SCIENCE TO PRACTICE: LESSON LEARNT FROM COMMUNITY BASED ADAPTATION IN SEMI ARID REGION OF INDONESIA

The SPARC Project

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Science to Practice:
Lesson Learnt from Community based Adaptation in Semi Arid Region of Indonesia

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STRATEGIC PLANNING AND ACTIONS TO STRENGTHEN CLIMATE RESILIENCE OF RURAL COMMUNITY

SPARC

EXECUTIVE SUMMARY

Indonesian government already paid a serious attention to address the potential impacts of climate change, particularly since the convening of the Climate Change Conference in Bali in 2007. In 2010, a report on the potential impacts of climate change on various economy sectors was documented by the Ministry of National Development Planing – Badan Perencanaan Pembangunan Nasional (BAPPENAS) in a report named Indonesian Climate Change Sectoral Roadmap (BAPPENAS 2010). Understanding the impacts of climate change, climate change adaptation should be devised and mainstreamed into development plan as described in the document of the National Action Plan on Climate Change Adaptation, Rencana Aksi Nasional Adaptasi Perubahan Iklim (RAN-API) published in 2014 (BAPPENAS 2014). In supporting the needs for devising climate change adaptation (CCA), as is also mandated by the law No.32/2009 verse no.16 on vulnerability assessment, a tool designed for measuring regional climate change vulnerability has been released (KLHK, 2015). In accordance, the government through the Ministry of Environment and Forestry, Kementerian Lingkungan Hidup dan Kehutanan (KLHK) has also released the ministerial decree No. 33/2016 to provide the guidance for devising strategies on climate change adaptation. As a focal point on managing climate change issues, the Directorate General of Climate Change under the Ministry of Environment and Forestry has been formed in 2015 through presidential decree No.16/2015. The government has also ratified the Paris Agreement in October 2016 that showed the government commitment in the global initiative on climate change.

The government attention is considerably high because climate change has been identified also to impact social livelihoods particularly those who lived in rural and coastal areas (i.e., farmers, fisherman). Concerning this potential issue, in 2013, the Indonesian government and the provincial government of East Nusa Tenggara Timur - Nusa Tenggara Timur in cooperation with international institutions launched a project called "Strategic Planning and Action to strengthen climate resilience of rural society in East Nusa Tenggara" or known as SPARC (2013-2016). The United Nations Development Programme (UNDP) with support from the Global Environment Facility (GEF) facilitated the implementation of SPARC program. The KLHK is the implementing partner at the national level and the Planning and Development Agency, Badan Perencanaan Daerah (BAPPEDA) of the NTT Province, is the responsible partner at the provincial level. The SPARC program focuses on strengthening the resilience of rural communities to the impacts of climate change, particularly on three sensitive sectors: agriculture, water resources and livelihoods. For pilot sites, three districts of the NTT province, namely: East Sumba, Manggarai, and Sabu Raijua, suggested by the NTT provincial government with consideration of geographic and economic conditions were chosen.

The SPARC program geared to devise and implement CCA activities in the three-targeted districts, i.e., Manggarai regency, East Sumba and Sabu Raijua. In support the SPARC program, the project team was formed, composing of the national, the provincial, and the district government officers. The provincial government also released Peraturan Daerah (PERDA), a provincial regulation, No. 1/2014. At the district

level, Surat Keputusan (SK) Bupati, the regent decree, was issued to form a task force for each district. At the moment, programs on CCA have not been included into Rencana Pembangunan Jangka Menengah Daerah (RPJMD) – Medium Term of Development Plan at the district level, but the CCA programs have been integrated into Rencana Kerja Tahunan (RKP) - Annual Development Plan of the targeted-districts. The SPARC programs also targeted different beneficiaries. For the local government, the SPARC enhance their capacities on CCA through capacity building programs such as trainings and workshops. For the community, the implementation of CCA actions engaged with 78 communities in the three districts. The priotized locations and actions for each targeted-district was determined based on the vulnerability assessment, planned development programs, and stakeholder consultation. The CCA programs promoted by the SPARC aimed at improving the resilience of agriculture, water resources, and livelihoods.

As of 2015, the CCA actions have been implemented in 9 villages (three villages per district). In the district of Manggarai, the three villages are Desa Gapong, Ndehes Copang Village, and Village Iteng, and CCA actions involve 18 communities. The CCA actions in Gapong included the provision of water infrastructure, the cultivation of vegetables, business on cotton mattress and traditional woven fabric called 'kain tenun', cattle and fattening pigs. The results of these activities included water infrastructure, vegetable cultivation such as carrots, beans, chickpeas, eggplant and tomato, mattress and the traditional woven fabric. The mattress is sold @IDR100.000,- a piece and the traditional woven fabric is sold @ IDR 450.000,-. As of this report, there were about 10 mattresses and 67 'kain tenun' sold. In Copang Ndehes, the activities included cultivation of vegetables, provision of water infrastructure, irrigation, and reforestation. The activities resulted in about 3000 trees planted, provision of drinking water networks and irrigation system repairs. In Iteng, the activities were cultivation of green beans and horticulture, cooperation with fruit seed supplier, livestocks such as pigs, chickens and goats. The results were cultivation of watermelon and melon, adjustments of planting schedule based on the market demand.

The other CCA implementation was in the district of Sabu Raijua, involved about 20 communities. The works were placed in three villages, namely: Eimau, Ledekapaka, and Tada. In Eimau, there are several activities, i.e., enhancement of agricultural products, solar pumping, water conservation and catchment (water drill called Sumur), fiber craft for creating a boat and cemented bricks. The results were 'big' harvest attended by the Regent Mayor (BUPATI), the management of community groups with dues 5000/month/ member, eight 8-observation wells, a boat and 800 cemented bricks, and 200 wind-stone. In Tada, the adaptation activities were installation of solar pump and pipeline, and plant cultivation. The results were cultivated plant sold @ IDR 10,000 - 15,000. In Ledekapaka, the activities were vegetable cultivation, conservation of water ponds called "embung", installation of solar pumping and manufacturing water channels. The outputs included crop cultivation of purple sweet potato, five points of solar pumping, and 22 culverts for market sale. The other adaptation activities were implemented in East Sumba (involved 40 community groups). The implementation of activities was in the villages of Napu, Palanggai and Rakawatu. In Napu, the activities

were construction of Solar Pump, crop cultivation, and climate field school. The activities resulted in the installation of solar pump and pipeline, the development of vegetable gardens, planting 200 coconuts, 2500 cashew seedlings, and the training of rainfall observation as a part of climate field school. In Palanggai, the activities included the construction of wellbore, field school of cultivating paddy and diversifying local food, cultivation of annual crop, and climate field school. The results were the constructed wellbore, 3000 coconut seedlings, 1000 breadfruits, 3500 cashew seedlings, and a training of rainfall observation. In Rakawatu, the activities were field school of paddy cultivation, the use of biochar technology for vegetable cultivation, cultivation of snails for animal feed, freshwater fish farming, cultivation of annual crop, and climate field school. The results included harvesting of vegetables, cultivation of cassava with cutting-methods, cultivation of peanuts, and plantation of annual crop (i.e., 2500 hazelnuts, 1500 breadfruits, 2500 coconuts, 1000 coffes, 1000 oranges, and 5000 mangos).

The implementation of CCA activities under the SPARC provides a lesson-learn on the process of adaptation efforts from planning to actions. The SPARC offers a list of learning processes that can be grouped into: 1) issues in the implementation, 2) awareness on climate change impacts, 3) rules and actions on CCA at the local level, 4) mainstreaming CCA into local government programs and budget allocations. The implementation of CCA activities under the SPARC, which are spread acroos three districts, is a challenge on the efficiency and effectiveness of monitoring and evaluation. The targeted districts of Sumba Timur, Sabu Raijua, and Manggarai are geographically laid on three different islands, affected financial needs and mobilization. A district coordinator was assigned for each district to manage SPARC activites, which is considerably effective concerning the geographical condition. The coordinator also works collaboratively with the local non-government organization recruited by the SPARC to assist in implementing CCA activities at the community level. The local culture of targeted-implementation area, i.e., villages is another concern. The target villages have traditional leaders who are significantly influential in deciding local actions. The other concern is that the CCA activities has not been included in the Medium Term Development Planing called Rencana Pembangunan Jangka Menengah Daerah (RPJMD) at the district level; although, the CCA has been ruled by the local regulation, called Peraturan Daerah (PERDA) at the provincial level through PERDA No.1/2014.

Specifically for one of the SPARC focus on strengthening livelihoods, efforts have been made to diversify source of income. For example, in the Gapong village of Manggarai district, a group of women spend their time to create the traditional woven fabric called ‘kain tenun’. As of this report, the group has produced 67 pieces of ‘kain tenun’ sold for IDR 450.000,- a piece. Another example is the production of fiber boats, 800 cemented-bricks and 200 windstones In the Eimau village of Sabu Raijua district. Concerning the longer dry season period, the salt production and sea grass cultivation are two major economic activities along the coastal lines of the targeted-districts, whose products are exported to the other districts or province in Indonesia. The local government is in chage in promoting the products.

As for the other two focuses, agriculture and water resource, the SPARC promotes the cultivation of superior varieties to adapt with the climate fluctuation, cultivation of vegetables and annual plantation, and development of access to water infrastructure. In general, the implementation of SPARC program has led to encourage local activities that can be sustained after the project ends; although, the effectiveness and efficiency of budget utilization should still be improved. Based on the implementation of CCA activities under the SPARC, further steps are proposed as follows:

- Defining criteria to incorporate CCA programs into local development plans that consider stakeholders' involvement, stakeholders' understanding, human resources capacity, a sense of ownership, funding availability, local resources, and government policy.
- Promotion of the CCA implementation through training and community facilitation by local partners, particulalrly the formation of local community groups as the implementor of Climate Village Program - Program Kampung Iklim (PROKLIM).
- Measurement of CCA investment for determining the costs and the targets through documentation of initial condition prior to the CCA implementation, agreement on unit analysis for monitoring the CCA activities, and documentation of the activities in a systematic reporting format.
- Strengthening the capacity of stakeholders (public and private), considering the implementation of CCA actions involved multi-stakeholders, leading to the needs for developing the technical guidelines for CCA implementation.
- Strengthening funding allocations and mechanism for CCA, learning from the involvement of a financial institution in the CCA implementation under the SPARC, namely: BANK NTT, offering an approach for the disbursement of CCA funding to communities, leading to the needs for developing the technical guidelines for the involvement of financial institutions in the implementation of community-based adaptation to climate change.

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1. INTRODUCTION

The Intergovernmental Panel on Climate Change (IPCC) in the Fifth Assessment Report (AR5) (IPCC 2013) reported that global climate change has a significant impact on countries in the Southeast Asia region. At the global level, the impact of climate change is exarcebating due to increased environmental damage. Human activity causes an increase in greenhouse gas emissions because of energy use, fossil fuels use, and reduced absorption of greenhouse gases (due to reduced green open spaces, illegal logging, or forest fires). A report released by ADB entitled "The Economics of Climate Change in Southeast Asia," said Southeast Asia is the most vulnerable area of the world to climate change, and may result in famine, water shortages, and economic losses. By 2100, Southeast Asia's economy will suffer a loss of 6.7% of the total regional GDP per year. This means that the loss of this region is more than the doubled global economic loss. The report also mentions that Indonesia is the most vulnerable country to the impacts of climate change in Southeast Asia (ADB 2009).

Indonesian government already paid a serious attention to address the potential impacts of climate change, particularly since the convening of the Climate Change Conference in Bali in 2007. In 2010 the Indonesian government through the Ministry of National Development Planning (Badan Perencanaan Pembangunan Nasional - BAPPENAS) published a report on the potential impacts of climate change on various economy sectors through the document called Indonesia Climate Change Sectoral Roadmap (BAPPENAS 2010). Understanding the impacts, climate change adaptation should be devised and mainstreamed into development plan as described in the document of the National Action Plan on Climate Change Adaptation published in 2014 (BAPPENAS 2014). In supporting the needs for devising climate change adaptation (CCA), as is also mandated by the law No.32/2009 verse no.16 on vulnerability assessment, a tool designed for measuring regional climate change vulnerability has been released (KLHK, 2015). In accordance, the government through the Ministry of Environment and Forestry, Kementerian Lingkungan Hidup dan Kehutanan (KLHK) has also released the ministerial decree No. 33/2016 to provide the guidance for devising strategies on climate change adaptation. As a focal point on managing climate change issues, the Directorate General of Climate Change under the Ministry of Environment and Forestry has been formed in 2015 through presidential decree No.16/2015. The government has also ratified the Paris Agreement in October 2016 that showed the government commitment in the global initiative on climate change.

The government attention is considerably high because climate change has been identified also to impact social livelihoods particularly those who lived in rural and coastal areas (i.e., farmers, fisherman). Bickerstaff et al. (2004) revealed that people tend to be less concerned with climate change and forget it both in temporal and spatial so that they were experiencing difficulties to identify the climate change impacts on their local environment and daily life. This has implications to adaptive capacity of the community. The adaptation strategies should be designed in order to increase the adative capacity

and climate resilient of the community. Empirical evidence suggests that adaptation is locally specific contexts (e.g., Risbey et al., 1999). Socio-economic characteristics, social networks, local knowledge, and non-climatic factors play a key role in shaping the adaptation actions. Communities and local government are considered as the most capable groups in providing protection for vulnerable groups. Best adaptation options must be adjusted to the cultural, social, and economy of the local area. A set of values should be considered when devising adaptation efforts. In this context, the values are defined as the standard that guides the decisions, choices, and behavior (Rokeach 2000). These values also determine the purpose of adaptation plans, for example, to preserve the status quo of a particular ecosystem or to improve the quality of life and well-being. Values and goals of adaptation also determine what is considered as the limit and what adjustments should be made (Adger et al. 2009). Decision on adaptation efforts should involve various elements of social institutions, especially the culture, resources and vulnerable groups at the local level.

Climate change in Indonesia almost be felt in many areas. As an example, the regional impacts on agriculture sectors in East Nusa Tenggara. Based on the assessment of CCROM IPB (Boer et al. 2015), the livelihoods in East Nusa Tenggara heavily dependent on agriculture (80%) with rural incomes about six times lower than the income of urban communities. The farm is dominated by rainfed with subsistence-based. The rural communities are heavily dependent upon agricultural production and water resources, which significantly affected by climate fluctuation. Thefore, ensuring food and water security is a major challenge. Furthermore, the impacts of the disruption caused by climate change will very likely exceeded the capacity of the rural communities in East Nusa Tenggara, which urges actions on climate change adaptation as a necessity.

Adaptation strategies should be designed specifically for an area depending upon the impacts of climate change and should be directed to enhance community resiliency to the impacts. Concerning the potential impacts of climate change and socio-economic condition of the East Nusa Tenggara, hereafter called Nusa Tenggara Timur (NTT) was selected as a case study. The livelihood condition and income per capita of NTT were lower that most province in Indonesia. Meanwhile, global climate change is expected to significantly affect extreme climate events in NTT (Boer and Faqih 2011), which will significantly affect the agricultural activities as the main source of income contributing to the regional economy.

In order to reduce the potential risks of climate change, especially in the food sector, water resources, and livelihoods, the Indonesian government and NTT provincial government in cooperation with international institutions launched a project called "Strategic Planning and Action to strengthen climate resilience of Rural Communities in East Nusa Tenggara" or known as SPARC (2013-2016). The United Nations Development Programme (UNDP) with support from the Global Environment Facility (GEF) facilitated the implementation of SPARC activities. The KLHK is a partner at the national level and the Planning and Development Agency (BAPPEDA) NTT Province is a responsible partner at the provincial level. The SPARC program focuses on

strengthening the resilience of rural communities to the impacts of climate change, particularly on three sensitive sectors: agriculture, water resources and livelihoods. For pilot sites, three districts of the NTT province, namely: East Sumba, Manggarai, and Sabu Raijua, suggested by the NTT provincial government with consideration of geographic and economic conditions were chosen.

The main objective of SPARC is to design adaptation strategies in order to increase adaptive capacity and strengthen climate resilience of communities (resilience capacity), especially those who live in the targeted-districts of the SPARC project. The adaptation programs developed for NTT focus on strengthening and developing the capacity of institutions and rural communities so that they are resilient to climate change, particularly in the three sensitive sectors, i.e., livelihoods, food and water security. This project has also contributed to the development of national policies on climate change adaptation. SPARC also resulted in the development of community action plans derived based on the vulnerability and risk assessments. Based on the assessment, community-based adaptation strategies (CCA) were prepared. Local facilitators have been trained to guide the implementation of the CCA actions by the community designed to manage the risks of climate change on food and water security, and livelihoods. The SPARC project team composing of KLHK, UNDP, and BAPPEDA NTT are responsible for the facilitation and monitoring of the CCA actions implemented by the targeted-communities.

This book aims to identify the planned adaptation measures, targets and activities that had been implemented in the NTT province, particularly the locations of SPARC targeted-district, i.e., Sumba Timur, Sabu Raijua, and Manggarai. The other objective is to provide information on how CCA actions are prepared starting from planning to implementation at the local level. Therefore, the sections are divided into specific dicsussions on the climate change impacts, desiging process of CCA actions, the implementation of community-based CCA actions, and lesson-learnt based on the implementation of the SPARC project, particularly the implementation of adaptation actions and the involvement of multi-stakeholders in the project.

2. CLIMATE IMPACTS IN THE PROJECT AREA

East Nusa Tenggara (NTT) is a province located in the southeastern part of Indonesia precisely the western region of the Timor (Timor Leste). NTT located between 8° - 12° south latitude and 118° - 125° east longitude with a total area of 47931.54 km². Geographically, the province is composed of 1,192 islands, where there are 432 that have a name and only 42 islands are inhabited. The large island inhabited are Flobamorata (Flores, Sumba, Timor, Alor, and Lembata). The regional boundaries of the province of East Nusa Tenggara include:

- In the north, bordering the Flores Sea
- In the south, bordering the Indian Ocean
- In the west, bordering the Province of West Nusa Tenggara
- In the east, bordering Maluku province, Banda Sea and the East Timor Nation

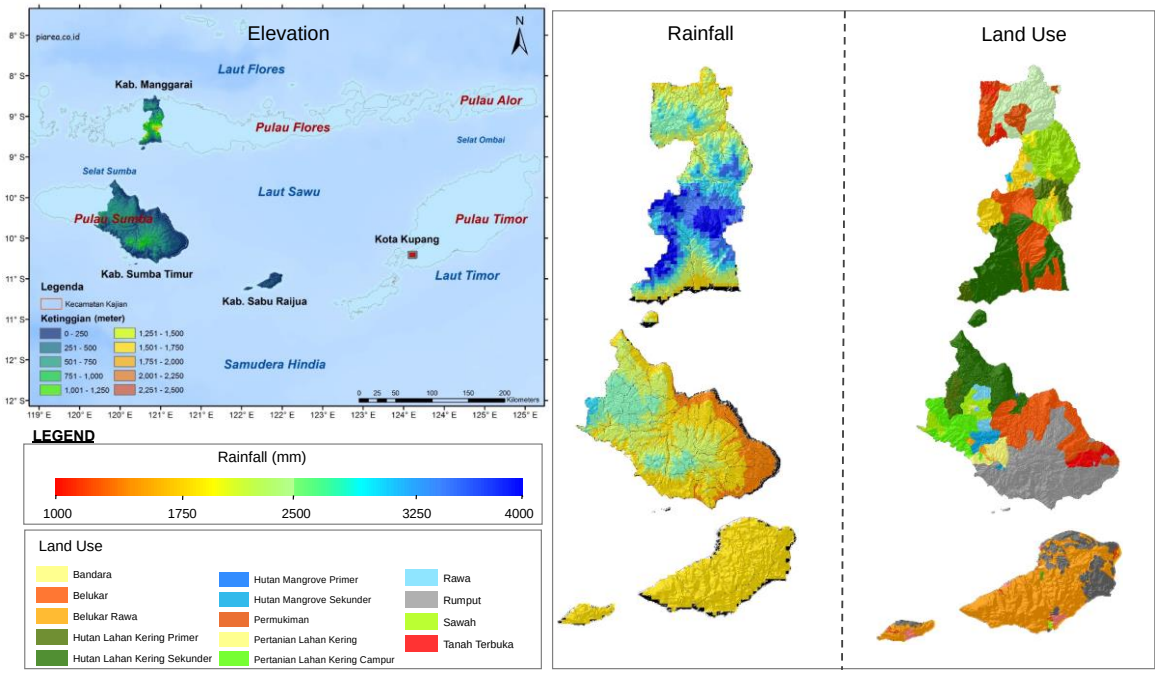

Figure 1. Geography dan topography condition of East Nusa Tenggara (left) and information on annual rainfall for the climatological periode of 1971-2000 (middle) and land use (right) of the districts of Manggarai (above), Sumba Timur (middle), dan Sabu Raijua (bottom). Source: prepared by PIAREA.co.id using various data sources

Based on data from BPS (2016), NTT has 21 counties and one city, 306 districts, 2,952 villages and 318 sub-villages. The largest area are the East Sumba district with an area of 7005 km² (14.61%) and Kupang district with an area of 5,525 km² (11.53%). The smallest region are the city of Kupang with an area of 180.27 km² (0.38%) and Sabu Raijua with an area of 460.47 km² (0.96%).

Most of the relief in the regions of NTT is mountainous and limestone hills with slopes greater than 40%. Region with a slope of less than 8% is quite limited, causing the rate of erosion and landslides is considerably high. Only small areas of the coastal region is lowland, while the central parts of the island is a plateau such as Kalimutu Mountain in the Flores Island. NTT included in the Circum-Mediterranean mountains where there are active volcanoes such as: Mount Ineria (2,245 m), Mount Lewotobi (1,704 m), and Mount Kalimutu (1,690 m). While, Sumba, Rote, Timor, and Sawu included in the Circum-Mediterranean are outside of the arc and does not have active volcanoes. This causes the area of Flores and Alor Solor Islands is a volcanic region that has fertile soil. Most land in NTT has shallow solum (<30 cm). Based on the distribution, the percentage of soil types in the region of NTT is comprised of mediteran soil (51%), mixed soil-types (32.25%), Latosol 9.72%, Grumusol 3.25%, Andosol 1.93%, Regosol 0.19%, and 1.66% Alluvial.

On the islands of Flores, Sumba and Timor, there are grassland areas (savanna) and the large steppe. Some grassland areas are cut by the river flows. The rivers located in NTT, such as Reo and Wera rivers (Flores island), Menet and Melolo rivers (Sumba), Benain and Mina rivers (Timor Island). There is no lake in NTT. The area are also covered by marine, such as: Flores Sea, Sawu Sea in the south of Flores island, Timor Sea in the east of Rote island, Sumba strait at the north of Sumba island, Ombai strait, Sape strait, and others.

As mentioned above, the NTT was chosen as a project location for climate change adaptation action focused on the three selected districts, which are Sumba Timur, Sabu Raijua, and Manggarai. The districts are the three zones of agro - ecology with different characteristics. Sabu Raijua topography is hilly and rocky. Soil mostly savanna, which is about 31% of the total area, with shrubs around 11 718 ha (25%) and agriculture around 10 437 ha (22.65%). Manggarai district characterized by upland areas around 1200m - 1500m above sea level. Most of the area is mountainous (84% of the total area), agriculture and coastal lands located on the flat plains (16% of total). Agricultural land in Manggarai is 31 030 ha, and about 210 624 ha of forest cover. Sumba Timur is characterized by semi-arid climate. The rainy season per year is about 3-5 months from February to March, with minimum temperature of 28,8 ^{o}C and maximum temperature of 31,4 ^{o}C. The dry season occurs from August to September. The topography mostly rocky and hilly, dominated by coral reefs and terraced plains.

The above information on the NTT characteristics shows that NTT is a semi-arid region. As a semi-arid region, this area has a specific climate and environment, which is different from other areas in Indonesia. Region with semi-arid climate type is a region characterized by lower rainfall and higher potential evapotranspiration. Another specific characteristic of a region with semi-arid climate is striking difference of dry and rainy season. The average rain season fell in three to four months and the dry season is about seven to eight months. Another feature of the semi-arid region is very high intensity rainfall occurred in the rainy season.

The region of NTT, similar to the most regions categorized into monsoonal climate type in Indonesia, has two seasons: dry season and rainy season. The dry season occurs in May to October, while rainy season occurs in December to Maret. The season changes every half a year after a transitional period in April-May and October-November. This climate condition classifies the regional NTT as a semi-arid region where just four months (December to Marc) that are relatively wet, and eight months remain relatively dry (KLHK 2014).

Climate condition, based on 10 climate stations in NTT, reported that the highest temperature in 2015 was 37,4 °C and the lowest was 8,8 °C. Typically, NTT has a high temperature, with average temperature of 26-28 °C all year in 2015. Average precipitation recorded by the climate stations was between 600-2700 mm. On the basis of the highest numbers of rainy days in a year, Manggarai has 160 rainy days, Manggarai Barat has 125 rainy days, and Ngada has 121 days. Area with low rainy days are Sumba Tengah with only 31 rainy days, then Timor Tengah Selatan with 62 rainy days, and Timor Tengah Utara with 68 rainy days in 2015. The lowest relative humidity (63-76%) occurs in the season of Southeast-East from June to November, and the highest humidity occurs in the Southwestern season (82-88%) from December to May. The average wind speed in November to April is anout 3 to 5 knots and the wind speed during the Southeast-East season from May to October can reach 6-10 knots. The region climate information are presented in Figure 2 and Figure 3.

A study conducted by Gianinni et al. (2007) in Riwu Kaho (2013) shows there is the impact of climatic anomalies (climatic change from normal) classified as strong in NTT where the El-Nino occurs (prolonged drought), marked by the declining rainfall from October to December in most NTT, causing a delay on the beginning of rainy season up to 2 months and leaving only about 2-3 months of rainy season, the occurrence of false rain and prolong dry-spell. On the other hand, La-Nina, which may cause prolonged rainy season, often cause flooding in prone areas to flood. Furthermore, exploration of historical information on hazard events related to climate, such as flood, drought, landslides, and tornados, especially for the three targeted-districts of SPARC (i.e., Sumba Timur, Sabu Raijua and Manggarai), show that these three regions have also experienced various incidences of climate-related hazards as described in Figure 4.

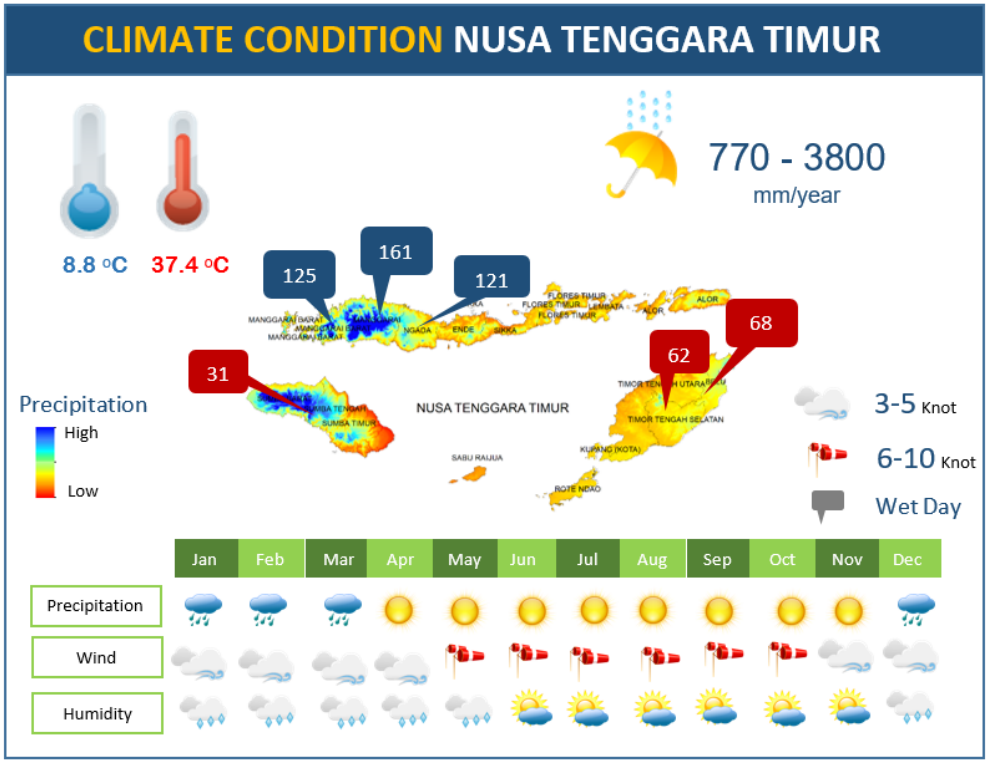

Figure 1. Climate condition in East Nusa Tenggara. Source: BPS 2016

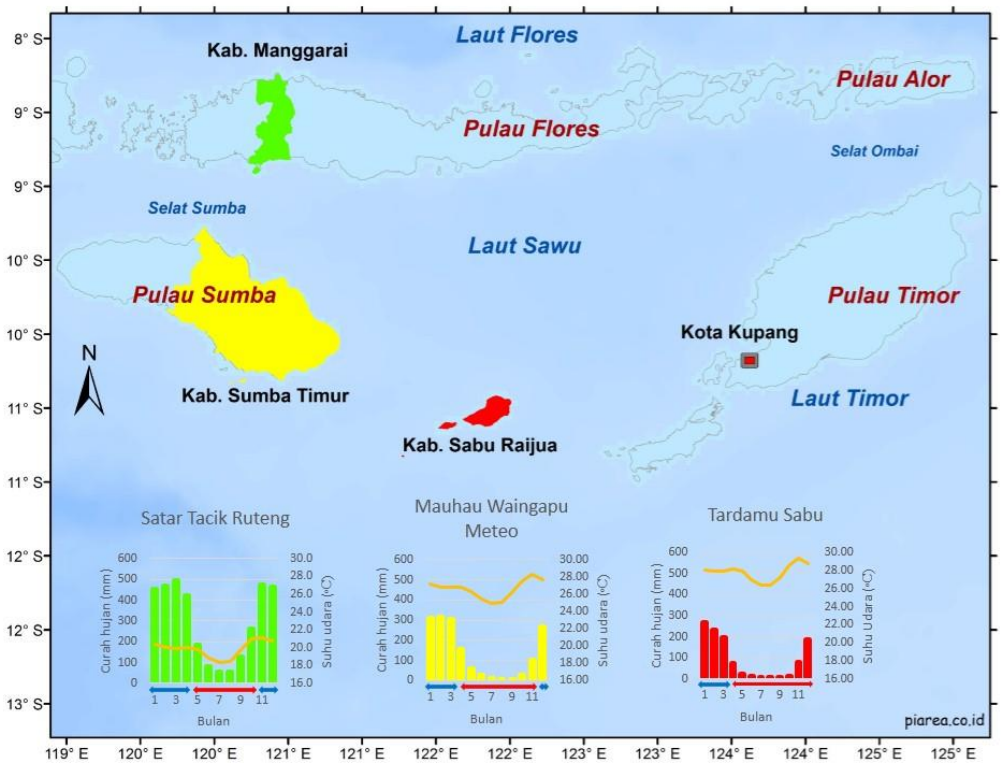

Figure 2. Climate Information of monthly precipitation and air temperature for the period of 1980-2011 in the study area. Data source: BMKG 2016

Figure 4. Distribution of historical hidrometeology hazards for the districts of Sumba Timur (above), Manggarai (bottom-left), and Sabu Raijua (bottom-right). Legends indicate the type of hazard and the numbers indicate the name of the administrative area within each district. Source: compilation of Perdinan et al. (2016).

The impact of climate change in NTT is expected to increase the frequency of high and low rainfall extremes based on the scenario of RCP4.5. In most areas, the intensity of extreme wet rain will increase in the future. Based on analysis of historical data for 30 years (1983-2012), the monthly rainfall had increased by 25-100 mm, and monthly air temperature on average increased by 0.2-0.4 ^{o}C. While the onset of the rainy season is likely to be deterred 1-3 dasarian (1 dasarian = 10 days) than normal. The rainy season will be shorter, whereas, the dry season will be longer. The climate projections of future period 2011-2040 for NTT show that the change in the return period of ten-year events in the future. The incidence of extreme dry and wet frequency will be increased to once in 4-8 years (KLHK 2014). This condition may increase the occurences of climate related hazards in many areas. For instance, the hill region that has a high slope, the extreme wet rain will increase the potential occurrence for landslides (the Lewa sub-district of Sumba Timur, the sub- district Cibal of Manggarai, and the sub-district Sabu Timur of Sabu Raijua). Based on the discussions during a training on climate change adaptation and disaster risk reduction held in the three districts, the participants reported that there is an increasing frequency of hazard occurences in the last decade.

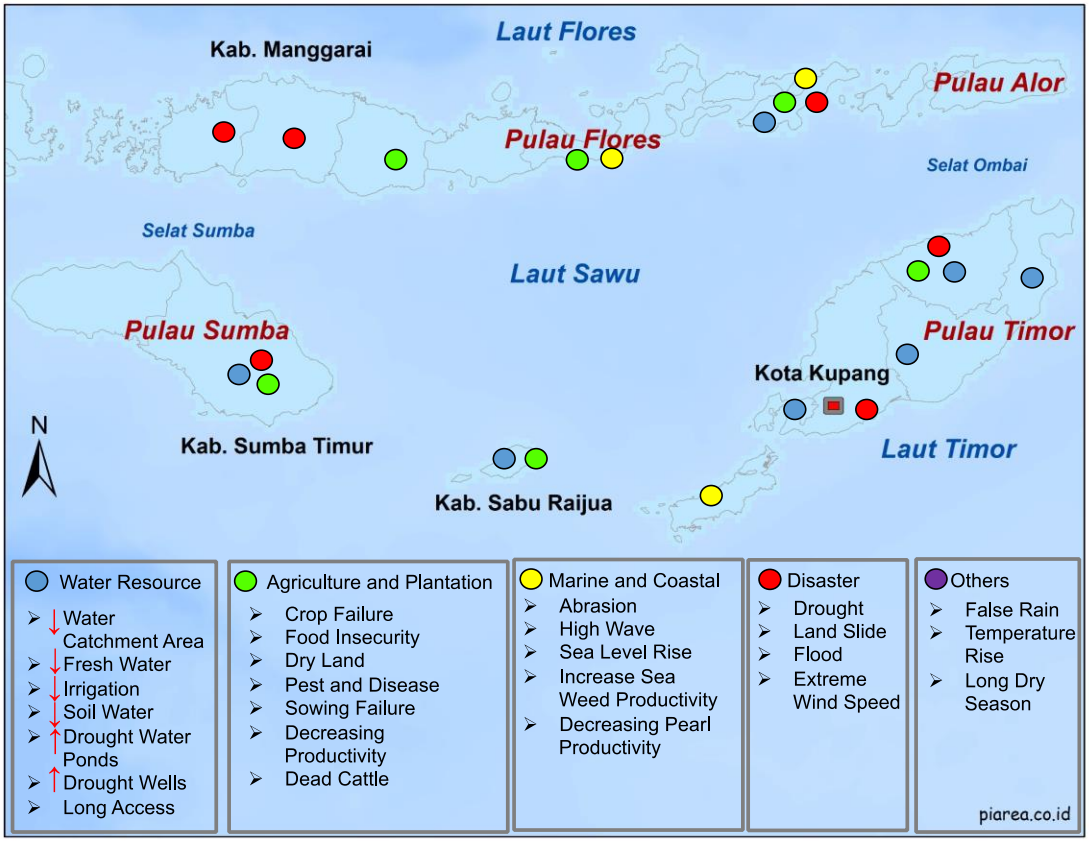

Figure 5. The identifation of the impacts of climate-related hazards on various sectors in the region of East Nusa Tenggara. Source: compilation of Perdinan et al. (2016).

The sector mostly affected by the impacts of climate change is water resources. Drought is a common issue throughout the year in NTT. The province is known to have dry areas, and water is the main limiting factor every year. In addition, the low rainfall, rocky soils, and limited areas of water catchment is the main constraint for water availability in NTT. Studies of Research and Development Centre for Geotechnology – National Science Agency (Lembaga Ilmi Pengetahuan Indonesia – LIPI) in NTT Province (Sule et al 1989; Arsadi et al 1995) showed that the amount of groundwater available is very limited and the cost of exploitation is relatively expensive. Sumba Timur for example, as many as 80% of the population are worked in agriculture and water supply is a necessity for the production process as well as needed for domestic needs. Clean water is also an obstacle for the majority of communities in coastal areas and upland savanna.

Furthermore, climate change affects the agricultural sector. The heavy rainfall occuring at the time of harvest may decline crop production. Repeated crop failures due to extreme climate events contribute to the problem of food security in the province. Food and water security has become an endemic problem in the province of NTT for over 15 years. There are indications that the situation of food security and water has begun to deteriorate and has a strong relationship with increasing climate variability and extreme events (SPARC Team 2014). Based on the study of CCROM IPB (2013), a rural community in NTT heavily dependent on agricultural production and their water resources on climate fluctuation, so ensuring food and water security is a major challenge for the province.

The change in rainfall pattern is vary from location to location. The farmers who live in the highland regions will be most miserable because of the loss in soil layers due to erosion. The production of crops cultivated in highland areas such as soybeans and corn can be decreased. The threat of landslides in the highland areas, not only threatening residential areas, but also agricultural areas or sources of their livelihood, including sources of clean water. Landslides may also isolate upland area because the main road is buried by landslides.

Climate anomalies are not only characterized by extreme rainfall, extreme wind speed is also a threat to human life. One of the communities directly affected by the extreme events were fishermen, especially the *artisanal* fishermen. With the wind speed is above average, it will be followed by high waves. The high waves would be a threat to the *artisanal* fishermen who employed a traditional fishing gear. The high waves and strong winds in 2010, for example, has eliminated the livelihoods of fishermen in NTT. The coastal area is also under threat from rising sea levels, especially the islands whose locations are spread-over in NTT.

3. DESIGNING CLIMATE CHANGE ADAPTATION

The impacts of climate change directly affect people's lives, especially in sensitive sectors to fluctuating climatic conditions. According to IPCC (2007) poorest communities will be the most vulnerable to the impacts of climate change because it can be hard for them to make efforts in preventing and mitigating the effects of climate change due to lack of adaptive capacity. To overcome these conditions, increasing the adaptive capacity of society is a necessary as an effort to improve the community resilience to the impacts of climate change. Multi-stakeholders' involvement is also required in the preparation and implementation of climate change adaptation. Theoretically climate change adaptation is a social process that requires the support of various parties ranging from individuals, households, communities, and government (Adger et al., 2003, 2006). Perdinan and Winkler (2014) recommend combining the results of the risk assessment or the impacts of climate change, based on the use of climate/impact models (top-down approach) with the local knowledge (bottom-up approach) in designing climate change adaptation options. Desigining climate change adaptation plan has currently been set in the Ministerial Decree of Ministry of Environmental and Forestry No. P.33/2016, as described in the introduction.

The ministerial decree provided a guidance to design CCA, which is described briefly as follows. The first step in determining the adaptation options, the affected areas or sectors should be identified through consultation among stakeholders. The consultation aims to collect data and information related to the impacts of climate events. Then, the scope of works should be decided, containing the target analysis, the impacts of climate events, and the contribution of focused sectors or region to regional income (Pendapatan Domestic Regional Bruto – PDRB). The next step is conducting the vulnerability and risk assessment under a set of climate change scenarios as an effort to understand the potential impacts of climate change. In this stage, the indicators of vulnerability should have identified and decided. The vulnerability and risk analysis are purposed to measure the degree of vulnerability and risk of a region or sector using a vulnerability/risk method such as those employed in the Sistem Informasi Data Indeks Kerentanan (SIDIK) – Information System on Vulnerability Index, issued by the KLHK. Climatic conditions such as extreme climate, future climate scenarios, and the impacts of historical climate events are also included in the analysis. Next, the guidance suggested to mapping the capacity of stakeholders in a region or sector in order to obtain supports for the development and mainstreaming climate change adaptation into development planning. The results of vulnerability and risk assessment are used as the basis for identifying adaptation options. Thus, the options for specific targeted-area or sectors are determined based on: (1) the recommendations of vulnerability/risk assessment, (2) the regional socio-economic information, (3) the regional biophysical conditions, (4) the available essential resources and local knowledge, (4) the local capacity, and (5) the benefits of adaptation options on environmental quality. These steps of developing adaptation options has been employed by the SPARC and summarized in Figure 6.

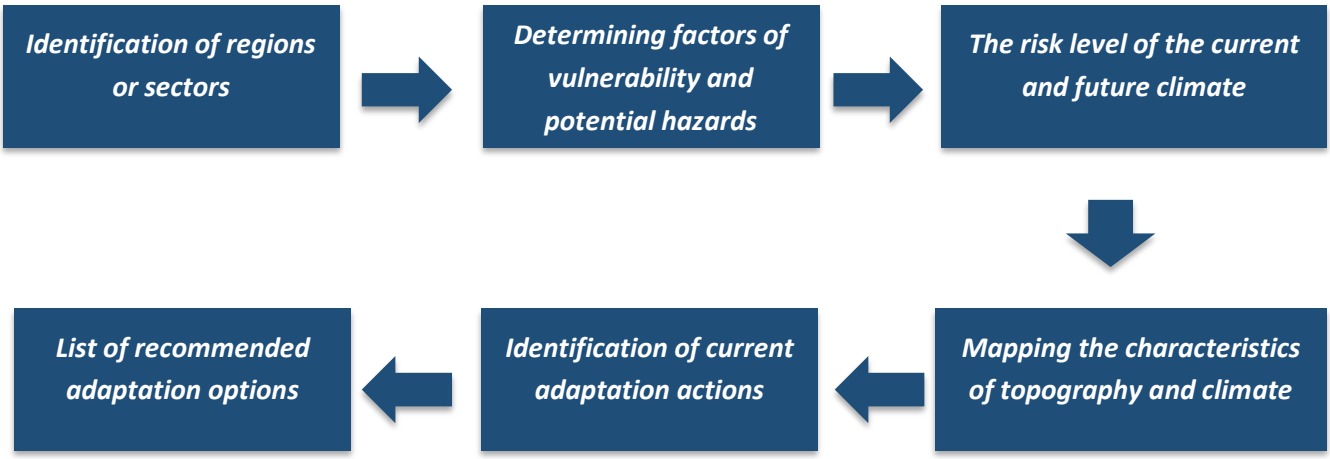

Figure 6. Process of forming adaptation options in SPARC target region

In general, the stages of developing climate change adaptation options are below:

- Determination of priority areas for the implementation of adaptation action based on the analysis of climate vulnerability/risk
- Determination of priority adaptation actions with regard to determinants of vulnerability and its contribution to development, and the other related information (e,g., topography and land cover)
- Determination of the targets and the implementation period for the priority actions
- Determination of the parties to support the implementation of the planned actions (upscaling and expansion, improvement of adaptation actions)
- Coordination of the implementation of adaptation actions

A. Approach and Targets

SPARC program has two major goals: (1) to improve the ability of institutions in integrating climate actions into sustainable development at district and provincial levels (integration of climate resilience into development), (2) to diversify and improve the livelihood and source of income for rural communities that are vulnerable to climate change. The first goal was approched using the five strategies shown in Figure 7. This approach is proposed concerning the lack of institutional capacity for climate change adaptation and the lack of local government capacity mandated to support the integration of actions to strengthen climate resilience into programs and policies of the district and the province. The SPARC attempted to address these issues through stakeholders trainings/workshops targeted to about 100 participants. For the second goal, the activities are targeted at the level of rural households in the targeted districts, which are highly vulnerable to climate risks. Actions to reduce climate risks are also implemented in order to raising community awareness at the local level. The activities are purposed to strengthening the resilience of vulnerable communities through the development of community-based adaptation actions, which are targeted to reach 40 villages as outlined in Figure 7.

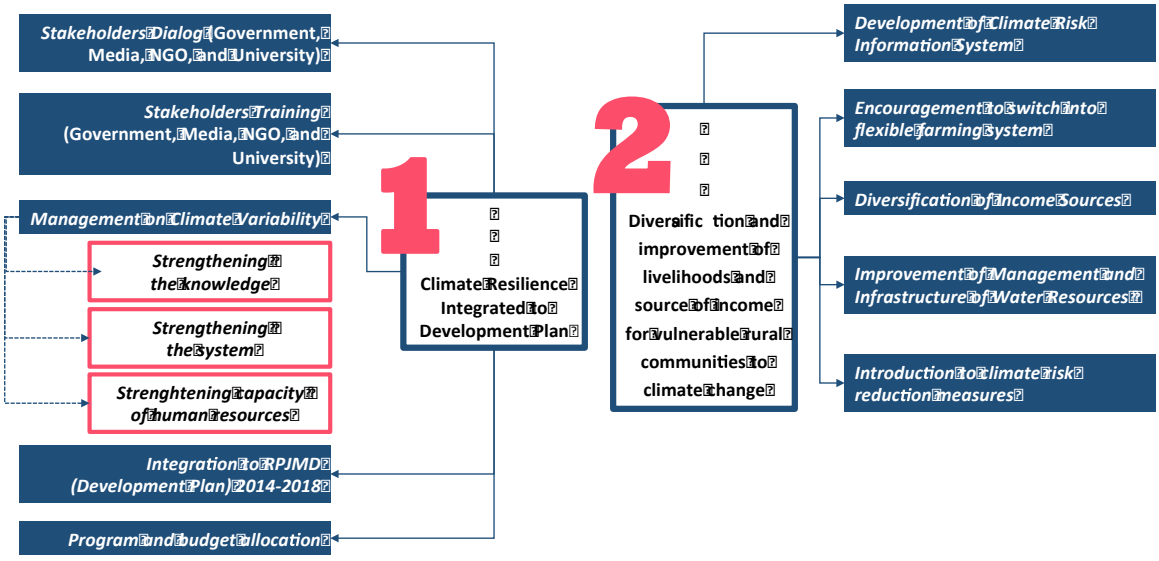

Figure 7. The activities approached for each major goal of the SPARC program

B. Project Location

Selection of the target location for each targeted-districts, hereafter called the steps of selecting target location, was determined based on vulnerability analysis conducted in partnership with CCROM IPB and suggestions from the local area. Several criteria are used, namely: 1) the degree of vulnerability, 2) the local governments recommendation, 3) the location coincided with the provincial government program named “ANGGUR MERAH” or programs of the district government, and 4) the commitment of the local stakeholders to participate in implementing climate resilience program focusing on water, food, and livelihood. The selections are also considered the analysis of Rural Rapid Appraisal - Kajian Cepat Pedesaan (RRA), a household survey of socio-economic and climate related risk assessments, which resulted in the targeted villages and climate adaptation options for the community. The villages potentially targeted for the implementation of CCA for the 3 districts are presented in Figure 9.

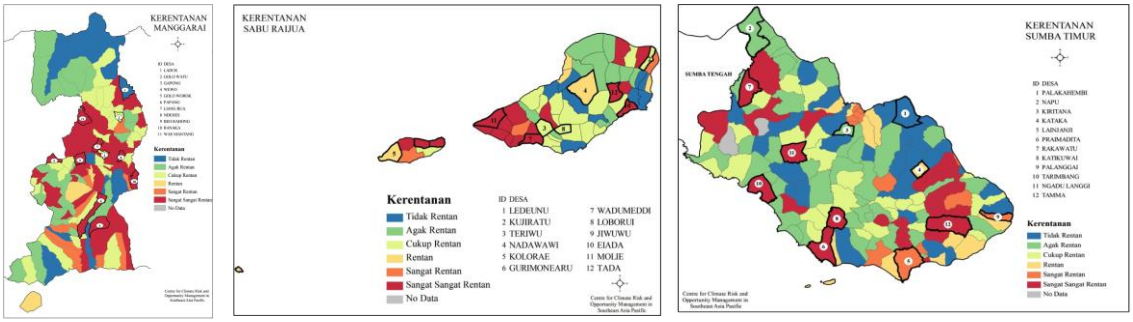

Figure 8. The villages based vulnerability mapping for Manggarai district (left), Sabu Raijua district (middle), and Sumba Timur (right). Source: Perdinan et al (2015)

In the process of developing adaptation options, a list of adaptation options was also obtained by literature study (Perdinan et al., 2015). The list of adaptation options was then grouped based on recommended adaptations spesifically intended for: Management and Utilization of Water Resources, Agricultural Value Added, Rural Institutional Development, Animal Husbandry Management, Technology for Water Scarcity and Drought, Adjustment to Seasonal Patterns and Changes in Climate Extremes. The list of adaptation options for each group can be used as a reference for the development of adaptation actions intended for specific purposes. The selection of adaptation options was also considered its potential application in the three target districts based on the results of field survey. Understanding the importance role of stakeholders in the implementation of CCA, the list of selected adaptation options were also discussed with stakeholders in each district. This selection process proposed a list of adaptation options for the three-targeted districts as presented in Table 1.

Table 1 Adaptation options for three target regions of SPARC

• The use of high yielding varieties/other plants
• Implementation of Climate Field School/Field Schools and Integrated Pest Diseases
• Dissemination of planting calendar
• Development of agroforestry systems and garden plants/local annual
• Development of coastal communities and institutions (e.g. seaweed business)*
• Conservation of upland areas with local annual crops or agroforestry
• Improved harvest index
• Greening coastal areas*
• Development of breeding areas (savanna)
• Development of inventory system or the availability of local crop seeds (seed center)
• Water saving technology/water harvesting
• Greening for water conservation area/expansion of rainwater catchment area
• Improved transportation to support agriculture
• Value-added on bussiness of agricultural products/domestic industry
• Early warning system and weather station
• Development of rural institutions (dissemination of information, financing mechanisms)
• Repair drainage/irrigation system
• Development of a network of climate stations to support Climate Field School
• Integration system for conservation in the upstream and water catchment areas

*specifically for coastal areas.

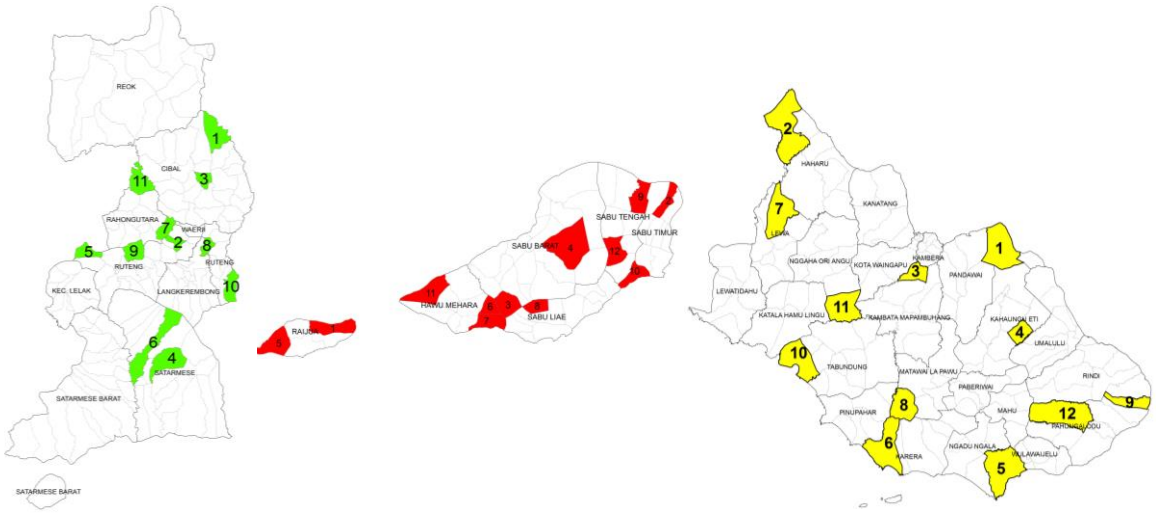

Figure 9. Location of the villages selected for climate change adaptation actions

C. Stakeholders Involvement in Adaptation Actions

The implementation of SPARC project in NTT targeted as many as 21 vulnerable villages to climate change impacts in the three districts, namely: Sumba Timur, Sabu Raijua, and Manggarai, expecting of bringing benefits to more than 1000 households. The SPARC intervention is proposed concerning the difficulties faced by the communities in NTT, especially during the dry season (April to October) due to a shortage of water for their daily needs and farming purposes. For examples, community residents in Sabu Raijua and Sumba Timur even must walk about 10 km or two hours to fetch water from available water sources. The dry climatic condition causes difficulty in doing agricultural activities over the dry season. This condition is exacerbated by the lack of other livelihood options that can be done by the community.

As mentioned in the previous section, the results of climate change risk assessments and a participatory approach of rural community groups were combined to identify appropriate adaptation actions for each village on the basis of the determinants contributing to regional vulnerability or risks of each village. Then, the community groups implement the selected adaptation actions through the facilitation process. The facilitation was made by the SPARC project team in collaboration with the Local Government (Bappeda) and non-governmental organizations (NGOs) in the target area to ensure inclusiveness and quality of the implementation of adaptation actions in the villages conducted by the community. For financial supports, the funding disbursement for implementing the community-based adaptation actions was distributed through cooperation with the Bank of East Nusa Tenggara (Bank NTT). The role of each partner in the implementation of CCA actions is presented in Figure 10.

Figure 10. Stakeholders' involvement in the implementation of adaptation actions

As can be seen from Figure 10, the role of local government and NGOs are facilitating the community to 1) identify and prioritize adaptation actions based on the information on climate risks, 2) verify the selected adaptation actions, 3) establish the community group, 4) provide information on the legal basis, 5) provide technical assistance during the CCA implementation, and 6) support the policy advocacy at the village level to mainstream CCA into the development planning. In general, the process of desigining development planning in Indonesia is started from planning meetings named 'Musrembang' at the village level up to the provincial level. However, concerning the competition of submitting proposed activities at the community level, the vulnerable groups are often misrepresented in the planning process at a higher level. In this case, the local government and NGOs of the SPARC project can play an important role by creating a communication between the community and government officials. The NGO also facilitates the targeted-communities in setting priorities and designing adaptation actions, so the communities can have a better understanding on the CCA actions that they selected. This process also can increase a mutual cooperation between the communities and the NGOs with the support of local governments.

The mechanism of distributing grants on the SPARC program is under the coordination of Badan Pemeriksa Keuangan dan Pembangunan (BPKP) – Auditing Agency for Finance and Development. The BPKP provides guidance related the auditing process of the project implementation. The procedure of project implementation follows the written agreement documented in Standardized Operating Procedure (SOP). The program is audited following the SOP as the reference. The BPKP also reminds specific concerns of the finance ministry in particular the Directorate General of Budgeting and Treasury. The SPARC project in cooperation with the regional development banks, i.e., Bank NTT, is channeling the CCA funds to communities in the targeted-villages. Each targeted-village has one bank account with which the allocated grants for CCA actions were added to the account. This mechanism is chosen considering the flexibility for rural communities to access the CCA funds, which can be managed to each individual schedule. The funding mechanism is also intended to increase transparency in using the CCA funds, also to introduce the community to the banking system. The involvement of the financial institution such as Bank NTT also provides an opportunity to provide microfinance scheme for potential business in the village as part of the implementation of CCA actions. The execution of the funding disbursement through the Bank NTT has been running successfully. In the first quarter 2015, a grant of USD 750,000,- has been accessible to nine (9) villages, the targeted-areas for the implementation of CCA actions implemented by community groups. Through the partnership, the Bank NTT have also expressed interest in the company's obligation to allocate funds to support community-based social activity known as corporate sustainability response (CSR) to add the CCA grants for the community. This situation offers a possibility for sustaining the CCA actions at the local level when the SPARC project ended. The provincial and district government and the Bank NTT are expected to continue the initiation that has been made the SPARC to implement CCA actions mainstreamed into development plan in order to enhance the community resilience to the impacts of climate change.

D. Implementation Activities

In general, the implemented activities in the SPARC project at the provincial level and the three districts have been directed to: (1) increase the institutional capacity in formulating development program adaptive to climate change, and (2) increase the capacity of rural communities that are vulnerable to the impacts of climate change. As of the year of 2015, the SPARC already conducted many activities to improve the institutional capacity to integrate CCA actions into development plan at the provincial and the district level. The implementation has produced below results.

Technical Team on Climate Change at the Provincial and the three targeted-districts of the SPARC project has been formed and work.

The technical team on climate change at the provincial and the district level has been established and validated with the Decree of Head of Bappeda NTT Province and the Regent of each district. The technical team supports the SPARC activities starting from planning, implementation, and monitoring. In the planning process, the technical team has a role and function in:

- **Identification and verification of targeted-location and technology needs for enhancing climate resilience**. Technicaly, verification was executed by the related department of the technical team members at the district and the province; while, the identification biophysical land suitability and technological requirements was made by Badan Pengkajian Teknologi Pertanian (BPTP) – Agency for Assesing Agricultural Tecnology of the Ministry of Agriculture.
- **Review of adaptation actions proposed by Kelompok Masyarakat Program Kampung Iklim (Kemas Proklim) – the community involved in Climate Village Program.** The Technical Team has done the review process to the received proposal in early 2015 to determine the 9 pilots of Proklim Phase I and at the end of 2015 to 12 pilots of Proklim Phase II.

For the implementation, the Technical Team **provided technical inputs such as seed types/varieties that are more resistant to climate extremes**. Specifically, the BPTP of NTT Province provide technical recommendations on (i) rice varieties (ciherang, Inpari, Inpago), corn variety (Lamuru), green beans variety (Vima 1); (ii) the land cultivation method with low cost technology. The Technical Team also contributed in increasing the capacity of the NGO partners and **Kemas Proklim** through various technical trainings and field school (FS) including Climate Field School (CFS). The Technical Team of the provincial and the district levels also worked together in **designing the format for monitoring and conducting the evaluation of the deliverables of activities at the community level**. The evaluation is important to provide feedback needed to improve the implementation of CCA actions at the community level. The designing of monitoring format to evaluate the deliverables of CCA actions at the community level, implemented by the NGO partners and **Kemas Proklim,** has been completed in January 2015, and the evaluation processes conducted by the Technical Team has also been performed several times in 2015.

In addition, the Technical Team of NTT province has also made a series of meetings related to the coordination for several purposes as described below:

- **Coordination to agree on the implementation mechanism of adaptation actions and disbursement grants to Kemas Proklim involving Bank NTT and three (3) NGO partners (CIS Timor, Koppesda and Tunas Jaya).** The coordination confirms the role of each member of the technical team. Bank NTT as the channeling grants, can also provide technical assistance to community groups, the NGO partners as a companion community, the District Coordinators as the program manager (on behalf of the SPARC), BPTP as a provider of technology-based climate, BMKG as providers of climate information, the other related technical institutions (Agriculture, Food Security, BLHD, Cooperatives, Forestry, BAPPEDA, etc.) play a role in facilitating regional programs.
- **Coordination to supply climate Information involving BMKG, BPTP, Agricultural Agency, Food Security Agency, and Agricultural Extension Workers of the NTT Province.** Coordination was held to discuss constraints faced regarding access to climate information (such as the technical term on climatology) and the efforts needed to facilitate public access to available climate information such as Rainfall Analysis and Forecast and Planting Calendar.

The series of coordination meetings have reached an agreement for the roles of each agency, namely: BMKG in the provision and dissemination of climate information/ forecasts of rainfall, BPTP in the provision of planting calendar, and the NGO partners in disseminating climate information to the communities. The dissemination mechanism of climate information has also been decided through **Posko Iklim** or **Kemas Proklim**.

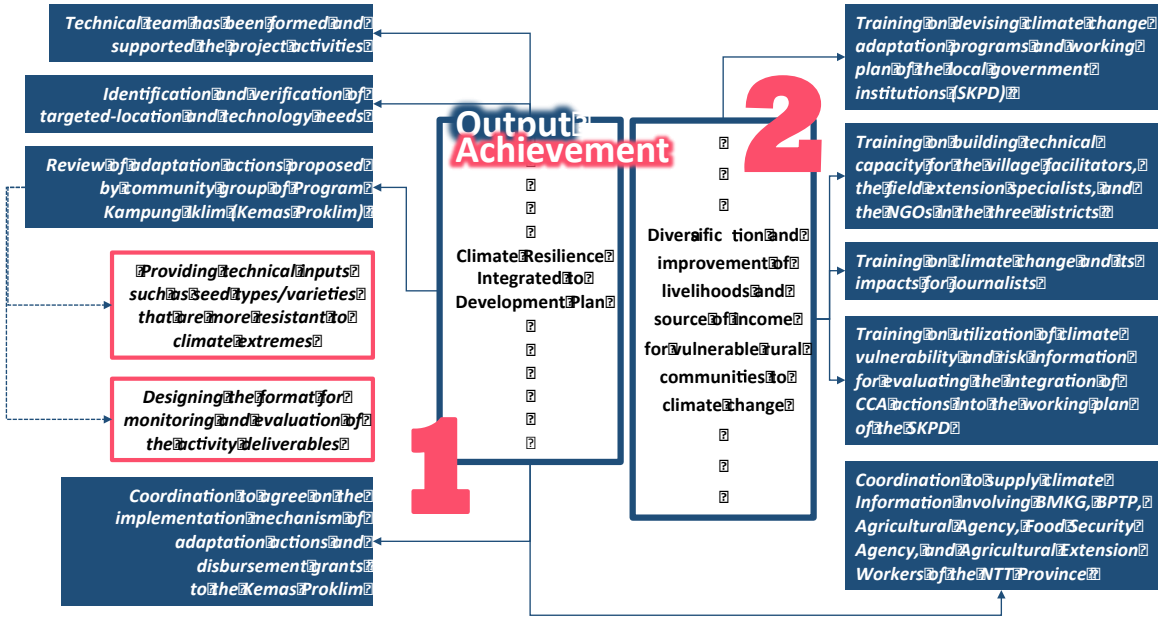

Figure 11. The approaches made by The Technical Team of the provincial and district level in supporting the SPARC program

The SPARC activities at the provincial level have also been conducted to strengthen the capacity of local governments and stakeholders through training and technical assistance provided by the SPARC team or the participation of relevant stakeholders in a number of activities on the topics of climate change organized by other organizations. The training activities that have been implemented are below:

- Training on building capacity in formulating and devising climate change adaptation programs and working plan of the institutions/SKPD
- Training on building technical capacity for the village facilitators, the field extension specialists, and the NGOs in the three districts
- Training for journalists to disseminate information on climate change and its impacts on rural development and community livelihoods
- Training on Technical Preparation and Evaluation of Working Plan of the local government institutions (*Rencana Kerja SKPD*) and the utilization of the Vulnerability Maps and Climate Risk Information to support the development of working plan at the provincial level – the NTT Province.

Besides the trainings organized by the SPARC, the government staff of NTT, supported by the SPARC, has also participated in the following activities:

- Workshop on the implementation of RAN-API Pilot Sites in 16 Regions, as an effort to share best practices and build capacity among the provinces and districts as the implementers of RAN-API activities
- Meetings on designing working plan of the local government named in Indonesian *Rencana Kerja Pemerintah Daerah* abbreviated as Pre-Musrembang RKPD 2015 and the Launching of NTT One Data program.

The above activities to strengthen the capacity of institutions are presented in Figure 12.

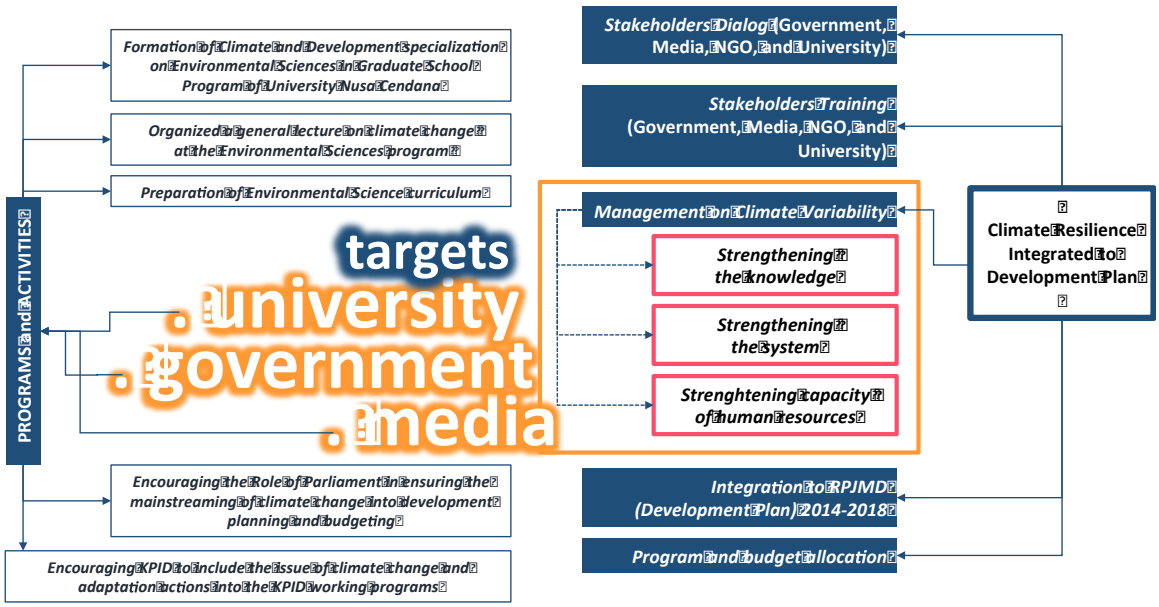

Figure 12. Activities on capacity buildings organized by the other institutions followed by the government staff of NTT supported by the SPARC

As another effort to improve the institutional capacity (i.e., systems, programs, and human resources) in tackling the challenges of climate change, the SPARC also supports several activities through cooperation with relevant institutions, among others:

- Establishment of academic specialization of Climate and Development in Environmental Science of Graduate program offered by the Universitas Cendana UNDANA located in Kota Kupang, the capital city of NTT, and the General Lecture on the Environmental Science Program provided by professors in climate sciences of Bogor Agricultural University - IPB.
- Development of Environmental Science curriculum, which included subjects on the climate and development specialization field, starting from the competency criteria for the master degree beared in the profile of environmental science program and the curriculum development for the Environmental Science
- The initial meeting with the parliament to share information related to climate change and also promote the role of Parliament in ensuring the mainstreaming of climate change issues into development planning and budgeting
- Encourage the Commission on Broadcasting of Indonesia at the local level - Komisi Penyiaran Indonesia Daerah (KPID) - to incorporate climate change issues and adaptation actions into KPID working program. The collaboration begins with a meeting coordination and training for 54 journalists to provide better understanding on climate extremes.

Furthermore, as of the year 2015, several activities have also been performed to achieve the second goal of SPARC that is to strengthen community capacity on implementing CCA actions designed for the sectors of food security, water resources, and livelihoods. The deliverables are below:

- Selection of three (3) NGOs as partners in assisting the implementation of CCA actions at the community level. The NGOs are: CIS Timor (Sabu Raijua), KOPPESDA (East Sumba district), and Yayasan Tunas Jaya (Manggarai)
- A total of 46 primary groups/communities have been conducted activities in agriculture/food security. A total of 105 primary groups in targeted-villages of the SPARC Phase II is in the planning process to conduct activities in 2016
- Initiated the establishment of the Information Center on Climate Risk (Post Climate named Posko Iklim in Indonesia term), the installation of rainfall observation tool and the implementation of Climate Field School at 9 villages
- A total of 46 communities have grown a variety of crops
- A total of 18 community groups involved in livelihood programs to improve the household economy, such as cultivation of main crops (rice, corn, green beans, peanuts), horticulture/vegetables, planting annual crops, creating mattresses and fiber boats. A total of 114 other primary group will involve in Phase II 2016

The water supply infrastructure in the 9 targeted-villages of the SPARC Phase I has also been used for domestic and agricultural needs. The government of Sabu Raijua district has also expressed the intention to replicate the solar pumping activities. Summary of the project activities at the community level is presented as follows.

Figure 13. Deliverables of the SPARC Activities at community level

4. COMMUNITY BASED ADAPTATION ACTIONS

In the previous section, the discussion is directed to the SPARC project activities on planning and implementation at the provincial and the district levels. In this section, the discussion focuses on the project implementation at the community level, climate change adaptation actions that are conducted by involving the community (community-based). In the execution, 46 primary groups involved in conducting activities in agriculture or food security through the cultivation of plants, and planned to be 105 groups involved with refer to the submitted proposal for the year of 2016). The Other activities included the establishment of Climate Risk Information Centre named Posko Iklim – **Climate Kios** initiated by installing the rainfall counter and the execution of Climate Field School at the nine (9) pilot-villages, the implementation of economic activities by the involved households in 18 communities, and infrastructure development of water resources in the nine villages for domestic and agricultural needs. Selected communities conducted the CCA actions at the community level. For example, in Manggarai district, 18 community groups located in three (3) Villages, i.e., Compang Ndehes, Iteng and Gapong, involved. Four other villages, namely: Papang village, Liang Bua, Wae Mantang and Bea Rahong will start in 2016. Various activities at the villages in each targeted-district, which were selected as the SPARC sites, are presented below.

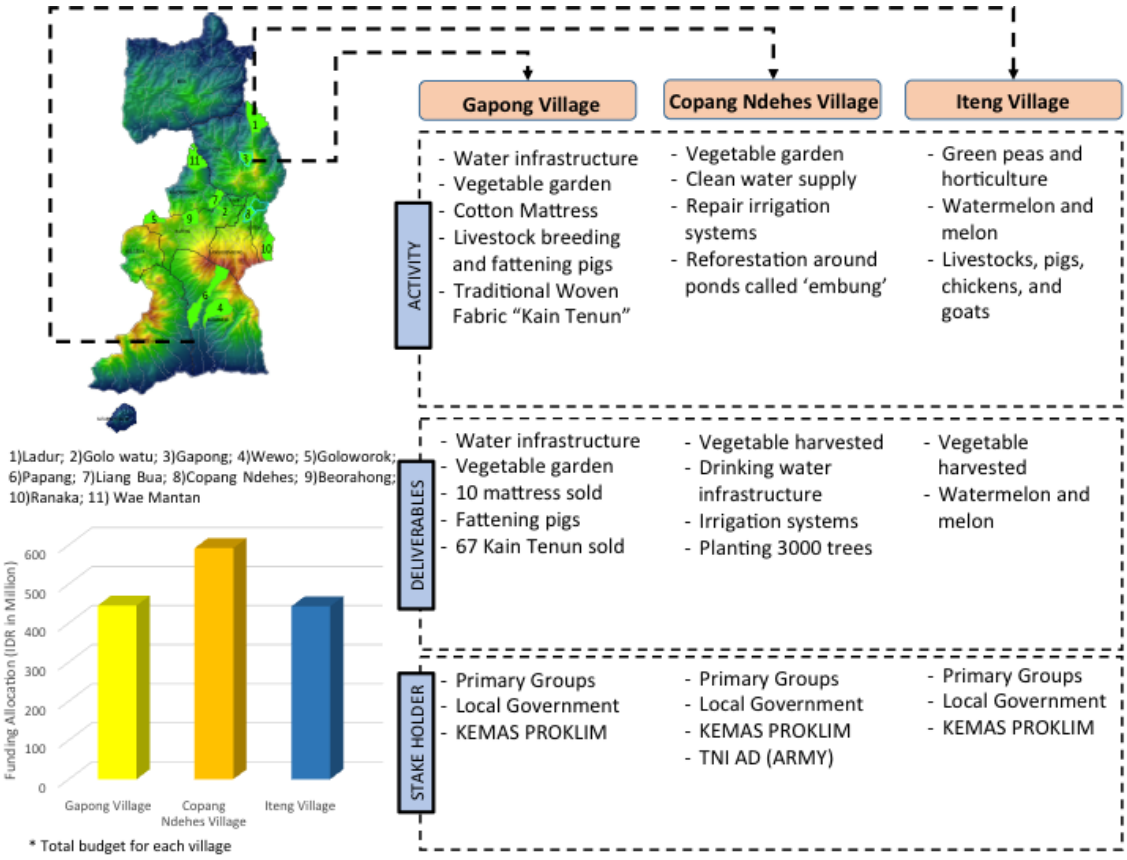

Figure 14. Adaptation actions at the villages in the Manggarai district

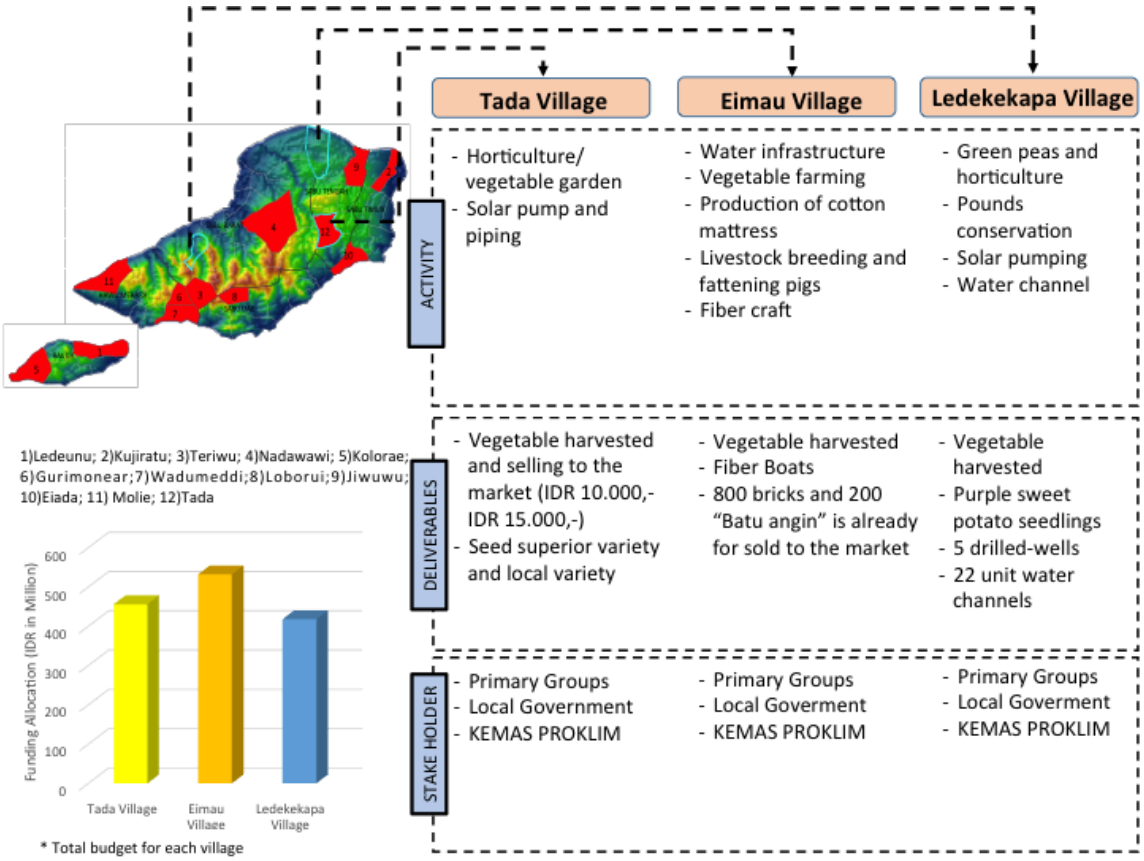

Figure 15. Adaptation actions at the villages in the Sabu Raijua district

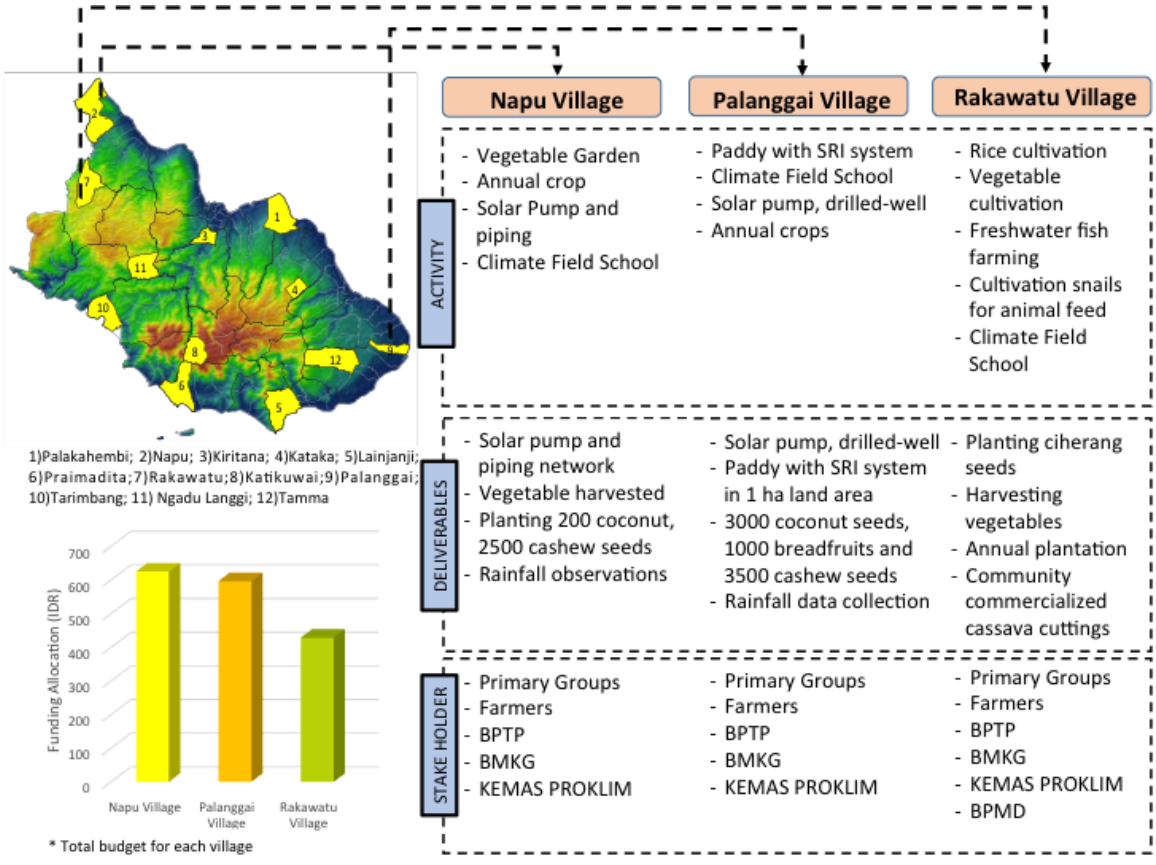

Figure 16. Adaptation activities at the villages level in the Sumba Timur district

In detail, the undertaken activities and deliverables of each of the community groups involved in each pilot-village are described below and summarized in Appendixes 2 – 4.

Manggarai district (18 Communities)

❖ **Gapong Village**

- Provision of water infrastructure for agriculture (2 groups) and fresh water
- Vegetable cultivation by Baeng Koe groups. Types of vegetables which were grown are carrots, beans, chickpeas, eggplant, and tomatoes. The vegetable area had increased.
- The cotton mattresses business were conducted by women's groups. Through this initiative, it has sold 10 mattresses at a price of 1 million rupiah per mattress. The next step is the process of producing mattresses Phase II.
- Breeding pigs (Wae Nanga 2 Group) and fattening pigs (Gendang Gampong Indigenous groups) were conducted through the cultivation field school.

❖ **Copang Dehes Village**

- Horticultural/mixed vegetables cultivation: planting schedules based on market.
- Procurement of fresh water by utilizing water resources owned by individuals, in cooperation with the village government, serving about 400 families in four hamlets. Operations and maintenance will be regulated in the village regulation.
- Reparation/construction of irrigation network for paddy and vegetables.
- Trees planting in the area around the reservoir (3000 trees) assisted by Army.

❖ **Iteng Village** :

- Green Beans Vima 1 and horticultural cultivation. Planting schedules tailored to the needs/demand of market.
- The cultivation of watermelon and melon are in cooperation with Panah Merah and Bissi Supplier
- Development of pigs breeding (1 group), the development of broilers (1 group), the development of the goat breeding (1 group)

Sabu Raijua district (20 Communities)

❖ **Eimau Village**

- Increased crop production in the rainy season (corn, peanuts, dry-land paddy, and green beans) in the period from November to March. Seeds were distributed to farmer groups and planted in the end of December 2015.
- Increased productivity of vegetables in the summer (April to October). The Regent of Sabu Raijua attended the first harvest in October 2015.
- Development of solar pump and piping network installation (Nawonga Mandiri group) was implemented in September 2015. PROKLIM already formed a group

of water managers and determined the monthly fee of Rp. 5.000,- for each member of the group.

- Water conservation using the infiltration-well system. Activities have been conducted from December 2015 to January 2016 at eight (8) wells owned by the primary group members of the four (4) community groups.
- Fiber Crafts (boats). This activity was performed by a new group of 'Karena Kasih' (14 people). They began the business in January 2016. A total of three (3) fiber boats already produced and ready for the market. Primary Group "Karena Kasih" had also received orders of 6 fiber boats from Eiada village in April 2016.
- Cemented bricks and wind-stone (Batu Angin) production performed by the group 'Purudonga', consisted of 13 members, started in January 2016. A total of 800 bricks and 200 wind-stone are now ready for the market.

❖ **Tada Village**

- Installation of solar pump and pipeline for farming papaya California, planted in area of 1.5 hectares or about 500 trees (Group Mangngi Ruba Ruba Muri, Ruba Ama and Bersatu group). The provision of solar pumping by Vice Regent Sabu Raijua to PROKLIM had been conducted on October 31, 2015. Solar pump is not only used for agricultural purposes, but also for fresh water supply.
- The cultivated vegetables had been sold. The second planting had been done. Area of vegetables were not too large, the total selling of about IDR 10000,- - 15000,-. The income was generally used to buy rice or children needs.
- Increased production of crops (corn, rice, mungbean, peanut), followed by nine (9) Primary Groups who planted in December 2015 and early January 2016. Although the rainfall was very low, but the distributed seeds were considerable resilience so the growth of a number of commodities was relatively better than the local commodity such as those cultivated in the sub-district of Sabu Tengah.

❖ **Ledekekapa Village**

- Cultivation of vegetables (Naliru group, Gape). Vegetable farming activities were conducted around the reservoir and already harvested by several members of the group. Obstacles faced by the Leolungi Group and Latamako as the water reservoir called 'embung' was drying, causing several group members moved the cultivation activities to locations near water sources in the neighboring village.
- Efforts to preserve the area around the reservoir using purple sweet potato was conducted and the development of purple sweet potato seedlings was prioritized.
- Installation of solar pumping and piping network of the water source resided at the Hawwi to the Ledekepaka village for a distance of 3 km for fresh water supply, inaugurated by the Sabu Raijua Regent in October 28 2015. The water source is used by the Ledekepaka villagers (50-60 households). The water source was added from one (1) point intended only for the Ledekepaka village to six (6) points so that fresh water can be supplied also to the Raedewa villagers. The addition of the five (5) water-source-points was a community initiative that was independently conducted.

- Six (6) primary groups had done cultivation of crops such as corn, green beans, and peanuts. The green beans were firstly harvested. The cultivated green bean seed produced better yields than the local seeds at very low rainfall conditions.
- Production of cemented-water-channels performed by Raemabua group of 20 people. The production began in late January 2015, producing of 22 culverts.

Sumba Timur district (40 Communities)

❖ **Desa Napu**

- Cultivation of vegetable gardens. Nursery operation and cultivation of vegetable gardens were centrally conducted in one location closed to a water source (3 ha). Vegetables had been grown and harvested since the beginning of August 2015. The planting had been done four times. The income obtained from selling the vegetables was used for domestic purposes, i.e., buying rice and school needs.
- Plant nursery of coconut and cashew nut had produced 300 coconut seedlings and 2500 cashew seedlings. About 500 cashew trees had been sold to neighboring villages. The seeds planted on land owned by the group members.
- Solar Pump and piping networks already installed and used by communities resided at the Prailangina hamlet (56 men and 50 women), the members of the three groups (Rinjung Pahamu, Kama Ninya and Mangga Manung).

❖ **Desa Palanggai**

- Cultivation of paddy using SRI system. In August, two members of the group on total area of one (1) hectare performed the replication. The SRI system offers more efficient use of paddy seeds, water, time and energy, and higher yields.
- Cultivation of annual plants. Types of plants seedled in the nursery were 3000 coconut, 1000 breadfruit, and 3500 cashew seeds. The activities performed by five groups (Mandaki Ruku, Lupang Tahamu, Andali Mahamu, Bidihunggar and Harapan), a total of 75 members of the group (male 15 and female 60).
- Cultivation of maize, peanuts and green beans. To increase the production of dry land and the diversity of local food, the project supplied 75 machetes, 500 sharp-wires, 600 kg superior corn seed, and 500 kg peanuts. Cassava stem and green beans supplied by the community (self-supply). The beneficiaries are five (5) dryland groups (~75 people) cultivated total area of 53.75 ha.
- Drilling-wells and diesel fuel pumping performed by 13 groups. The drilling-wells of 72-meter depth and the reservoir basin had been supplied.

❖ **Rakawatu Village**

- Cultivation of paddy. About 1,450 kg of ciherang seeds were supplied to three (3) groups (Inamete, Rarapandak, and Hamupeka), whose total members were about 59 people and total area of 43 ha.
- Cultivation of vegetables (Group Ampera 1 & 2).
- Cultivation of freshwater fish since August 2015, but still needs more assistance.

- Processing golden snails for the livestock feed (the forerunner of the productive unit of PROKLIM), the animal feed processing engine and training fodder provided by BPMD of East Sumba had performed.
- Cultivation of maize, cassava, peanuts. Supply about 525 kg of corn seeds to community groups of Ampera I, Ampera II, Mbuhangu Palori Rinjungu Pahamu, Elungera, covering a total area of 21 ha. The communities commercialized the cassava cuttings and peanut independently.
- Cultivation of citrus, nuts, walnuts and coconuts by 74 members of the group, with details of 2,500 trees of hazelnut, 1,500 tress of breadfruit, 2,500 of coconut trees, 1,000 of coffee trees, 1,000 of orange trees, and 500 of mango trees.

5. LESSON LEARNT

East Nusa Tenggara is a province, consisting of three major islands called Flores, Sumba and Timor Island. The SPARC project implemented in the three islands and represented by one district in each of the main islands, namely: Manggarai, Sabu Raijua, and Sumba Timur. The implementation of the SPARC project has been done in the last three years with the involvement of the multi-stakeholders from the national government, province and district goverment, non-governmental organizations, and the community. The adaptation efforts offered learning-experience on how the process of adaptation actions from planning to implementation as described in Figure 17.

Figure 17. Identification of lesson-learnt obtained from the SPARC project in NTT

Figure 17 summarizes key points of lesson learnt from the implementation of the SPARC project in NTT. The points provide information on what subjects should be considered for implementing CCA actions at target-locations. Further discussion on each subject is detailed below.

A. Climate Task Force

Climate Task Force is assigned to ensure the implementation of the SPARC project through the formation of Technical Team or working group on Climate Change at the provincial and district level of the SPARC pilot sites. The team has been established and validated with the Letter Head Bappeda NTT Province and Regent decree of the each district. The technical team/working group supports the SPARC activities, from the planning, implementation and monitoring. The Technical Team is also responsible for the coordination among stakeholders involved in the SPARC project.

B. Issues for the Implementation

Implementation of adaptation activities at geographically distributed locations across the NTT province is a challenge and impact efficiency and effectiveness of program management, considering the constraints and barriers as follows.

- Geographical locations. The SPARC project are located in the three islands of NTT province affected financial needs for mobilization. Air transportation is the appropriate mode to conduct monitoring and evaluation conducted by the SPARC team to the targeted-districts. Conditions of the targeted-villages chosen as the project locations are also quite distant, and the road infrastructure is still under development affected the travel time to the targeted-villages.
- Local culture. The targeted-villages have a strong traditional leaders who can influence the decision for actions. For example, the use of agricultural land, the time of planting, and the choice of crops for farming. Understanding this situation, the implementation was not only to community groups but also through traditional leaders and religious institutions at the village and district level.
- Local development planning. The issue of climate change has not been included into RPJMD of the targeted-districts, since the targeted-districts have compiled the RPJMD in previous year. Thus, the SPARC project contributed to facilitate and integrate CCA actions into the annual development plan and the implementation of CCA actions at community level by the primary groups.
- Local capacity on financing and policy. The financial support is required in implementing CCA actions in the NTT province considering the provincial income is considerably lower than the national averages. The issue of climate change is considerably ‘new’ for the government and community, so local policy should be established to support the acceleration of CCA actions as has been suggested by the national government following the issuance of Ministerial Decree of Ministry of Environment and Forestry No.P33/2016.

C. Awareness on Climate Change

The impact of climate change is already felt, particularly farmers. Repeated crop failures due to extreme climate events contribute to threat food security in NTT. Factors identified threatening the food security are a prolonged drought, accounted for about 54%, plant pests and diseases (31%), floods/landslides (6%) and high wind speed (6%). Food security and water resources are being endemic development problems in NTT for over 15 years. There are indications that the situation of food security and water resources might be worsen due to increased climate variability and extreme events. Thus, the support of government policies and programs as well as development partners needed to be more effective in addressing these problems.

In order to increasing awareness on climate change, the SPARC coordinated with the Meteorology, Climatology, and Geophysics Agency of NTT Province (Badan Meteorologi, Klimatologi, dan Geofisika – BMKG NTT) to supply rain gauges at the selected targeted-districts and villages, used as a learning media for community groups. The SPARC organized trainings for provincial and local government staffs and the NGO partners in conducting vulnerability mapping and identification of climate risks and CCA options. The government staffs at the district and provincial level followed the training on Climate Field School, providing knowledge and skills on identifying the local wisdoms for doing seasonal forecasts, 'modern' technique for seasonal climate forecasts, introduction to weather instruments (e.g., rainfall measurement), understanding climate information, cropping calendars, and agroclimate information. The trained-field staff is then trained and assisted the community groups on understanding the climate subjects.

D. Local Actions on Formulation Rules

In supporting the mainstreming of CCA into the development plan, The SPARC team together with the team of experts from the University Cendana, Wirya Mandira Catholic University and the Public Health Association of Indonesia (IAKMI) promoted the integration of climate change issues into RPJMD 2014-2018 of the NTT Province, focussing on food security, water resources, and livelihoods. The document of RPJMD 2014-2018 has been available at the website of BAPPEDA NTT (bappeda.nttprov.go.id/new) and legalized by the provincial regulation named Peraturan Daerah (PERDA) No. 1 year of 2014.

To support the implementation of the SPARC activities in the three targeted-districts, the Memorandum of Understanding (MoU) were signed between Sabu Raijua Regent, Sumba Timur Regent and Manggarai Regent, and the NTT Provincial Governor and the Deputy of Climate Change – Ministry of Environment and Forestry. This agreement aims to improve the capacity and resilience of the NTT community in responding to climate change issues focusing on food security, water resources and livelihoods. The scope of the collective agreement covers a number of agrements such as the provision of funds, team coordination, monitoring, evaluation, and reporting. The MoU is also the basis for the assigment of responsibility of each involved stakeholder, particularly the local government districts and provinces, for the project implementation.

E. Investment on Adaptation and Partnership

The implementation of the CCA activities under the SPARC project requires investment and active participation of multi-stakeholders. The multi-stakeholders' participation has been throughout the SPARC project activities. The socialization of CCA actions to community in the targeted-villages, facilitation of the development of working plan, technical inputs for strengthening institutional capacity, already involved the local government institutions named Satuan Kerja Perangkat Daerah (SKPD), namely: as Agencies on Agriculture and Plantation, Development and Planning Agency, Cooperation, Forestry, Environment, Public Works, and Food Security. The multi-stakeholders' involvement is intended to increase the ownership of the SPARC project.

At the community level, the SPARC project provided assistance starting from planning to implementing the prioritized CCA actions, including the financial resources. The disbursement of grants to the community is in in collaboration with the local development bank named Bank NTT. Each targeted-village has one bank account with which the allocated grants for CCA actions were added to the account. This mechanism allows for the flexibility for rural communities to access the CCA funds. The funding mechanism is also intended to increase transparency in using the CCA funds and to introduce the community to the banking system. The involvement of the financial institution such as Bank NTT also provides an opportunity to provide microfinance scheme for potential business as part of the CCA actions.

F. The Programs and Budget Allocation

The CCA actions are directed to integrate climate change issues into development programs in the province legalized in RPJMD (2014-2018), and formalized by the issuance of PERDA No. 1 year 2014 as dicussed above. However, for the district level, the integration of CCA actions is included in the local government working plan of the related sectors. At the district level, Surat Keputusan (SK) Bupati, the Regent decree, was issued to form a task force for each district. The SPARC programs also targeted different beneficiaries. For the local government, the SPARC enhance their capacities on CCA through capacity building programs such as trainings and workshops. For the community, the implementation of CCA actions engaged with communities in the three districts. The priotized locations and actions for each targeted-district was determined based on the vulnerability assessment, planned development programs, and stakeholder consultation. The CCA programs promoted by the SPARC aimed at improving the resilience of agriculture, water resources, and livelihoods.

The CCA actions are vary from location to location depending upon the needs. For example, the CCA actions in the Gapong village of Manggarai included the provision of water infrastructure, the cultivation of vegetables, business on cotton mattress and traditional woven fabric called 'kain tenun', cattle and fattening pigs. Another example is in the Eimau village of Sabu Raijua, the CCA actions were enhancement of agricultural products, solar pumping, water conservation and catchment (water drill called Sumur), fiber craft for creating a boat and cemented bricks. The other adaptation activities were implemented in the Napu village of Sumba Timur that included activities such as

construction of Solar Pump, crop cultivation, and climate field school. In general, the CCA actions focused on agriculture and water resource were the cultivation of superior varieties to adapt with the climate fluctuation, cultivation of vegetables and annual plantation, and development of access to water infrastructure.

The SPARC project also focuses to strengthen livelihoods through diversification of income sources. For example, in the Gapong village of Manggarai district, a group of women has produced 67 pieces of the traditional woven fabric called ‘kain tenun’ sold for IDR 450.000,- a piece. Another example is the production of fiber boats, 800 cemented-bricks and 200 windstones in the Eimau village of Sabu Raijua district. Concerning the longer dry season period, the salt production and sea grass cultivation are two major economic activities along the coastal lines of the targeted-districts, whose products are sold to the other districts or province in Indonesia, promoted by the local government. In general, the implementation of SPARC program has led to encourage local activities that can be sustained after the project ends; although, the effectiveness and efficiency of budget utilization should still be improved.

The SPARC project is working with the Bank NTT to provide channel funds to communities in the targeted-villages. Each target village has a village account, with all the grants allocated for adaptation action was added to the account. This mechanism is chosen to allow for easier accessibility of rural communities in accessing the CCA funds. The funding disbursement through the Bank NTT, as of the first quarter 2015, already channeled a grant of USD 750,000 to be accessed by the nine (9) targeted-villages to support the implementation of adaptation actions undertaken by community groups. Furthermore, through this partnership, the Bank NTT have expressed interest in allocating CSR funds to add the funded grants to the community. After the SPARC project ended, it is expected the local government and the Bank NTT can continue the mechanism of CCA financial disbursement and increase the financial resources to support the implementation of CCA actions intended for enhancing the resilience of vulnerable communities to the impacts of climate change in the future.

DELIVERABLE OF ADAPTATION ACTIVITY

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APPENDIX 1 Identification of CCA Actions in each village of the three targeted-districts

Identification of adaptation actions in Manggarai district

SPARC Village	Activitiy	Community involved	Allocated Fund (IDR)	Achievements	Geography condition	Local Resources
Gapong village, Cibal sub-district	Provision of water infrastructure	2 groups	445,750,000	Provision of water infrastructure	Wide area: 1.68 km². Slope: 50-95% (steep). Altitude: 300-800 masl (Low-High land)	Carrots, Tomatos, Beans, Eggplants and lettuce, peanuts
	Vegetable cultivation	Baeng Koe community		Types of vegetables are grown: carrot, long beans, beans, eggplant, tomato and additional total area		
	Making cotton mattresses	Female community		Sold 10 mattress (IDR 1 million/mattres)		
	Field school for farming pigs	Wae Nanga 2 Community		The process of fattening pigs successfully		
	Diversified Farming "cash crop"			67 pcs tenun (IDR 450.000/pcs)		
	Cattle farming with colony system (BPTP)					
	Reforestation land for potential landslides					
	Installation of rainfall station and Climate Field School					
	Increased production of crops					
Copang Dehes village, Wae Rii sub-district	Cultivation of horticulture/ vegetables		592,100,000	Planting schedule customized to the needs /demand market	Wide area: 6.20 km². Slope: 8-39% (sloping). Altitude: 600-650 masl (Middle land)	Paria, long beans, cucumbers, Petsae; Pack Choy, cabbage, Broccoli, Eggplant, pumpkin; chili, Tomato, Beans
	Clean water supply	Local government, 400 families		Construction of drinking water supply		
	Repair and construction of irrigation system			Repair of irrigation system		
	Reboisation around water ponds	Army, Community		Planting 3000 trees		
Iteng village, Satarmese sub-district	Cultivation of greenpeas Vima1 and horticulture		433,350,000	Planting schedule customized to the needs / demand market	Coastal area, low land. Slope: 0-15%. Altitude: 0-300 masl.	Green peas, chili, longbeans, eggplant, tomato, water-melon, melon, spinach, papaya
	Collaboration with seed supplier of Panah Merah and Bissi			Cultivation of watermelon and melon		
	Livestock development of pig, chickens, and goats	8 Groups				

Identification of adaptation actions in Sabu Raijua district

SPARC Village	Activitiy	Community involved	Allocated Fund (IDR)	Achievements	Gegraphy Condition	Local Resources
Eimau village, Sabu Tengah sub-district	Increasing crop production in the rainy season	2 Groups (Gala Iki and Nada Sehati)	532,150,794	The seeds have been distributed to farmer groups and already planted end of December 2015.	Wide area: 11 km²	Paddy, maize, peanut and Green peas
	Increasing crop production in the dry season	3 Groups (Nawonga, Lobokepelu and Mira Dei Hari)		The first harvest has done by the Regent of Sabu Raijua in October 2015.		
	Development of solar pump and pipeline installation	Nawonga Mandiri community		Have been conducted in September, forming a water management group as well as dues of IDR 5000/month/member		
	Water conservation with infiltration wells	Primary group members (4 groups)		It has been done in December 2015 at the 8 wells of group members		
	Fiber crafts (creating boats)	"Karena kasih" community		Boats fiber can be produced and marketed		
	Fabrification of cemented bricks and “Batu Angin”	‘Purudonga’ community (13 people)		The fabrification started in January 2016. 800 brick and 200 “Batu angin” is ready for the market		
Tada village, sub-district Sabu Tengah	Development of solar pump and pipeline installation	Local government, Mangngi Ruba, Ruba Muri, Ruba Ama and Bersatu group	456,010,364	Have been grown and sold about IDR 10,000,- to 15,000,-	Wide area: 10.82 km²	Paddy, peanuts, green peas and maize
	Cultivation of vegetables					
	Increased Crops Production	9 primary groups		Seeds have a better durability than the local commodities. Planting in December 2015 (maize, paddy, greenpeas, peanut)		
Ledekapaka village, Sabu Barat sub-district	Vegetable Cultivation	Naliru group, Gape	418,614,863	Planted near the water ponds, but sometimes the ponds dries up, moved to nearby water sources in the neighboring villages.	Wide area: 6.9 km²	Greenpeas, peanuts and paddy
	Conservation around the ponds area			Conducted successfully, the next target is the development of purple sweet potato seedlings		
	Installation of solar pumping and piping from water resources	Ledekepaka community (used by 50-60 family), Raedewa village		Inaugurated by the Regent in October 2015, used by 50-60 families. The addition of 5 spot for Raedewa village.		
	Cultivation of crops such as maize, green beans, and peanuts	6 primary groups		Has been harvested, greenbean seeds introduced had higher yields than the local seeds in very low rainfall		
	Fabrification of culverts for water drainage	Raemabua (20 people)		22 unit culverts were ready to be marketed		

Identification of adaptation actions in Sumba Timur district

SPARC Village	Activitiy	Community involved	Allocated Fund (IDR)	Achievements	Geography condition	Local Resources
Napu village, Haharu district	Development of Solar Pump	Prailangina village 106 people: 56 male and 50 female) from 3 groups (Rinjung Pahamu, Kama Ninya and Mangga Manung).	380,000,000	Installed Solar Pump and piping network	Wide area: 142.6 km². Altitude: 207 masl (Low Land)	Maize, buckwheat, cassava, local pottato, cashew, coconut, various vegetables
	Vegetable demonstration plot	Community groups	9,300,000	Vegetable gardens have been developed and harvested		
	Diversification of local food	Community and proklim	118,250,000	Start planting the other crops		
	Increasing the numbers of annual plantation	Members of the group of Proklim	72,500,000	Planting 200 coconuts, 2500 cashew seedlings		
	Climate Field School	Farmer, BPTP, BMKG, LSM, Kemas Proklim	24,000,000	Training on rainfall observation and maintaining the observation tool		
	Operational costs of Proklim and office stationery	Proklim	20,400,000			
	Total		**624,450,000**			
Palanggai village, Pahunga Lodu district	Development of drilled wells in Laomang	13 groups	335,000,000	Installation of the solar pump, artesian well (height 72 m)	Wide area: 33.5 km². Altitude: 88 masl (Low Land)	Paddy, Maize, Cassava, peanuts, local pottato, cashew, coconut, breadfruit
	Paddy field school	2 groups	17,500,000	Utilizing System Rice Intensification (SRI) at land area of 1 ha		
	Increased rice production		58,520,000			
	School field diversification of local food	5 groups (mandaki ruku, lupang tahamu, andali mahamu, bidihunggar and harapan) (75 people)	18,500,000	Cultivation of maize, peanuts and greenbeans		
	Diversification of local food		21,000,000			
	Cultivation of annual plantation with biochar technology		101,250,000	3000 palm seedlings, 1000 breadfruits, and 3500 cashew nuts		
	Climate Field School	Famers, BPTP, BMKG, LSM, Kemas Proklim	24,000,000	Training on rainfall observation and maintening the observation tool		
	Operational costs and office stationery		20,400,000			
	Total		**595,900,000**			
Rakawatu village, Lewa district	Paddy field school	3 groups (Ina Mete, Rarapandak, Hamu Peka) (59 people)	18,250,000	Distribution of seeds and planting has been conducted as much as 1,450 kg of Ciherang seeds for 43 ha of land		
	Paddy production in each group		89,900,000			

	Cultivation of vegetables with Biochar technology	Ampera 1 and Ampera 2 group	16,500,000	Planting and harvesting vegetables	Wide area: 16.6 km². Altitude: 543 mdpl (Midle land)	Paddy, maize, cassava, local pottato, manggo, orange, breadfruit, cadlenut, coffe
	Cultivation of snails for animal feed and fertilizer granules	Community groups, BPMD	10,000,000	Animal feed processing engine and provided training fodder by BPMD Sumba Timur		
	Diversification of local food	Groups of Ampera I, Ampera II, Mbuhangu Palori Rinjungu Pahamu, Elungera	79,500,000	525 kg maize seedling with total area of 21 hectares. Community commercialized cassava cuttings and peanuts		
	Freshwater fish farming		5,000,000	Starting in August 2015, still need assistance		
	Increasing the cultivation of annual plantation	Community group (74 people)	169,350,000	2,500 hazelnut trees, 1,500 breadfruit trees, 2,500 coconut trees, 1,000 coffee trees, 1,000 orange trees, 500 mango trees		
	Climate Field School		24,000,000			
	Operational costs and office stationery		15,600,000			
	Total		**428,100,000**			