 (persons). The average age of the household head in the fishing group was quite high (47.7± 9.19). The working age of the household head in the fishing group was between 31 and 65 years old. In particular, the working age of the household head from 46 to 60 years old accounted for the majority. This was the age that most of the working age laborers had a lot of experience due to the characteristics of living in coastal areas and the male joins in the fishing activities very early (14-18 years old). Therefore, these household heads have had many years of working in this field. More significantly, none of the interviewed household heads was between the ages of 15 and 30. Thereby, we can see that the labor structure of the fishery sector was aging, because young labors have not continued to follow the agricultural, aquacultural and fishery activities, they have trended to move to big cities or industrial zones to find another jobs.

The education level is the basis to reflect the level of knowledge as well as the ability to acquire advanced science and technology, largely affecting livelihoods and income of the household. According to the survey results, the average educational level of the fishing group was 6.8 grades (±2.02), through which we can see that their educational level was quite low. Among them, the household heads with secondary school (grades 6 to 9) had accounted for the largest number (70.9%). These household heads were the early adopters of fishing.

Table 2. Annual income structure of fishing household group

Income per year	Number of household	Percentage (%)
Less than 150 million VND / year	14	25.5
From 150 to 200 million VND / year	18	32.7
Over 200 million VND / year	23	41.8

(Source: household survey, 2019)

The data in table 2 show that the difference of total annual income of fishing households was relatively low. In which, the number of households with the total income over 200 million/ year was the largest, accounting for 41.8% (n=23). In contrast, the number of households with income below 150 million/ year accounted for at least 25.5% (n=14). Compared to the common income in rural areas, the income of each household from 150-200 million/ year was quite high (32.7%, n=18).

Table 3. Annual per capita income of fishing households

Income per person per year	Quantity (Household)	Percentage (%)
From 40 - 65 million VND/ person / year	22	40.0
Under 40 million VND/ person / year	21	38.2
Over 65 million VND/ person / year	12	21.8

(Source: household survey, 2019)

The data in table 3 show that the average income per capita of the fishing household group was not much different among income levels. The majority of households had income below VND 3.5 million/person/month (40%, n=22). Compared to the income average of the Hai Lang district, the average income of the fishing household group was similar (3.7 million VND/person/month). The results from in-depth interviews showed that *"Hai An is the coastal commune with high average household size, thus compared to the total income of the fishing household per year, the average income per person per month with less than 3.5 million was relatively low. In addition, the fishery depends much on the natural conditions, so the income of fishing household group has been often unstable"*

Related to the fishing ground, the majority of households in Ha An commune participate in near-shore fishing and use small boats with small catching small capacity. Therefore, the catching productivity has been limited. The season for the catching is from February to August because of heavy rainfall, storms, and floods from September to January the next year.

4.2 Impact Of Marine Environmental Incidents On The Livelihoods Of Fishing Households

The fishery is considered a traditional livelihood activity of the households in Hai An commune in particular and the coastal communes of Hai Lang district, Quang Tri province in general. However, the marine environmental incident Formosa 2016 has affected on many aspects to the fishing households. In particular, the most affected aspect was the time of exploitation and material life and whether the affected households have continued to maintain traditional livelihoods or have had to other plans.

4.2.1 Impact of the marine environmental incidents on the time of catching activities

Based on the results of in-depth interviews with local authorities and review the water quality assessment reports, indicators to measure catching time of the fishing households were divided three periods, including (1) downtime below 6 months, (2) ceased operations for 6 to less than 12 months, and (3) ceased operation for 12 to less than 24 months

Table 4. Impact of Formosa incident on the operation time of exploitation

Criteria	Quantity (n household)	Percentage (%)
Discontinued for 6 to less than 12 months	27	49.09
Discontinued for less than 6 months.	20	36.36
Discontinued for 12 to less than 24 months	5	9.09
Non-stop operation	3	5.46
Total	55	100

(Source: household survey 2019)

The data in table 4 show that marine environmental incidents have greatly affected the catching time of fishing households in Hai An commune. There were many households had to stop catching activities from 7 to 11 months, accounting for the largest number of 27 households, equivalent to 49.09%. Two main reasons for the households to stop catching were: (1) due to the low price of fish, and (2) consumer psychology about the fish quality. In addition, a part of household mentioned that the decrease in fish productivity due to dead fishes and the regulations of the government in time and areas for catching. Therefore, the affected time for catching was long.

4.2.2 IMPACT ON THE PHYSICAL LIFE OF THE FISHING HOUSEHOLD GROUP

In order to measure the impact of the marine environmental incident on the physical life of the fishing household, it is necessary to make statistics on the catching fish production before and after the incident. The data in table 5 show that the average fish production at the present (2019) was higher than before the incident.

Table 5. Average of fishing output and income of each household in each period

Criteria	Unit	Before Incident	During Incident period		Present
			exploitation <50%	exploitation >50%	
Average of fishing output	kg/household/month	704.36	209.27	361.63	728.73
Average of income	million VND/household/month	6.7	0.8	2.9	6.9

(Source: household survey 2019)

The results from the survey and in-depth interviews showed fishing households have changed or adjusted the size of fishing boats, the areas for catching as well as invested in fishing gears. Therefore, the catching fish yield has increased to before. However, during the time of the incident, the catching fish production was very low due to the low market demand because of untrust of customer on seafood/fish quality, thus the income of these households group had strongly decreased

Table 6. The percentage of income lost from fishing activities of the surveyed households

Criteria	Quantity (Household)	Percentage (%)
Income lost from 50% to less than 75%	22	40.0
Income lost from 75% to less than 100%	11	20.0
Income lost from 25% to less than 50%	10	18.2
Income lost less than 25%	8	14.5
Income lost 100%	4	7.3
Total	55	100.0

(Source: household survey 2019)

The data in table 6 show that the average income of the fishing household group during the incident heavily reduced. At that time the average income of the affected fishing households was only 0.8 million VND/household/month (see table 5). More significantly, 40% (n = 22) of the surveyed households mentioned that their monthly income lost from 50% to less than 75% in the first month after the incident. 20% (n=11) of respondents indicated that their income lost from 75% to less than 100% within 1 month and even 4 households referred that they completely lost their income. More or less income loss during the period of the incident entirely depends on the perception of each household and the diversification of income sources. Many households have chosen through finding alternative jobs or they only knew to stay home and look forward to the time when the sea has recovered to come back to fishing activities.

The results from the survey showed that households with income loss rates below 50% were mostly those who sought suitable livelihoods and were able to adapt well. More significantly, among the surveyed households, there were two poor households whose income loss rate was less than 50% because these household heads were aware of the situation and found alternative income sources to overcome difficult times. In addition, four households lost their income completely (100%) because the household heads were difficult to adapt to new jobs. When the marine incident has gradually recovered, fishing households have also increased the intensity of exploitation. At that time, the income from fishing activities has increased (2.9 million VND/ household/month). However, the income from fishing activities was still very low, making the life of these people still difficult and arduous.

4.2.3 PERCEPTION OF FISHING HOUSEHOLDS ON THE IMPACT OF THE FORMOSA INCIDENT

The marine environment incident has created many consequences for the fishing and aquacultural households in particular and other households related to fishery activities in general in Hai An commune. Assessing the perception of fishing households

related to the impact of marine environmental incidents on (1) fishing activities; (2) total income; and (3) life was expressed through 5 levels: very serious, serious, normal, not serious and not very serious. The results of the survey indicated that there were not any household thought that the impact of the incident on the three evaluation indicators that were not serious and very not serious. The percentage and number of households assessed the impact of the incident on the three assessment indicators with normal, serious and very serious were shown in table 7.

Table 7. Perception of fishing households on the impact of the Formosa incident

Indicators	Normal (n, %)	Serious (n, %)	Very serious (n, %)
Impact on fishing activities of households	1 (1.8)	36 (65.5)	18 (32.7)
Impact on total household income	0 (0)	48 (87.3)	7 (12.7)
Impact on the daily life of the household	0 (0)	51 (92.7)	4 (7.3)

(Source: household survey 2019)

The data in table 7 show that the majority of households' perception of the impact of marine environmental incidents on fishing activities were "serious". Fishing activities are the main livelihood activity of the fishing household group in Hai An commune. When the incident happened, this activity was completely stopped, meaning that people had to find a new job to ensure daily life and their income. In the perception of this group, the alternative livelihood jobs for fishing households were less efficient than fishing activities. Therefore, the level for assessment was a serious and very serious majority.

4.3 THE COPING AND RECOVERY SOLUTIONS OF FISHING HOUSEHOLDS

The incident of Formosa caused many serious consequences for the people, particularly near-shore capture fisheries. From the household group with a stable source of income from fishing activities, but when an incident occurred, the income structure of these groups was fragmented. Instead of the daily work is fishing activities, now they have had to change or adjust to other jobs, even some jobs were quite new or had never been done before. Therefore, the solutions for coping and recovery of the fishing household groups were understood through two related activities: alternative livelihood activities and emergency response activities.

4.3.1 ALTERNATIVE LIVELIHOOD ACTIVITIES OF FISHING HOUSEHOLDS DURING THE AFFECTED TIME

The main income activities of fishing households in Hai An commune, Hai Lang district, Quang Tri province are from catching. However, when the Fomosa marine environment incident occurred, it seriously affected the exploitation activities and livelihoods of fishing household groups. According to statistics from the survey, the environmental incident caused the exploitation of 52/55 households to stop completely. In order to cope with the impact of the incident, these households have had a change in the livelihood structure following different directions. Specifically, there were 14 livelihood strategies that have been applied by households in the context of reducing fishing activities. These were: reducing expenditure, access loan, livestock raising, collective activity, offshore fishing, business linkage, trading, relative support, aquaculture, wage labor, rural service, crop production, sell assets, and migratory labor. Remarkable solutions must be mentioned including: expanding the scale of cultivation and livestock production and transition to non-agricultural activities

Table 8. Alternative livelihood activities of fishing households

Area	Adaptive activity	Number of households implemented
Agriculture	Livestock	41/55
	Cultivation	25/55
Non-agricultural	Small business and retail	22/55
	Wage labor	39/55

(Source: household survey 2019)

The data in the table 8 shows that the alternative livelihood activities of the fishing households were very diverse. In general, agricultural activities were considered as important activities to adapt and recovery after the incident of most households. Other activities had lower participation rates of fishing households. However, the research results showed that there were many cases of households applying different measures at the same time to improve coping capacity. The research results also

showed that most of the households said that "thanks to these alternative livelihoods, their income and living conditions were recovered faster". Therefore, all households indicated that the diversification of livelihoods has contributed to help households recover faster after the Formosa incident.

4.3.2 EMERGENCY RESPONSE ACTIVITIES OF FISHING HOUSEHOLDS

The impacts of the Formosa marine environmental incident were very fast and severe. The fishing household groups have to have different solutions to cope with these impacts. Emergency response activities of fishing households were considered as critical solutions. These activities were addressed as high priorities of fishing households rather than finding an alternative job to pay for daily living costs. In addition, there were some households that applied both emergency responses and alternative livelihood activities to cope with the incident.

Table 9. Emergency response activities of fishing households

Activities	Quantity (Household)
Join collective activities	34/55
Reduce expense	30/55
Official credit loans	17/55
Unofficial credit loans	8/55
Get support from relatives/ neighbor	5/55
Sale of property	2/55
Switch to offshore fishing	2/55

(Source: household survey 2019)

The data in the table 9 show that the most active responses that many households choose was to participate in social activities such as training on animal husbandry, cultivation, and participation in associations (Farmer's Union, Women's Union, Veteran's Association) which accounted for the largest number of 34 households. Participation in collective actions, they can exchange, share and receive information to be able to solve some difficulties in their life. Through these associations, households can also borrow money (informal credit loans) to pay for daily life. In parallel with participation in social activities, 30 households choose to reduce expense as an immediate solution to deal with the incident that occurred in order to save and tighten spending. Most of households also choose the solution of credit loans for temporary spending in the short term. The form of credit loan was decided by the head of the household without any support from the government or local authorities. As a result of the interviews, the loan amount of the household ranged from 30-50 million VND. Particularly, the shift to offshore fishing was selected by 2 households which related to traditional family livelihoods. However, this form was only a momentary one, it was implemented during the time when near-shore fishing activities stopped and there was no sign of lasting.

In addition to the ability to adapt and respond to the marine environmental incident of fishing households, the government had also helped fishing households overcome difficulties in life. The Decision No. 772 / QD-TTg and Decision No. 1138/QD-TTg of the Prime Minister, the Ministry of Finance were issued through the total funding subsidizing rice for each fishing household. Specifically, the government supported 15 kg of rice/person/month for a period of 06 months for each household. Decision No. 772/QD-TTg, 1138/QD-TTg, 1880/QD-TTg, 309/QD-TTg were implemented. The average compensation amount for each fishing household was 110 million VND for households with motor-boats and 63 million VND for households with boats. In addition, to support financial and fishing facilities, the government also provided the assistance in creating jobs, restoring production and some tuition assistance for families with children who went to school.

According to the results of the survey, affected fishing households in Hai An received all support sources such as emergency assistance (rice), damage compensation (money), tuition support (exemption and reduction tuition fees) and other sources of support such as breeding materials or expenses for expanding livestock and crop production. For compensation policy, fishing households were supported in the form of monetary compensation. According to the report on the compensation policy of Hai Lang district, the total compensation for all fishing households in Hai Lang district, including Hai An commune, was 31.2 billion VND. Accordingly, each affected household in the commune received an average compensation amount of 76 million VND/household. With that money, each household received and used for many different purposes. In general, the activities

that households used that money were: repairing house, building a mausoleum, buying crafts (buying/ changing fishing gears and boats), expanding agricultural activities (livestock, farming), paying debt, participating vocational rehabilitation, or savings.

5 DISCUSSION AND CONCLUSION

Basing on the findings of this research, we can see that fishing activities much depend on natural conditions and face high risks as well as require high labor intensity than other economic sectors. With the near-shore fishing, the means for catching are mainly small boats with wood material and low capacity. The fishing households largely based on their own experiences and self-learning. They did not have opportunities to access modern science and technology. In addition, the fishing activities in Hai An commune were individuals, so fishing households lacked of the cooperation following collective activities. The Formosa incident has caused so many serious consequences. Specifically, the majority of fishing households had to stop catching activities completely for 6-12 months after the incident. When the environment has begun to recover, they have returned to fishing exploitation. However, the exploitation output significantly dropped by reducing half the exploitation output compared to before the incident that led to a serious decrease in income. In particular, the majority of the income of households lost from 50% to 75% compared to the pre-incident and the living conditions of the household group also decreased. Although the Formosa incident has seriously affected all aspects of the lives of people in Hai An commune, Hai Lang district, Quang Tri province, however, fishing households have been actively responsive in this case of emergency. The majority of household groups carried out other livelihood activities in order to adapt to and cope with during the time of delaying in fishing activities. In addition to the autonomy of fishing households to overcome the difficulties after the incident, the supports of the government also contributed to the successful recovery of fishing household groups. After the Formosa incident, most fishing households received large compensation and the people continued their economic development based on fisheries.

The negative impacts of shocks on individuals and community are a frequent topic and rightly so, in popular media, scholarly publications and policy makers' agendas. The sudden loss of a major employer is less dramatic, but may cause as much or more individual and community harm (Pomeroy et al., 2006). Therefore, livelihood analysis can be done without the sustainable livelihood framework. However, the framework helps to broaden and structure the scope of inquiry. Assessment of livelihood impacts is very useful for showing how an intervention fits with livelihood strategies and how people's livelihood are being enhanced or constrained (Ashley, 2000). According to Plummer and Armitage (2007), there are three broad components to assess the adaptive management in the linking ecology, economics and society including ecosystem conditions, livelihood outcomes and process, and institutional conditions. However, the scope and methods of livelihood analysis varied, but in each case it involved identifying the livelihood issues that are priorities for local people and then exploring the links between livelihood strategies and the various resource initiatives (Ashley, 2000). Our findings show that impact assessment of anthropogenic marine environmental incidents on people livelihood resilience should focus on several components in the livelihood capitals. They include impact duration, impact on material life (household income and production cost), impact on labor income. Besides that, the perception of impacted households on impact levels and capacity to resilience of labor as well as capacity to recovery of households and community are also considered important aspects for assessment framework. Exploring the adaptation measures at household level and the government responses are also necessary to know how impacted households can overcome impacts. All these aspects are considered valuable for supporting impacted households and community in the recovered process after the Ha Tinh Formosa incident. It is clear that the Ha Tinh Formosa incident has impacted on all aspects that related to livelihood of households and community. However, based on the effort of self-households and support policies of the government, impacted households have gradually recovered livelihood as well as their life.

It is clear that the degree of damage to environment can also affect to the recovery duration of impacted households and community (Amer, 2014; Leach et al., 1999; Maldonado & Moreno-Sánchez, 2014; Somers, 2009). Our findings showed that the government can help to shorten the recovery duration by working with impacted households and community to understand their needs as well as to facilitate the implementation of community-specific policies towards increasing resilience capacity through the first step is assessment the impacts of the Formosa on all aspects that related to livelihoods and their life.

Increasing the resilience capacity of households and community has two dimensions (Chambers & Conway, 1992; Pomeroy et al., 2006). The first is external through public action - to reduce external stress and shocks to provide employment, prophylaxis against diseases, and the like. The second is internal through private action, in which a household adds to its portfolio of assets and repertoire of responses so that it can respond more effectively and with less loss. Extreme events are nothing new to the Central people in Vietnam, particularly related to climate. However, the environmental incidents were indeed new extreme event in this area. Awareness, experimental innovation, and adaptability contribute to dynamic capabilities (Reidsma et al., 2010; Renko et al., 2012). Perception of impacted households and community to impact levels and understanding impacts of the anthropogenic marine environmental incidents have positively influenced the capacity as well as

duration to recovery. We found that most of three of household groups are very aware of impacts of the Formosa and therefore they already have and are most willing to invest in coping strategies as well as consensus with support and guideline to recovery livelihood and life from the central and local government.

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