

The vulnerability of fishermen's community and livelihood opportunity through drought and seasonal changes in border area of Indonesia-Timor Leste

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Abstract. Communities that live in coastal areas in Indonesia are affected by the ecosystem degradation because their livelihoods majority depends on ecosystem's services. Fishermen in Timor Tengah Utara Regency depends on their livelihood on fish catches and crops. TTU Regency is known as a place with drought. Agriculture sector and fisheries play the central role of communal livelihood. This research was conducted to gain information and baseline study to support the intervention scheme reducing the vulnerable level of coastal communities. This research was conducted in Insana Utara, Biboki Moenleu and Biboki Anleu District. The social-ecological and statistic descriptive analysis were undertaken and involving 53 fishermen, 4 women groups, 11 clan's elder and staffs of local government as the respondents. The data shows that the majority of the fishermen are small-scale fisheries commercial fishermen and possess a high level of vulnerability. The factors that are mostly affected the fishermen livelihood is the job diversification as farmers which is primarily supported by the crops and rely on the rainfall. The vulnerable context of fishermen in TTU can be reduced by optimizing and enhancing communal institution capacity and increasing the cooperation among the stakeholders and government also women participation.

1. Introduction

Coastal communities invariably depend on their livelihood from ecosystem services. Not only in economic aspect but ecosystem also mainly related to several, social and cultural values inside the community. Depressing ecosystem quality has commonly led them to poverty and interfere with their culture [1]. However, every community has the resilience context as well, which is the opposite of the vulnerability context. There are three aspects of vulnerability; exposure, sensitivity and adaptive capacity [2]. Exposure is the level which an ecosystem, is determined by environmental conditions. Sensitivity is the levels of dependence on natural resources and the technologies used to harvest resources. Adaptive capacity is a latent characteristic that reflects people's ability to anticipate and respond to changes and to minimize, cope with and recover from the consequences of change [3].

Timor Tengah Utara Regency is located between east and west region of Timor Leste and passed by an international road that connects it. Geographically, this current situation is a strategic location to be developed and could increase the economic opportunity for the communities around it. Regardless its strategic locations, the inhabitant that live in the village around the international road, which is coastal areas, still live in poverty. The majority among them are fishermen and farmers. Dwelling in



the border area is considered as a challenging task. The fishermen in the border area are potential to have border conflict to claim their fishing ground with another country or to distribute and market their catch. Located in border area without sufficient infrastructure support is a form of vulnerability. In 2014, there was no fishing port for the fishermen, and due to the proximity to the market is quite far, the fishermen throw away the catches in the sea. The situation will get worse if the condition of the fishing port and the facilities for cold chain system in the neighbor country better, the resource could be easily smuggled and landed in the mentioned port.

There is no report mentioned before described coastal community structure, stratification interaction and vulnerability level. This information is to support the next policy or program that will be implemented in that area to overcome poverty and to increase their livelihood opportunities, particularly to strengthen the fishery sector considering that the northern coastal areas of TTU have the susceptibility to water availability for agricultural land management, but have unutilized fisheries resources.

2. Methods

2.1. Study area

This research was carried out in the Timor Tengah Utara Regency, located at the north end of NTT between Timor Leste, Indonesia (figure 1). The study sites were three districts, namely Insana Utara, Biboki Moenleu and Bibooki Anleu. Those District were selected due to the majority among the dwellers were fishermen. The area has a rural character, dominated by fishing and agriculture as major economic activities. The research sites were selected according to accessibility, high dependence on marine resources and differences regarding predominant occupations, ethnic composition.



Figure 1. Research location in Timor Tengah Utara Regency, NTT.

2.2. Questioner and sampling design

Opportunistic sampling was used in this study to select participants for semi-structured interviews [4]. To reduce the risk of bias inherent in opportunistic sampling the interviewees were chosen throughout the entire area of the village to get the better understanding of vulnerability level in the community. The social-ecological analysis was undertaken and involving 53 fishermen, 4 women groups, 11 clan's

elder and staffs of local government as the respondents. Quantitative questionnaire surveys were preceded by qualitative assessments of the study villages to obtain background information and a better understanding of local conditions and to refine study questions. In qualitative data assessment, the focus lies on the quality of statements, meaning the analysis of what and how regarding a certain situation.

Besides the sampling and preparing the questioner to the fishermen, field observation and focus group discussion were held as the introductory research. This process involved traditional leaders of each clan who dwell in the coastal area, traders, local government, fish processor woman group and shop or outlet owner. Due to limitations of time available for this study, Participatory Rural Appraisal (PRA) techniques through semi-structured interviews, focus groups or (non-participant) observation, which mostly generated qualitative data, could collect only limited quantitative data was done as the introductory and to validate the collected data.

3. Results and Discussion

3.1. Fisherman profiles

Fishing activity in North Coast of Timor Tengah Utara (TTU) Regency is characterized as a traditional fisheries. Regardless of the fishing gears, the fishermen in TTU that observed in five villages indicate that they are have been undertaking professions as a fishermen during much time. They were starting their profession as a fishermen 21 years ago in average and majority among them was inherited by their parents. Most of the fishermen graduated from elementary school as high as 73.58 %. Most of the respondents' age is 42 years old and based on the further interview they are willing to inherit their skills to their children.

Table 1. Number of fisherman of each village and it's characteristic.

| Village | Fisherman | Age (average) | Experiences as Fisherman (average) |
|------------------------------------|-----------|---------------|------------------------------------|
| Oepuah (Insana Utara) | 7 | 39.9 | 18.7 |
| Oesoko (Insana Utara) | 26 | 42.7 | 23.2 |
| Liusoesoko (Biboki Monleu) | 9 | 43.6 | 31.0 |
| Oesoko kolam dapur (Biboki Monleu) | 6 | 37.7 | 21.0 |
| Lius kolam dapur (Biboki Anleu) | 4 | 46.0 | 18.8 |
| Kolam tua (Biboki Anleu) | 11 | 42.2 | 17.0 |
| n | 53 | 42.0 | 21.6 |

Table 2. Education level of fisherman in Timor Tengah Utara Regency.

| Education Level | Fisherman | % |
|--------------------|-----------|-------|
| Illiterate | 1 | 1.89 |
| Elementary | 39 | 73.58 |
| Junior High School | 10 | 18.87 |
| High Senior School | 4 | 7.55 |

As much as 34 % of fishermen possessed boat and based on the area study, the boat that majority under fishermen's possessions is a traditional boat that made from wood and constructed approximately 7 m length and 1 m wide and only 2 % using a machine. Another 66 % of the fishermen was boat-less and using nets to catch fish and work as a labor in other boats that they have to divide their catch equally (50 %) after it reduced by operational cost. The composition of fishing gears that

are used in TTU Regency was beach seine, gillnet, mini purse seine and long line with percentage orderly 45.3 %, 49.1 %, 3.8 % and 1.9 % (table 2). Works as a fishermen in TTU is not a primer job. Their primer job mainly as a farmer and fishing activity as a side job that they are performed during extra time, yet gradually fishing becomes main activity because farming activity cannot be done when the dry season comes. During dry season vulnerability of the fishermen increasing, because it is happening at the same time with the fishing lack season.

Table 3. Fisherman ownership of boats and fishing gear.

| | Yes (%) | No (%) |
|------------------|---------|--------|
| Boat | 34.0 | 66.0 |
| Beach seine | 45.3 | 54.7 |
| Gill net | 49.1 | 50.9 |
| Mini purse seine | 3.8 | 96.2 |
| Long line | 1.9 | 98.1 |

3.2. *Catch and price dynamic during peak and low catch season*

The fishermen in the site research have a unique counting system for the catch. They do not use kilograms scale to weighing their catches but using basket scales instead. One basket could be estimated as 50 kg. According to the data that were gathered from the fishermen, the effort and the catch disperse variably. It shows that effort of fishermen to gain catches different one another. Based on the linear analysis, it does not show that the increase of effort or time is in line with the increasing of catches. Based on figure 2, the uncertainty of catches occurs, where the increase of effort does not show a significant increase of the catch in a week. The optimum fishing trip hour based on this study which provides the optimum return was around 20 hours/week during low season. However further analysis of the cost-revenue analysis needs to be done in peak, low and moderate season as well. Based on figure 3, there are significant differences in price, catches and income during a week for fishermen within peak, moderate and lack fishing season. The income at peak season is higher respectively fourth times than lack season, yet the price of fish lower as high as more than 100 % compare to the lack season.

There were three seasons of fishing, where lack of fish and where there are hard to catch a favourable fish. As a comparison, in Spermonde Islands South Sulawesi, there were differences between peak and low season it is also related to the wet season which usually the catch was lower than the dry season. However, the differences between the low and peak season were different compared to what had happened in TTU. They caught 28.62 kg/week with six days works which were valued 327.12 USD during low season and 38.64 kg/week which is valued 412.92 USD during the peak season [6]. Meanwhile, in TTU the fishermen caught 21 kg/week during the low season and valued 74.27USD and 198.9 kg/week which valued 337.75 USD. We revealed that there was significance during the low season that the catches were very small and during the peak season the volume of catches is high, but the value was cheap. It also regards to the commodity that is caught which mostly mackerel or sardine where it is considered as a commodity that has a regular price. Whether it is on low or in peak season the vulnerability of the fishermen were still occur.

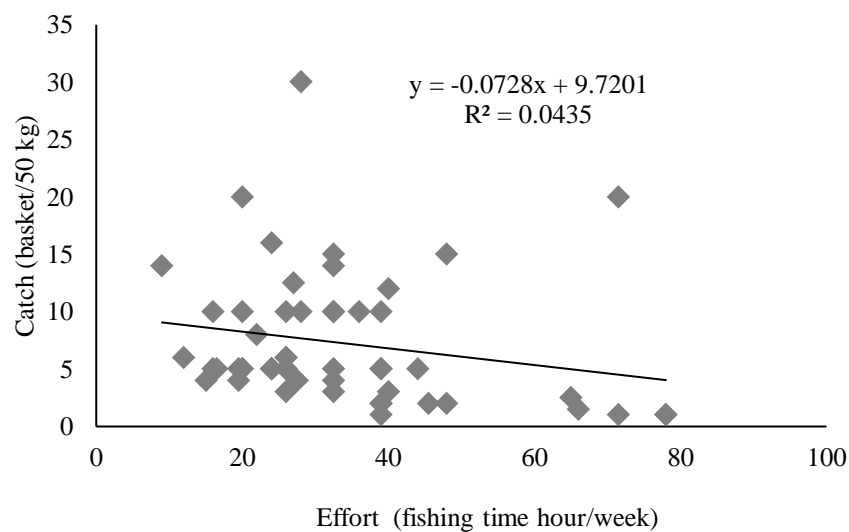


Figure 2. Average catches and effort in Timor Tengah Utara Regency.

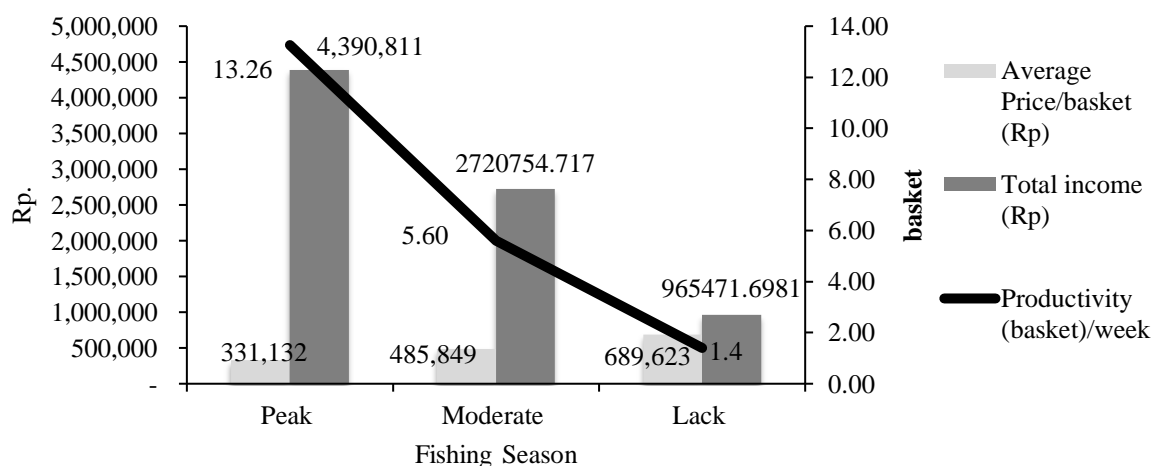


Figure 3. Fisherman's production and income during peak, moderate and lack season.

3.3. Patron-client system in TTU

Patron-client systems are typical for small-scale fisheries especially in tropical fisheries in Southeast Asia [7]. It has widespread due to the function of the patrons provide the link between the fishermen and the buyer [6], where usually fishermen stay in the remote area and apart from the market. Patron-client relationships in coastal communities which possess high vulnerability level have profound implications for fishing household livelihood security and their vulnerability by providing economic income through fishing or fish trading and social security in times of hardship and by contributing flexible and potentially exploitative credit-debt systems [8]. Fishermen in TTU Regency performs patron-client relationship 13 %. The majority of the fishermen are individual fishermen that poses their fishing gear and needs no boat. Those fishermen perform no interaction with the middleman and 77 % of the share harvesting system is 100 % for the fishermen. It is showed that commercial fishing in TTU regency is small-scale fisheries. It was not long time ago from the first catching that informing fishermen in TTU were classified as subsistence fishermen. Fishing activity was densely undertaken in

Kupang or other areas which has proximity to market. Fishermen in TTU Regency initially create small boat and function it as assets to fulfilled food to adopt drought when the dry season comes. It is learned that the elder of fishermen in TTU Regency was not increasing their fishing gear instrumental even though they use to fulfill their economic needs.

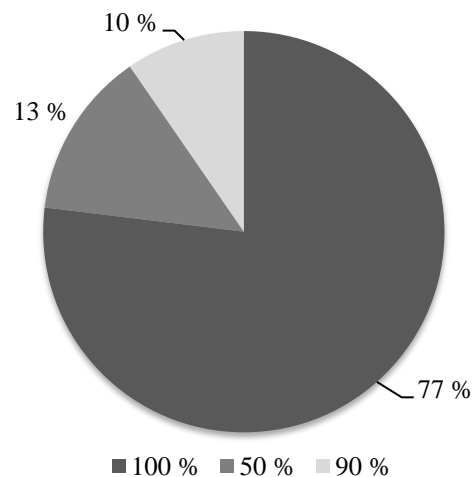


Figure 4. Share harvesting system in TTU Regency.

3.4. Vulnerability through the drought season

Based on Indonesian Agency for Meteorology, Climatology and Geophysics (BMKG figure 5), NTT was categorized as a location, which has a low to medium rainfall each year, further experienced long drought and has a problem with fresh water supply during several months in a year [5]. There are some evidences that rainfall and climate affected the catch [17]. The catch in TTU were usually occurred mostly in the peak season during August-September. However, those typical were changing since 2015. The drought season which usually starts in June which is indicated by the decrease of rainfall (figure 5) also indicate the start of fishing time. However, within three years it was changing. At present, during the drought community in the coastal area don't fish either farm. It harms their livelihood, and they have to adapt to this change.

4. Discussion

Vulnerability context is acknowledged as the adversity for a system or community to compromise and adapt to the changing that potentially reduce their resilience [3]. Also described as a stage of the exposure, sensitivity and adaptive capacity [2, 3, 11, 12, 13, 14, 15]. For the coastal community, It also regards those exposure, sensitivity and adaptive capacity are interpreted as the threat to the marine resource as a habitat change, fishing and climate impacts [2, 13, 16]. Some of the coastal communities in Indonesia do not always depend exclusively on fishing but often prefer to diversify their livelihood portfolio to comprise activities such as farming and construction in addition to fishing [9]. It also were occurred in TTU inversed way. The native fishermen possess dual existence as a fisherman and a farmer and start from the previous time; their main job is a farmer. Related to the aspect of household capital assets base and vulnerability context, fishermen in TTU, are minimum. Human capital indicates that fishermen in TTU area possess low accessibility to the fish resources due to many aspects, firstly lack boat and fishing gear. The fishermen came from Celebes who were Buton Tribe, yet the native (Dawan Tribe) was a beginner and knew a slight fishing technique. Other access is their skill to catch and operate the fishing gear and compromise with the season. Physical capitals that support fishing activity also low occurred such as availability of facilities to support cold chain system, facility for landing and handling the catch and to process it. The traditional way for the

fishermen was directly dry their catches. Developing product when catches are high can be undertaken to increase added value. Fish price at peak season falling up to 50 %.

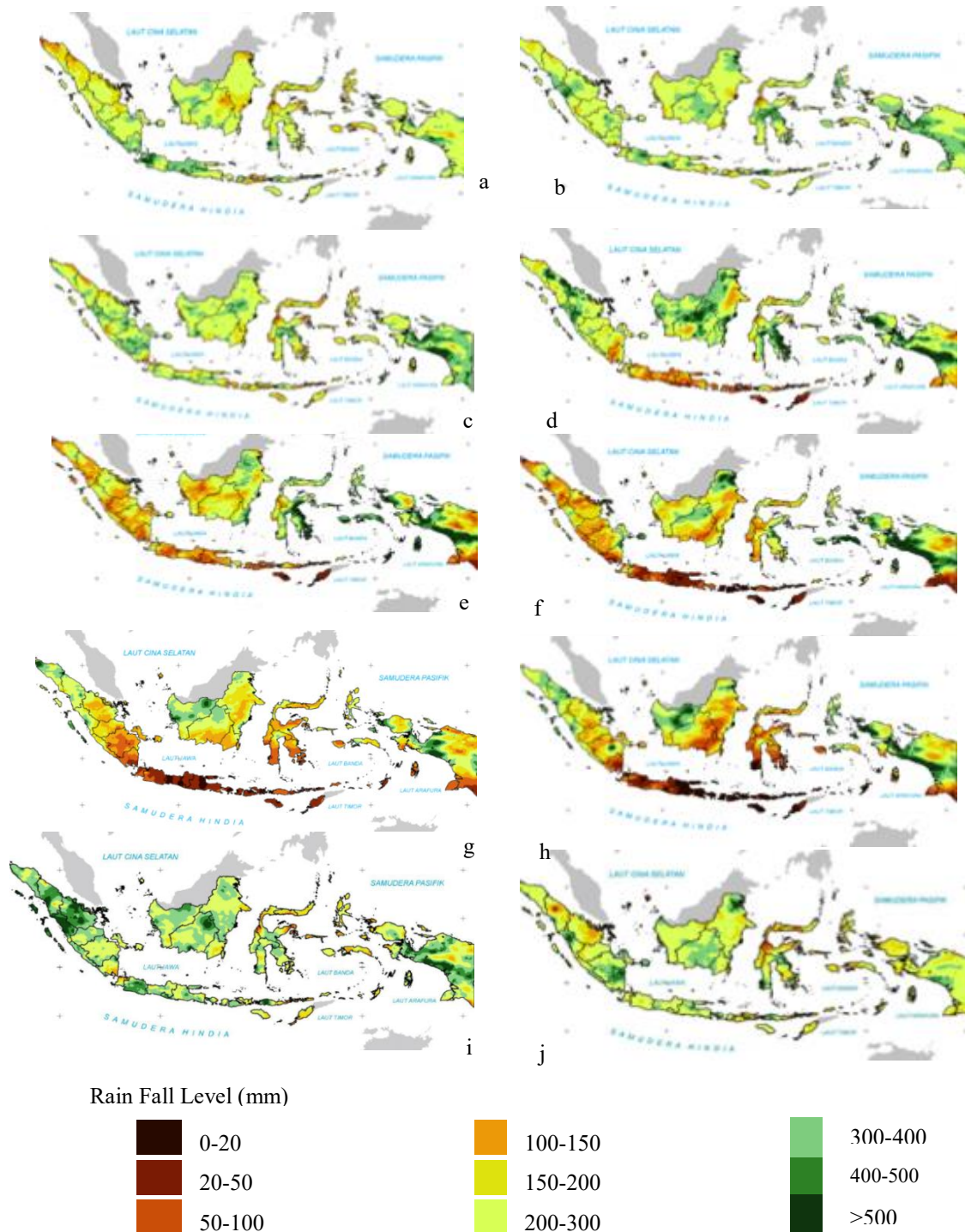


Figure 5. The rainfall rate in Indonesia in 2017, a. February, b. March, c. April, d. May, e. June, f. July, g. August, h. September, i. November, j. December. Source Indonesian Agency for Meteorology, Climatology and Geophysics [5].

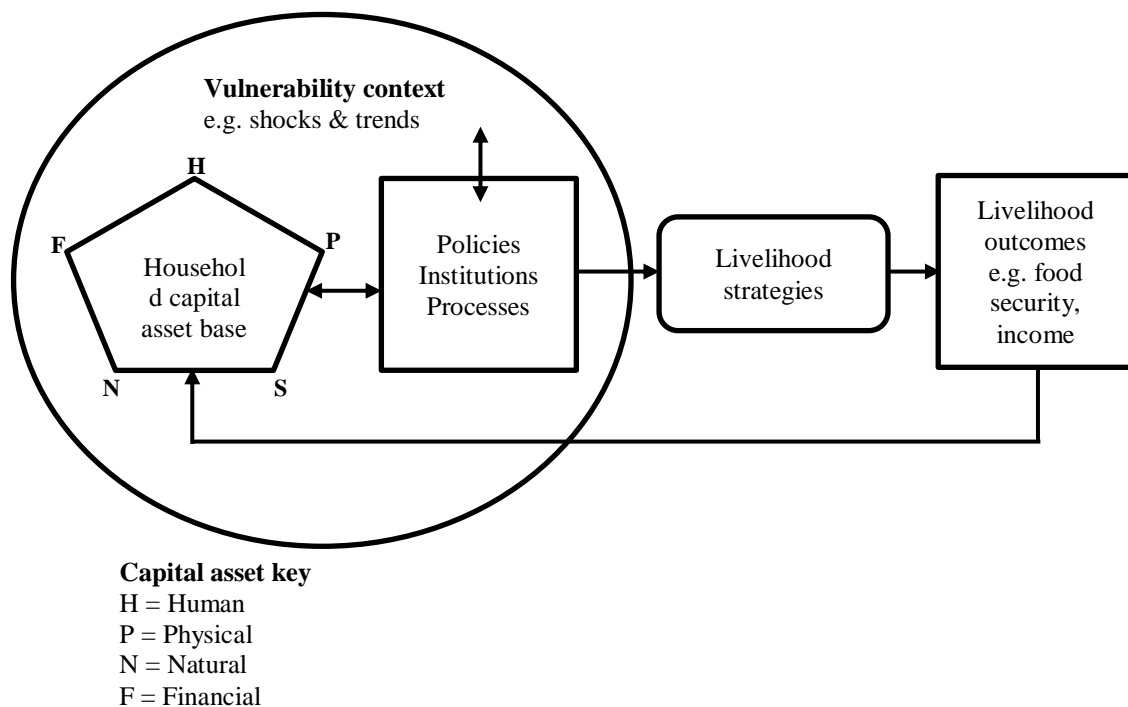


Figure 6. The Sustainable Livelihoods Framework showing the household assets and policies, institutions and processes components as existing together in the vulnerability context.

Increasing the other livelihood opportunity requires collaborations between authorities and local users. To smooth the marketing, fishermen, and stakeholder can rely on efficient information flow, involvement from government and nongovernment stakeholders which has good leader performance and a clear, structure and function, the active participation of both government and non-government stakeholders [10]. To assist and support the community, structured and transparent Governmental and nongovernmental stakeholder need to devise the fishermen and their families with several skills to extend their fishing skill and at the same time add the value of fisheries resource by proper cold chain facilities, handling or processing facilities. The facilities establishment in the border area, even more in Eastern Indonesia is a core agenda of Indonesia's national development plan. It should be followed by the capacity of the local government and also the beneficiaries communities.

The infrastructure's establishment such as road system, trading ports and fishing ports in border areas especially in the field of the fishery has been improved, since 2015, the construction of infrastructures such as roads and seaport has begun. However, there are some obstacles in the process of development of this infrastructure. The problem is the community's readiness to adapt to the changes itself. The development is expected to accelerate economic activity in the border areas and increase the sovereignty of the nations; mostly the community in the border areas has a chance for the better life. However, it also could be an exclusion potential for the local community when the economic growth lured many people from another area to join in the economic activities and left the local community behind. Therefore, the adaptive capacity of the local communities or the fishermen needs to be improved. Adaptive capacity needs to be increased as well with involved them in several productive meetings and training to protect the ecosystems on which their livelihoods depend on and making sure that there are no people in the community that are left behind towards the fast-growing access development. Lastly, there is a need to concern on the effort to repair the marine ecosystem and a water-efficient farming system to enriched their alternatives livelihood.

5. Conclusion

TTU community categorized as a vulnerable community. They just recognize the changing environment (climate and habitat modification) as an exposure, yet cannot compromise the changing. The increase of fishing effort was not followed by the increase of catches. It means that there were environmental issues related to the fish stock in the TTU waters and the fishermen have not compromised it yet. To assist and support the community, structured and transparent Governmental and nongovernmental stakeholder need to devise the fishermen and their families with several skills to extend their fishing skill at the same time add the value of fisheries resource by proper cold chain facilities, handling or processing facilities.

6. Acknowledgement

We would thank CARED Program collaboration between UGM and NZ-Aid to fund this research. Furthermore, we would thank University of Timor, TTU Fisheries, and Regency Government providing the network and link to the communities.

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