Comparative Study on Agriculture and Forestry Climate Change Adaptation Projects in Mongolia, the Philippines, and Timor Leste

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Abstract The impacts of climate change, such as increasing temperature, erratic rainfall pattern, sea level rise, etc., are being increasingly reported. These impacts are destructive for human activities and thus the development and improvement of mitigation and adaptation strategies is a priority globally. In the least developed and developing countries, adequate adaptive capacities are required so to boost the resilience of communities towards the projected climate change projected. Moreover, activities of climate change adaptation not only provide solutions and strategies to deal with climate change, but also encourage sustainable development. This comparative study evaluates projects in three countries: Mongolia, The Philippines, and Timor Leste, by mapping and contrasting the factors that contribute to adaptive capacity and support sustainable development. A heuristic matrix was used to articulate the capacities that influenced the desired outcomes of each project. Some key components of adaptive capacity were identified in each context. The interaction of those components improved the generic and specific capacity at individual and system level then ultimately improved resilience towards climate change.

Keywords Adaptation · Climate change · Agriculture · Forestry
Water management · Sustainable development

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1 Introduction

The impacts and risks of climate change are already affecting many sectors crucial for human livelihoods including water resources and food security (UNFCCC 2014). Economically precarious communities, especially those in developing countries and rural localities, are considered the most vulnerable to negative climate change consequences (Hallegate et al. 2016). Adequate attention and proper measures should thus be given to climate change adaptation capacities to prepare communities for projected climate change impacts. As part of this, interventions that build capacity should ultimately support the sustainable development of the region.

Activities attempting to address the climate change impacts have been implemented worldwide, and are expected to be expanded and integrated to mutually promote both adaptation to climate change and sustainable development, yet the role of different capacity attributes promoted in these activities, not least their interaction in different contexts, is still poorly understood. UNFCCC (TEC-UNFCCC 2014) presented that agriculture represented the single most important sector in the economy of many low-income countries, and 75% of the world's population relies on the related activities. On the other hand, WorldBank (2013) highlighted that hundreds of millions of people around the world depend directly on forest resources for their income and livelihood, including many people living in extreme poverty. However, both sectors are under threats of climate variables (e.g. temperature, precipitation, radiation, and extreme weather events) which ultimately jeopardize the survival of people who rely on those sectors. IPCC (2007) added: "The inter-annual, monthly and daily distribution of climate variables affects a number of physical, chemical and biological processes that drive the productivity of agricultural, forestry and fisheries systems." IUFRO (2009) reported that human dimensions of adaptive capacity in subtropical and tropical forests are more variable due to constraints on access to capital, information and technology. Since the recent report of IPCC AR5 suggested the urgent efforts of adaptation, the establishment of adaptation strategies are crucial for both sectors (i.e. agriculture and forestry).

This study analysed adaptation projects as case studies at agriculture and forestry sector in three countries: Mongolia, Philippines, and Timor Leste. The idea of this study was to explore aspects that influence the success of increasing communities' adaptive capacities at the end of the projects by adopting a heuristic matrix developed by Eakin et al. (2014). This matrix can be an alternative way to evaluate the impacts of adaptation projects as a lesson learned in a more comprehensive way.

Monitoring and Evaluation (M&E) and Measuring, Reporting and Verification (MRV) for climate change adaptation receive increasing interest and attention at both political and operational levels. On the political side, the outcomes of Paris Agreement indicated an increasing focus on the national reporting of both future adaptation actions that have been implemented. On the other hand, the operational side tends to the scale of the financial resources flowing into climate adaptation,

is likely to lead much stronger donor emphasis on documenting results and impacts in the future (Christiansen et al. 2016). Furthermore, M&E is crucial to capture the progress of the project whether sustainable development is achieved. In response to that, this study adopted qualitative analysis to evaluate the result of each case. The qualitative approach was selected to describe effectively the distinctive aspects and the contemporary phenomena of the project as they are unique cases and difficult to replicate. The qualitative approach is expected to reveal something about the case studies and contributes to a general understanding of the nature of this kind of activities.

2 Case Description

This study covered three adaptation projects in Mongolia, Timor Leste and the Philippines. These project activities aimed to improve the adaptation capacity and formulate the adaptation strategies at agriculture and forestry sector with the expectation of sustainable development stage is achieved. In Mongolia and Timor Leste case, the issues related to forestry management were highlighted, whereas the Philippines covered water management issues at agriculture sector. Improving adaptive capacity in the vulnerable areas are the focus of each project.

2.1 Mongolia Case

There were 7 vulnerable provinces (i.e. Tuv, Selenge, Khentii, Bulgan, Khuvsgul, Arkhangai and Uvurkhangai) selected as target areas aiming for improving livelihoods of rural communities through sustainable forest management and increasing apiculture. In those provinces, demographically, population densities are low and communities are usually dispersed and nomadic. Livelihood opportunities for local communities are limited by the short growing season and low yields for agricultural products. The communities consist mostly of herders with little access to non-herding income. The incidence of poverty generally increases with distance from municipal services and access to livelihood diversity. Thus, poverty in these areas is generally high—in 2012 (the baseline year of this project), according to World Bank assessments, more than 35% of the rural Mongolian population was considered impoverished following national standards. The 2006 Forest By-Laws, enacted in 2009, allow local communities to form community-based Forest User Groups (FUGs) to manage forest areas based on forest management plans approved by regional governments. To date, 1180 FUGs with about 26,000 members have been established, managing over 3 million ha of forest.

2.2 The Philippines

Lantapan, Bukidnon were selected as target areas to increase the adaptive capacity, especially capacity building of watershed management and up-land farming. Currently prolonged rains, impacts resulting from El Nino and La Nina, and early and delay onset of the rainy season have mainly negative impacts on crop yield, farm income, water and soil quality, and health of the farmers. Lantapan has an agricultural-based economy with 60% of the total labour force employed on bananas and pineapples plantations covering large tracks of land, and in commercial swine and poultry farms. Corn is the predominant crop, and is planted at higher elevations alongside coffee and other vegetables. Meanwhile, coffee is prevalent at the middle altitudes, with irrigated rice, and vegetables such as cabbage, tomatoes and potatoes being the other crops that are distributed within the watershed. Demographically, half of the population attended elementary school, a third entered high school, and slight less than 15% attained tertiary education. This limits their ability to seek non-farm employment in towns and cities. Many households live close to the poverty line. Thus, they seldom have the capital to start small, non-farm related scale business enterprises.

When the farmers are impacted by current climate hazards, they seek assistance from lending institutions for purchase of pesticides; local government units for provision of seeds, technical and financial assistance, and food subsidies/handouts; commercial plantations to seek additional employment; and local health centers and medicine men for the treatment of flue colds, coughs and fever. At times, the delay in the release of local budget can facilitate coping mechanisms, and other times constrain them, as there are challenges in arranging adjustments to budgets or to respond to climate variability and extreme events (e.g. to take on additional short-term staff), or results in a decrease in budgets.

2.3 Timor Leste Case

Climate data or forecasts is limited for Timor Leste, but climate change is predicted to cause hotter dry seasons, shorter and more unpredictable rainy seasons, more frequent extreme heavy rainfall and cyclone events and sea water intrusion. These natural disasters associated with droughts, floods, landslides and soil erosion, result in decreased capacity for agricultural production and damage to infrastructure. The country experiences a distinct ‘hungry season’ for up to four months of the year in many districts. In Timor Leste, a positive Indian Ocean Dipole equates to less rainfall, protracted dry seasons. During La Niña years above normal rainfall leads to increased flooding and landslides in Timor Leste, while El Niño years are associated with droughts. The most significant impact on the population during El Niño years is reduced ground water availability. Aileu is targeted as the project site. The communities are largely subsistence farmers who are very isolated, far from

markets, little access to roads, have poor crop quality, low yields, poor food security, over reliance on maize and rice for income. The communities have a history of exploiting the natural resources of forest, and poor history of engagement with government. Education levels are extremely low across the project population, and lower for women than men. These baseline data put Aileu as the vulnerable area which requires proper adaptation measures.

3 Methodology

This study dealt with an evaluation on adaptation projects at agriculture and forestry sector in three countries: Mongolia, Philippines, and Timor Leste at agriculture and forestry sector. The data collection was done by qualitative approaches. The approach was conducted by site visit, observations and interview the respective stakeholders such as the project developer, the local government, and the impacted communities. Those was also complemented by reviewing the projects' final reports, and survey to the impacted communities (i.e. number of people, number of households). At the end of each project, Eakin et al. (2014) suggested a simple heuristic matrix to evaluate the impact of each project. This is a proper tool used to articulate the influential capacities that have led to the desired outcomes of a project. The capacities matrix consists of two dimensions: *generic capacity* and *specific capacity*, as illustrated in Table 1.

Table 1 The manifestation of different forms of capacity at different organizational levels

	Individual actor	System-level
Generic	• Income level and structure • Savings • Material assets • Health status • Education level • Population mobility • Participation in social organizations	• Economic productivity • Information infrastructure • Poverty levels • Economic and social inequality • Transparency in governance • Population-level education • Sanitation • Health care services • Built environment integrity
Specific	• Climatic information use • Protection of private property • Climate risk insurance • Adoption of technologies to reduce climate impacts • Cultural climate prediction • Traditional risk mitigation strategies	• Insurance provisioning systems • Early warning systems • Scenario development • Infrastructure investment • Disaster planning and compensation fund • Risk mitigation planning

Source Eakin et al. (2014)

Generic capacity is related to capacities which are basic human development needs, while specific capacity is defined as tools and knowledge required to anticipate and effectively respond to climatic threats. Thus, generic capacity includes education level, health, mobility, livelihood, and security whilst specific capacity refers to the knowledge and system concerning adaptive procedure. Although project indicators on one project are not analogous to those of other communities', it is possible to draw out the essential aspects of generic and specific capacity profiles. The matrix also furcates these capacities for examination at individual actor and system level.

To evaluate the interaction between specific capacity and generic capacity, Eakin et al. (2014) suggested 4 classifications as shown in Fig. 1. Firstly, when both generic and specific capacity are at a low level, the target community is classified to be in a "poverty-trap". In this state, the targeted community suffers from intense stress that erodes human welfare and social structure that would otherwise support effective risk management. Secondly, if generic capacity is low whilst specific capacity is high, the society will be considered as a "safety-first" population. The circumstances of this community lead them to prioritize present day safety and security over investments in generic capacities that might enable future welfare gains. There are typically weak safety nets at the level of governance ("system-level") of "safety-first" communities. Furthermore, capacity to invest in assistance for household risk management, or build generic capacity, is lacking.

A further classification, the "safe development paradox" is defined when the target society has high generic capacity but low levels of specific capacity. It describes a society with a good level of education or health, but limited ability to cope with the risk and impacts of climate change. At the system-level of the "safe development paradox" community, there may well be very strong safety nets and public investments in risk management and programs to ensure socioeconomic stability. Lastly, characterized by high generic and specific capacity, there is the community enacting "sustainable adaptation". Communities in this domain are characterized by conditions that would most likely lead to a sustainable outcome and potentially, transformative adaptation. In this condition, generic and specific

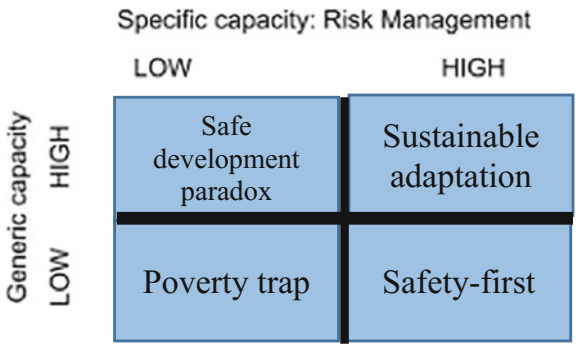

Fig. 1 Capacities matrix

risk management is high at both individual and system-levels, and as such, development and adaptation policies are mutually reinforcing to the benefit of reduced overall vulnerability (Eakin et al. 2014).

3.1 Mongolia Case

The project has two approaches: the focus on protection and sustainable management of the forests and sustainable livelihoods for communities in proximity to forests. To execute the project, a field visit was conducted by World Vision Mongolia to hold focus group discussion and key informant interviews with respected community members and officials. Then, it was followed by a workshop to assess the priority environmental issues and the most important causes of those issues. The project supported 24 households (1.6% of the total number of beneficiaries) that had members with disability and some bee-keeping groups had active members who had disabilities. Furthermore, document report from the project were also conducted to evaluate the impact of the project.

3.2 Philippines Case

The overall goal of the project is to promote climate change adaptation by upland farmers and watershed management. To achieve this, the impacts of climate variability to crop yield, vulnerability and adaptation policies/strategies were assessed through a combination of one-on-one interviews with farmers and stakeholders, focus group discussions, workshops and review of literature. Results of the assessment were presented and validated during workshops. Then, capacity building activities were undertaken in the forms of magazine, video and other easy understanding media. Those are aimed for non-technical people to increase the level of awareness of farmers and stakeholders on climate variability, climate extreme and climate change. A pre-test of materials was performed before distributing to the project site. In addition, formal and informal training sessions for climate change 'champions', farmer groups, stakeholders and policy makers were held at the local level, and efforts were made to ensure that these were covered by the local media to attract more stakeholders involved.

3.3 Timor Leste Case

At the beginning of the project, meetings and visits created awareness and agreement for local leaders to implement and enforce "tara bandu" which is the local land law. In Timor Leste, tara bandu is enforced a strict local forest policy which

prohibited cutting and burning of forests. Through the meetings (i.e. discussions, interviews), tara bandu was readopted and re-agreed to prohibit all burning, and limited and controlled wood harvesting. Stakeholders were able to advocate for more supportive arrangements for the management and utilization of natural forests. The project supported 46 people living with a disability (25 male and 21 female) to participate in training and project activities and were given priority access to agroforestry materials. Several assessments such as vulnerability assessment, participatory rural appraisal/PRA were performed.

4 Results

As result, Table 2 shows the overall outcome of projects in terms of adaptive capacity using the heuristic matrix suggested by Eakin et al. (2014). This result was based on the projects' final report, observation, interviews and survey. The logical view which lead to such results will be discussed in the next three sub-sections (i.e. Mongolia case, The Philippines case, and Timor Leste case).

Table 2 Project evaluation using a heuristic matrix suggested by Eakin et al. (2014)

No.	Location	Project name	Aim of the project	Status before project	Status after project
1.	Mongolia	Forest Protection and Enhanced Rural Livelihood Project (FPERLP)	To improve the livelihood of rural communities through sustainable forest management and increasing apiculture	Poverty-trap	Safety-first
2.	The Philippines	Mainstreaming climate change adaptation in watershed management and upland farming in the Philippines	To promote climate change adaptation by upland farmers and watershed management at the national and local levels in the Philippines	Safety-first	Safety-first
3.	Timor Leste	Building resilience to a changing climate and environment	Increased community and environmental resilience to climate change effects	Poverty-trap	Safety-first

4.1 Mongolia Case

4.1.1 Before the Project Implementation

Despite the potential to facilitate adaptation, most FUGs lack knowledge to establish forest inventories and management plans also capability on sustainably maintaining the forest- something the project attempted to address. On the other hand, the forest legislation constrains adaptation because they do not allow trees to be cut without a permit (permits being reserved for poorly regulated, private forest enterprises). Therefore, the climate vulnerability of local community members will be reduced by building the local community's capacity to protect, manage and create livelihoods from forests in an ecologically sustainable way. Given the situations mentioned before the project implementation, the community condition is categorized as "poverty-trap".

4.1.2 After the Project Implementation

The project increased community adaptive capacity by both increasing community's income by diversification of non-timber-forest-product livelihoods sources and improving awareness of environmental degradation and management. In terms of gender, there was no notable difference in vulnerability as it was not included in the scope of the project. Women's participation in the forest groups supported by the project was equal to men's, and women achieved slightly higher number of leadership roles than the men. The effort to diversify the livelihoods to non-timber-forest-production of the local community was assessed to have increased the specific capacity at both individual and system level shown in Table 4; as compared with the condition before the project implementation (Table 3). Specifically, diversifying the livelihood sources, at the generic level, reduced community reliance to exploit the primary resources and conditions required to profit solely from animal husbandry (livelihood diversification); while at specific capacity, it created new market opportunities, improved capacity to engage with market. Also, the mobility of community to urban areas as described in Table 3 was diminished. These outcomes may reduce the impact of climate change shocks and stressors. In addition, by explicitly educating community members

Table 3 The adaptive capacities at the beginning of the project in Mongolia case

	Individual actor	System-level
Generic	• Seasonal population mobility • Agrarian local knowledge and cultural appreciation for nature	• High population-level education rate
Specific	• Engaged in a livelihood activity (herding) • Some traditional use of forest resource	

Table 4 The adaptive capacities at the end of project of the project in Mongolia case

	Individual actor	System-level
Generic	• Social organization around resource management and markets • Increased awareness of environmental issues • Strengthened community and social cohesion through communal management and skills-transfer	• (Increased) economic productivity • Improved understanding of policies around sustainable forest management
Specific	• Engaged in an increased diversity of livelihood activities • Improved access/sustainable use of forest resources (across genders) • Improved capacity to engage with market • Improved community stewardship of forest resource	• New market opportunities and touchpoints • Improved DRR planning (specifically for bushfires)

around policy, environmental protection and livelihoods, as well as the links between these, the market economy activities related to forest resources have become molded. Overall, it was assessed that the project successfully improved the adaptive capacity from 'poverty trap" to "safety-first" community.

4.2 The Philippines Case

4.2.1 Before the Project Implementation

Considering the knowledge about climate change mitigation and access to funding, the state of the community is at "safety-first" where generic adaptation capacity is moderate at both individual and system levels, and specific adaptation capacity is relatively high. In the short-term, specific adaptation capacity is needed on the use of climate change information both at the individual actor and system level.

4.2.2 After the Project Implementation

The project found that the main factor related to vulnerability is low level of education that limits their ability to seek non-farm employment in towns and cities (Pulhin et al. 2016). Although the project has provided interactive education for non-technical people, it was claimed that there was no significant change in terms of adaptive capacity (Table 5) because the same table was produced at the end of project implementation. It was suggested that the development of insurance systems and the uptake on risk insurance should be introduced to alleviate food security

Table 5 The adaptive capacities before and after the implementation of the project in Philippines case

	Individual actor	System-level
Generic	• Population mobility • Participation in social organizations	• Economic productivity • Information infrastructure • Partnership strategies
Specific	• Climatic information use • Adoption of technologies • Traditional risk mitigation activities	• Risk assessment • Early warning system • Infrastructure investment • Risk mitigation/contingency plans • Disaster compensation/assistance funds • Recovery plans

issues during extreme climatic events in the short-term. In the long-term, climate scenario development and the analysis of positive and negative impact of climate change will help to inform development planning in the region. Additional investments in increasing education levels is required to improve incomes and ability of the community to find alternative employment that is less climate sensitive. Nevertheless, the project succeeded in identifying the impacts of current climate hazards on the local people, identifying their current coping mechanisms and raising their awareness of climate change. Overall, this project did not successfully improve the adaptive capacity of the respective communities, the safety-first condition.

4.3 Timor Leste Case

4.3.1 Before the Project Implementation

The condition of the community is categorized at "poverty trap" because of low capacity in generic and specific. For instance, low education level, lack of government support and social infrastructure are yet established in Aileu. On the other hand, climate change is hastening the decimation of the natural resource base, notably water, agricultural and forest resources.

4.3.2 After the Project Implementation

The project has significantly achieved its goal of increasing community and environmental resilience to climate change effects. The very significant reported decline in the incidence of burning is no doubt influenced by increased government messaging in this area, and in particular local level regulations promoted through tara bandu. A reduction in burning will greatly contribute to climate resilience. At the community level in the project area raising climate change awareness appears to have been effective. There are 76% of respondents claimed to know what climate

Table 6 The adaptive capacities at the beginning of the project in Timor Leste

	Individual actor	System-level
Generic	• Agrarian local knowledge • Tara bandu tradition	
Specific	• Some traditional use of forest resource in desperate times	

Table 7 The adaptive capacities at the end of the project in Timor Leste

	Individual actor	System-level
Generic	• Increased awareness of environmental issues • Improved understanding of prohibitions and rights around sustainable forest management • Decrease in destructive practices (specifically slash and burn)	
Specific	• Engaged in an increased diversity of livelihood activities • Improved community stewardship of forest resource	• Strengthened adherence to forest law (due to tara bandu governance)

change was but perhaps more notable was the rate of awareness on potential climate change impacts on agriculture with up to 84% of those aware of climate change able to describe at least one impact consistent with the general science. There was a reasonably high level of knowledge of suitable measures to mitigate climate change impacts. The improvement made by this project is shown in Table 7 when it is compared with the conditions before the project activity, shown in Table 6. Overall, the project successfully improved the adaptive capacity from "poverty trap" to "safety first" although mostly at individual level.

5 Discussion

A difference was ultimately observed for each project, and moreover differently affected the adaptive capacity of each target community. Herein, we will attempt to explain the interaction of adaptive capacities of each project that influence the outcome and subsequently provide comparative study especially in agriculture and forestry activity.

To further analyze factors that affect the success of each of the projects, this study highlighted the aspects to be evaluated including data availability, the importance of inception and participatory analysis, the education level of the target community, technology and knowledge transfer, policy and government support, and financial measures.

5.1 The Importance of Data Availability and Participatory Analysis

All cases suggest that inception and participatory analysis are significant to ascertain the success of a project (Pulhin et al. 2016; World Vision Mongolia 2015; World Vision Timor Leste 2016; Smit and Walden 2006). Likewise the development projects, data availability is significant in adaptation projects (Patwardhan 2003). For instance, the project proponent in the Philippines did assessment to picture the condition in the targeted areas by interviewing the respective stakeholders prior to assess climate vulnerability and impacts including the adaptation strategies (Pulhin et al. 2016). Understanding that the education of the community is low, then increasing the education level and awareness becomes crucial in the project.

5.2 Education Level, Technology and Knowledge Transfer

All cases imply that sufficient education level of local communities is crucial to assure the outcome of the project. The three cases described the education level of local communities are considerably low and various methods had been conducted to increase the awareness, knowledge and adaptive capacity (Pulhin et al. 2016; World Vision Mongolia 2015; World Vision Timor Leste 2016). However, the cases did not success in providing their adaptation strategies at the end of the projects because of the lack of knowledge and further need of capacity building. This illustrates the importance of education level in determining the pace of project implementation before proceeding to formulating the adaptation strategies. Therefore, an intensive and comprehensive capacity building is necessary as it was implemented intensively in the Philippines case and Mongolia. Focus Group Discussion, visual materials (e.g. book, video) and workshop could be options (Pulhin et al. 2016). In addition, high education level stimulates a good social organization that may contribute significantly on improvement at system-level (Williams et al. 2015). Having adequate education level also accelerates skill and knowledge transfer from one community to another.

According to the project report in the Philippines case, although the improvement is noticeable, it could have been better if the education level is not low (mentioned at the previous section). This implies capacity is necessary to ensure the enhancement of adaptive capacity occurs mutually at both individual and to an extent, at system level. Despite, the Philippines case study provides also a good example of a successful method to increase awareness and knowledge about climate change. As part of this project, the project team endeavored to use various media to increase the capacity at individual level based on familiar local means of communication, for example, all media used local dialect and easily-understood language for non-technical people to describe climate change and the importance of adaptive capacity (Pulhin et al. 2009).

Technology transfer is also considered plays important role in enhancing adaptive capacity of a community. Establishing improved pathways of technology transfer from the level of individual actor to system-level in the case of the Timor Leste project would improve specific capacity at both individual level and governance (system-level). The absence of this aspect, inhibits the enhancement of adaptive capacity as shown in Table 7.

5.3 Policy and Government Support

Policy is regarded as a notable attribute influencing the success of all projects in this study. This is in line with mainstream literature that attests institutional barriers are the most frequently reported barriers to climate change adaptation (Biesbroek et al. 2013; Brooks and Adger 2015). Governments have an important role in this context. They can help by creating an attractive environment for research, development and demonstration (RD&D) and safeguarding the drivers of innovation.

Well-designed targeted technology policies on both the supply and demand sides are a fundamental ingredient in a strategy to accelerate innovation. While the specific combination of policy measures will depend on country circumstances, it is important in all cases to construct the appropriate framework to allow breakthroughs to happen (IEA 2011). First and foremost, local and national responses to climate change need to be well coordinated. This ensures coherence of local and national action, while clearly acknowledging differences in the mandates of cities and national governments. City and sub-national regional leaders are generally best suited to design strategies to address their infrastructure needs, land use, geography, and economic profiles. Together they could work closer together to develop and exchange information about possible policy responses, to experiment with new solutions, to share experience and broaden and replicate successful initiatives especially in dealing with climate change. Mongolia is an illustrative case where inhibitory policy hindered the outcomes of the project. In Mongolia, the inhibitory forest legislation constrained adaptation so that adaptation was only realized at the individual level (Table 4).

Conversely, the case in Timor Leste is an example where amending policy to address the risk of climate change positively impacted adaptive capacity at the system level. This suggests that appropriate policy makes a significant contribution to adaptive capacity at system-level. Referring to Tables 6 and 7, at the beginning of the project, adaptive capacity at system level was absent. After readopting the local law of tara bandu, specific capacity at system-level was strengthened.

Furthermore, the Timor Leste case demonstrated government backing of favorable policy and/or governance contributes to development at both capacities, generic and specific, as well as at individual and system levels. Moreover, a supportive policy can facilitate the involvement of other stakeholders such as NGOs and local development agencies to contribute actively to accelerate project implementation to achieve its goals (Adger et al. 2011). Notably, such support expands the opportunities of partnership. These engagement principles are also suggested in

Timor Leste, where engagement is needed at the system-level to better support the individual actor, for example both in the improvement of forestry and agricultural industry to the development of markets that support sustainable forest management and ecological agriculture (World Vision 2016).

5.4 Financial Measures

Adaptation requires sufficient and sustained funding so that countries can plan for and implement adaptation activities. Indeed, the Intergovernmental Panel on Climate Change (IPCC) identifies economic wealth as a principal determinant of adaptive capacity (IPCC 2001). Central governments, in turn, can set out the broad goals and frameworks to encourage action in the right areas; they can also provide needed funding or other incentives for city initiatives. The costs of adaptation in cities will account for a significant proportion of this average, largely because of the expense required to adapt (or, in the case of many low- and middle-income countries, build new and resilient) infrastructure and services for densely populated areas. UNFCCC estimates that adapting infrastructure worldwide could require US$8–30 billion in 2030, one-third of which would be for low- and middle-income countries (UNFCCC 2007).

Most of the projects-those in Mongolia, Philippines, and Timor Leste, were precluded from being able to fully enhance community adaptive capacity to a sustainable state because of funding availability; e.g. lack of access to financial measures such as insurance, grants, markets or loans. Ultimately, the government plays a crucial role in mobilizing funds towards sustainable development at local, sub-national and national levels.

An example of an integrated financial measure is the Philippines case. When the farmers are impacted by current climate hazards, they are able to seek assistance from lending institutions for purchase of agricultural inputs; local government units for provision of technical and financial assistance, and food subsidies/handouts; commercial plantations to seek additional employment; and local health centers and medicine men for the treatment of flu, colds, coughs and fever. In addition, the development of insurance systems and the uptake of suitable risk insurance in the Philippines, may further alleviate food security issues during extreme climatic events in the short-term.

This measure does not effectively adapt the community to climate risk over the longer term however, nor provide the community with adequate and consistent financial reserve to support future-oriented adaptation activities (funding is aimed at recovering losses and responding to immediate needs). Additional investments to increase education levels would improve incomes and the ability of the community to find alternative employment options that are more advantageous, in accordance with the risk highlighted in climate scenarios. Unfortunately, the delayed release of the project budget hindered the project implementation. This implies that a sustainable and integrated funding is required to properly support projects building resilience to climate change.

In terms of progressing the requirements of sustainable development unmet at the project close, targeted monitoring data and strategies could promote follow-on projects. Funding is a need for all developing countries to develop and implement national adaptation plans and for these to exist at all levels: local, sub-national and national. This was found to be an important to support progress towards and perpetuation of sustainable development across the projects.

6 Conclusion

The analysis performed above identified the following attributes that contribute to improve adaptive capacity: data availability, the importance of inception and participatory analysis, the education level of community target, technology and knowledge transfer, policy and government support, and financial measures. How these attributes may change the generic and specific capacity at individual and system level was discussed.

We conclude from this analysis that the success of a project is contingent on meeting the following steps to ensure the formulation of effective adaptation strategies:

1. Strong scientific data basis for decision making
2. A pre-assessment on the vulnerability of climate change at local context including inception and participatory analysis
3. Education, training and public awareness on adaptation; including the establishment of pathways of technology transfer
4. Funding security
5. Project Evaluation and Monitoring to support follow-on projects in the future.

This study also reveals the complex interaction between project attributes. Notably, the presence of policy and government support is considered to give significant enhancement in generic and specific capacity at individual and system level. Likewise, both the analysis of positive and negative impacts of climate change through climate scenario development and the establishment of apprised pathways of technology transfer, will help informing and sustaining the development planning and innovation in the regions. It is these relationships and their interactions that determine the ultimate outcomes of adaptation activities. By doing so, it will be more likely to be implemented in a way that is effective, efficient and equitable. Furthermore, sustainable development stage is expected to achieve by implementing the suggested strategies above.

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