ICLEI Local Governments for Sustainability

ASIA PACIFIC ADAPTATION NETWORK

Climate Change Adaptation and Technology: Gaps and Needs in Southeast Asia

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Executive Summary

Most Southeast Asian countries are vulnerable to climate change risks and impacts. In large part, this is due to a lack of adaptive capacity towards resilience or self-organization. These are specific governance challenges at various levels of human organization.

A review of the vulnerability of Southeast Asian countries to climate change in terms of risks and impacts and their specific adaptation and mitigation response shows that the most vulnerable ones evolved advanced climate change adaptation and mitigation technologies to address these risks and impacts, as well as disaster risk reduction mechanisms to recover from calamities. The Philippines was recently cited as having the best Climate Change Adaptation (CCA) and Disaster Risk Reduction (DRR) policies.

The recent Durban Conference in December 2011 indicates that at the global target of keeping the upper limit of temperature increase to 2 degrees Celsius (3.6 degrees Fahrenheit), and carbon dioxide (CO_2) concentration in the atmosphere to 350ppm would be hard to attain in a timely manner even with prevailing United Nations Framework Convention on Climate Change (UNFCCC) mechanisms. With this consideration, climate change risks and impacts in Southeast Asia are expected to escalate to levels as high as 6.7% of Gross Domestic Product (GDP) by 2100. In the case of the Philippines, a 4 degree Celsius rise in temperature can lead to even higher levels.

In view of this prevailing trend and the current state of negotiations wherein the mechanisms and sanctions to effect a reversal of this trend has yet to be established and enforced, each of the SEA countries has to further develop, implement and evolve its own appropriate Climate Change Adaptation/ Mitigation CCA&M and associated technologies.

The UNFCCC and Kyoto protocol provide the policy framework at the international level as basis for institutional framework for each country in Southeast Asia (SEA). For each SEA country, the agencies tasked to address the environment and natural resources concerns and climate change are enumerated. Furthermore, two countries with more evolved institutional frameworks are compared with each other: Indonesia and the Philippines.

The specific country situations are presented to preface the sectoral report particularly for water, agriculture and socio-economics. This is followed by a presentation of the specific gaps and needs which were identified during the consultation and training organized by the International Council for Local Environmental Initiatives (ICLEI). These include: identification of relevant sectors which essentially covered everything from ridge to reef, and identification of specific tools, methods and models which covered various assessment systems, expert systems, policy science, local development planning, implementation, monitoring, evaluation, review and validation, and other various good practice – essentially a knowledge management challenge.

Among the more strongly felt needs articulated in the consultation meeting [1]included framing interventions, linking development strategy with DRR and CCA, leading to the early attainment of millennium development goals (MDGs), such as in the landmark case of the Province of Albay which formed the basis for DRR and CCA Policies for the Philippines (Gov. Joey Salceda, personal communication, February 11, 2012). Albay has been noted for practically zero casualties during disasters since they started implementing their programmes and has since achieved their MDG targets for 2015 well ahead of time.

From these data and experiences, a range of possible sustainability parameters for CCA/CCM technologies are suggested given the existence of climate change risks, existing policies, practices on the ground, and specific outputs and outcomes that are being achieved. One parameter suggested is that of having a policy and a mandated government body that will be responsible for: (1) the management of the environment, agriculture and natural resources; (2) climate change; (3) disaster risk reduction and management; (4) social and economic development planning and; (5) local government units (LGU) mandated and enabled to effectively implement adaptation measures. Other suggestions include: policy alignment and a correct framing of climate change and adaptation measures; integrating CCA and DRR in local development planning; and mainstreaming CCA and DRR by first incorporating them in the MDG and focusing on the achievement of the MDG.

Priorities as well as gaps and needs to reduce the negative impacts of climate change, are identified. A section is dedicated to present climate change, vulnerability and adaptation policies of SEA countries, followed by gaps based on the existing policies and programmes.

[1] Consultation meeting organized by ICLEI for the Southeast Asian sub regional hub, for the purpose of assessing focal sector, needs, capacity building requirements and setting priorities, February 8-9, 2012, Manila, Philippines.

The most crucial gaps identified are: the problem of institutionalizing the approach to climate change adaptation; the translation and implementation of international policies to the national and local level; and the task of integrated climate action planning (i.e., the development of programmes and policies for both climate change adaptation and mitigation). At the international level, global and local climate change mitigation indicators are presented, from the policy perspective of the Kyoto Protocol and the UNFCCC. Then an analysis is made of the gaps based on the existing policies and programmes.

During the consultation, the priority sectors identified practically covers all of the sectors from ridge to reef; for the capacity building it encompasses; most of the proposed priority activities initially are in the area of knowledge management, from assessment to project development, monitoring and implementation, including tools, methodologies and models of good practice which the participants can use or emulate.

Another section is dedicated to the analyses of current developments in the international platforms on adaptation technology. This section tackles the context and the gains of the Durban Climate Change Conference, including: the Durban Platform and its relationship to Nationally Appropriate Mitigation Actions, available support, and registry; the Adaptation Committee; financing, including the Green Climate Fund; the Standing Committee; Long Term Finance; Technology Transfer and Capacity Building; the Durban Platform and the urgency of lowering emissions. A link is also made between international developments with Southeast Asia's technology platforms in CCA technologies.

Lastly, key challenges and areas of cooperation are presented.

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1. Introduction

The belief is that the target 2 degree Celsius maximum allowable global average temperature rise and the associated emissions control to achieve this won't be attained given the general non-attainment of targets by various countries[2]. Citizens of various countries are still of the wait and see attitude. This delays achievement of targets at the country level.

As such, the scenario for Southeast Asian countries is one wherein there will be an escalation of climate change risks and impacts in the region, because there are conditions that make these countries vulnerable. The challenge thus is one of adaptation given these potential risks, and mitigation where it may be applicable.

The purpose of this paper is to identify possible interventions for implementation in the Southeast Asian region by the Asia Pacific Climate Change Adaptation Network (APAN). This paper was prepared (as part of the exercise) to inform the development of said regional strategy for Southeast Asia on Climate Change Adaptation and Mitigation (CCA&M).[3]

a. Background and context of the (sub-regional) policy on Adaptation

Climate Change (CC) and greenhouse gases (GHGs) are natural occurrences. GHGs serve as the insulator for our planet. However, the increased anthropogenic GHG emission is causing a progressive increase in the global average temperature (Houghton *et al.* 2001, in Villarin, 2001). This unnatural emission of GHG is causing significant changes in the environment, including associated risks and impacts to people. While Climate Change Adaptation and Mitigation (CCA&M) Technologies are available to lessen or prevent these impacts, they are however developed based on each country's

[2] In addition, Graciano P. Yumul personal communication (2012) points to the existence of scientific data which indicates that particulates from fossil fuel burning (such as from diesel engines and coal fired thermal power plants), contribute to the increased amount of moisture in the atmosphere, which in turn contributes to precipitation.

[3] It assumes that there have been a number of documents produced on the subject matter, but that there are gaps and recent developments.

context, which suggests the possibility of collaboration to advance knowhow in adaptation and mitigation technologies.

According to the United Nations Framework Convention on Climate Change (UNFCCC), these technological approaches to adaptation "include both hard technologies such as capital goods and hardware, as well as soft technologies such as knowledge of methods and techniques which enable hard technologies to be applied" (Levina and Tirpak, 2006). In mitigation, certain technologies are used to minimize the impacts of the change in the environment and to hopefully reduce the drastic changes that are happening to our climate.

This paper tackles both hard and soft technologies used for CCA&M. Specific case studies are discussed; using different Southeast Asian country experiences, on their approach to integrate CCA&M into their policies, and their enforcement[4].

Afterwards the broader picture will be analyzed to identify priorities as well as gaps and needs to reduce the negative impact of climate change.

The study objectives are to identify:

1. specific gaps and needs for technologies for adaptation in the sub region;
2. priority areas for technologies for adaptation; and
3. key policy recommendations based on the analyses of the regional adaptation programmes.

b. Brief discussion about the methodology

Identification of specific gaps and needs for climate change adaptation and technologies in the Southeast Asian countries was done through a review of related literature and references followed by an analysis of the presented output from the workshop sponsored by Asia Pacific Adaptation Network (APAN) on Climate Change Adaptation and Mitigation in February 10-11, 2012.

[4] The Desktop Study on Assessment of capacity Gaps and Needs of Southeast Asian Countries in Addressing Impacts, Vulnerabilities and Adaptation to Climate Variability and Climate Change provides a basis for this; however its focus is on knowledge management. This is supplemented by data from the consultations and the training workshop outputs. Other sources are also available.

This paper starts with a discussion of different cases of climate change impacts, vulnerabilities and risks to different Southeast Asian countries using a desktop study[5], complemented by a number of documents[6], and by outputs generated by participants during the workshop. ICLEI-Local Governments for Sustainability Southeast Asia, provided key inputs, some of which are also integrated into the paper.[7] The inputs serve to identify specific gaps and needs for technologies for adaptation in the Southeast Asian countries as well as priority areas for technologies for adaptation. The outputs from the workshop will particularly help in developing policy recommendations based on the analyses of the regional adaptation.

2. Existing policies and programmes in the National and Sub-regional level

This section covers the institutional framework for climate change adaptation, covering organization and national policy on climate change and related issuances climate change, vulnerability, adaptation and policy, referring specifically to programmes and projects under the water sector, agriculture and food security, and livelihoods; and the third part is the section on the development of sustainable parameters for adaptation technology policy framework.

2.1 Institutional framework for climate change adaptation

The UNFCCC and the Kyoto Protocol, ratified by Southeast Asian countries among others, provided bases for establishing national focal points for climate change. In most countries, the environmental agency is the national focal point of climate change. However, high level government bodies have been established for each country. These bodies are now tasked to develop and implement policies on climate change.[8]

[5] Ibid.
[6] Documents cited are found in the reference list.
[7] ICLEI served as the Secretariat and Sub Regional Node for the Asia Pacific Climate Change Adaptation Network (APAN). In addition to the training workshop, is also hosted a consultation on CCA&M for Southeast Asia. The training workshop had a few South Asian representatives.
[8] Koh and Bhullar accessed 2012 April 12.

Country	Environmental Agency	High Level Government Bodies
Brunei Darussalam	Department of Environment, Parks and Recreation	National Council on Climate Change
Cambodia	Ministry of Environment	National Climate Change Committee (April 2006)
Indonesia	Ministry of Environment: Climate Change Division	National Committee on Climate Change and Environment (1992) National Council for Climate Change
Lao PDR	Department of Environment: Water Resources and Environment	National Steering Committee on Climate Change (2008)
Malaysia	Ministry of Natural Resources and Environment	National Steering Committee on Climate Change
Myanmar	National Commission on Environmental Affairs	NA
Philippines	Presidential Task Force on Climate Change, which later was superseded by the National Climate Change Commission	Inter-Agency Committee on Climate Change (1991) Presidential Task Force on Climate Change (2007) Advisory Council on Climate
Singapore	Ministry of Environment and Water Resources	National Climate Change Committee (2007) National Climate Change
Thailand	Ministry of Natural Resources and Environment: Office of Natural Resources and Environmental Policy and Planning	National Committee on Climate Change (1993) National Board on Climate Change Policy and Climate Change
Vietnam	Ministry of Natural Resources and Environment: Department of Meteorology, Hydrology and Climate Change	National Climate Change Committee

Table 1: High-level government bodies as national focal points of climate change

While practically all Southeast Asian countries have no obligation to undertake emissions reduction, some have developed national policies, strategies, plans or programmes to address climate change. They have also started strengthening their adaptive capacity. One example

would be Indonesia. Indonesia has a National Action Plan Addressing Climate Change (RANPI) which provides government institutions with initial guidance to undertake coordinated and integrated efforts to address climate change adaptation. They also have laid out a Climate Change Sectoral Roadmap in 2010 which provides detailed policy guidance to mainstream climate change issues into national development planning.

The Philippines also has a Medium Term Philippine Development Plan (MTPDP) which is issued periodically to guide national development and also address disaster risk reduction. In the more recent issuances of the MTPDP, climate change has been a major topic of concern. The Philippines also has enacted a Climate Change Act in 2009, which recognizes the inter-linkage between climate change and disaster risk reduction. The country also has a 12-year National Framework Strategy and Programme on Climate Change to provide response guidance, as well as a National Climate Change Action Plan for specific responses per sector.

Indonesia and the Philippines are probably the two countries which have the most developed policy framework among countries of Southeast Asia.

2.2 Climate Change, Vulnerability, and Adaptation Policies of Southeast Asian Countries

This section presents the findings for the Southeast Asian countries, namely: Brunei, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam. Each country is introduced by presenting some context; this is followed by a report on three sectors, namely water, agriculture, and socio-economics.

Brunei

The climate of Brunei is influenced by El Niño and La Niña, periods of cold and warm episodes respectively. Brunei International Airport studied annual rainfall from 1966-2007. Weather patterns change as there are different peaks of rainfall patterns throughout the years.[9] There are usually two seasons for Brunei, as in the case of other Southeast Asian countries: dry and wet season. However in recent years, there are short

[9] David, Abraham, Hj. Sidup, Hj. Sirbaha, 2008. Climate of Brunei Darussalam. Brunei Meteorological Services. http://www.bruneiweather.com.bn/images/bruneiClimate.pdf

periods of heavy rain during the dry season. From 1979- 2006, the highest temperature for the country was recorded during the months of March to September. [10]

As reported by the Intergovernmental Panel on Climate Change (IPCC) 4th Assessment Report, Brunei, along with Malaysia and Singapore, experiences decreasing precipitation trend, increase in hot days and warm nights, and decrease in cold days and nights from 1961 to 1998; rising temperatures and rainfall variability; increase in endemic morbidity and mortality due to diarrhoeal disease associated with floods and droughts; increase in occurrence of extreme weather events (e.g., heat wave and intense precipitation); increase in the inter-annual variability of daily precipitation in the Asian summer monsoon ; and increase of 10-20% in tropical cyclone intensities.[11]

Water Sector

Brunei has to do in determining the impacts of climate change to their country. In a workshop on climate change adaptation technologies they identified flooding and landslide erosion, due to changes in rainfall patterns, as particular risks. The risk in coastal communities due to sea level rise was also identified.

Agricultural Sector

A significant portion of Brunei is composed of forest areas. The country focuses on restoring and protecting these forests, and opening them up for eco-tourism purposes. A key threat is the cutting down and conversion of forests industrial area according to the Climate Change, Brunei Darussalam Perspective (2010).

Socio-Economic Sector

Brunei has managed implementing a solid waste management programme in different areas in the country. Big companies have taken the lead in supporting this cause by implementing the waste minimization policy. This policy helps educate the public on the importance of climate change adaptation and mitigation. Reducing the use of plastic

[10] David et al., 2008.
[11] World Wildlife Fund. Climate Change Impacts on APEC Countries. 1997. p. 7.

bags for example, helps consumers understand that with less oil being used to produce plastic, less greenhouse gasses are emitted. Other policies that Brunei implements to support mitigation is the subsidy for fuel of hybrid cars, and a higher tax for the fuel of regular cars. Other initiatives related to alternative sources of energy, such as solar power and green building concepts are also being supported by government (Climate Change, Brunei Darussalam Perspective, 2010).

Cambodia

Cambodia reports an increasing severity of floods and droughts, which have led to crop failures and contribute substantially to poverty levels, water management and agriculture, are priority areas from climate change impacts.[12]

Water Sector

In Cambodia, severe flooding due to climate change is expected to have the most significant impact on its water resources. Most of these overflows are projected by the National Adaptation Programmes of Action (NAPA), to come from the Mekong River, and run down the basins of Cambodia - greatly affecting the areas of Kampong Cham, Prey Veng, Takeo, Kampong Thom, and Battambang. Drought is also anticipated to affect these same areas due to rainfall decline and ambient temperature increase. With this, the NAPA has identified the priority activities for climate change mitigation. They have included improvement of rainwater harvesting facilities at the villages, and the design of reservoirs and irrigation channels, multiple uses of canals, coastal protection infrastructure, community-based mangrove restoration, and agricultural soil conservation.

However, some of the adaptation measures at present are still in the capacity development phase, limiting its full implementation in the regions involved.

[12] Gass, P., H. Hove, J.-E.Parry, 2011. Review of Current and Planned Adaptation Action: East and Southeast Asia. International Institute for Sustainable Development.

Agriculture and Food Security

Potential impacts of climate change in Cambodia by the year 2030 were identified specifically in the Mekong Basin. Se San, Kratie, and Tônlé Sap will have an increase in agricultural productivity and food availability in excess of demand decrease. Phnom Penh and its border were also identified to have good yields. However, the shortcomings of the expanded irrigation and water harvesting schemes still make the country vulnerable to climate change. In response, Cambodia has implemented four adaptation schemes for both local and national levels. The government has divided these into: (1) decentralization of irrigation management to communities, (2) adaptation of agricultural practices to changing climatic condition, (3) planning for disaster reduction, and (4) promotion of information exchanges.

Socio-Economic Sector

The agriculture sector is essential to Cambodia's economic development. Rainfall increase may help highland agricultural areas increase in productivity, but will greatly affect the yields of low lying areas. Moreover, marginalized sectors located in the negatively affected areas may suffer more than the others.

Few socio-economic reports on climate change were mentioned in the existing studies in Cambodia. Country adaptations are mostly specific for the previously identified high-risk locations and are applied to specific sectors only. Cambodia focuses its adaptation measures on the improvement of irrigation, disaster reduction in the local communities and infrastructure improvement particularly in the coastal areas.

Indonesia

The country's 54,700 kilometers of coastline and over 17,500 islands makes the country particularly vulnerable to climate change impacts such as sea level rise. Also, concern over water resources and extreme weather events has been increasing in recent years.[13]

[13] Gass, et al., 2011.

Water Sector

An imbalance in the quantity and quality of water in Indonesia creates a water deficit in the various islands of the country. The flow of rivers and water levels at reservoirs are affected by drought at different time and space scales. This in turn affects the constancy of electricity supply coming from the reservoirs and the availability of drinking water for the citizens.

Indonesia also is not spared by sea level rise. It has been estimated that sea level rise per year will be around 1 – 3mm and can accelerate to 5mm over the next century. Marine resources, such as fish, mangroves and coral reefs, and even islands will be lost due to this phenomenon. To address this, Indonesia prepared a water balance model, a sea level rise model, and a digital elevation model to understand the various phenomena; they also prepared a Indonesia Climate Change Sectoral Road Map to respond to the various impacts of climate change, and in addition vulnerability analysis and interdecadal variability of rainfall. As a key strategy, Indonesia worked on Climate Proofing Development Processes, and on Climate Literacy [14]

Agriculture and Food Security

Climate change has both positive and negative impacts on Indonesia's agriculture and food security. The prolonged dry season can be a source of solar power, yet it can also be disastrous for agriculture. The negative impacts still outweigh the positive ones. Crop acreage and productivity are greatly affected by temperature rise, altered rainfall patterns and drought periods, changes in water availability and hydrological systems. The West Java and East Java regions were the areas identified as most vulnerable to a decrease in harvest, particularly for rice and cocoa.

Farmers have turned to the use of groundwater for irrigation during the dry season. However, over extraction of this resource has resulted in saltwater infiltration. The

[14] Tri Wahyu Hadi Climate Change Adaptation Planning with Disaster Risk Reduction Approach : Indonesian Experiences . Center for Climate Change. Bandung Institute of Technology http://www2.ir3s.u-tokyo.ac.jp/icssasia2011/pdf/presentation_paralel/Tri.pdf

traditional scheme of having their respected leaders serve as mediators to ensure their turns for getting water was not a sustainable practice. Only more recently, a long term framework and community level adaptation practices were introduced to the farmers in the country. These include cropping pattern and irrigation facility adjustment, establishment of early warning devices, and efficient use and conservation techniques of water resources.

Socio-economic Sector

The loss of human lives and property due to sea level rise and flooding due to heavy rainfall were identified as the two biggest impacts of climate change in Indonesia. Thus anticipated to increase, this can lead to an increase in malnutrition among children. The loss of income from the agriculture sector will also affect the non-agriculture sectors since the demand for goods and services in the affected localities will decrease.

The crucial factors that influence vulnerability in the household level were identified as: (1) the total number of household members, (2) time to be spent for coping with the events, and (3) the total household loss. These factors became the basis for the adaptation interventions of the country. Building flood walls using sandbags, and reconstructing houses and facilities with hard and protective material are some of the strategies formulated for the country.

Climate Change, Vulnerability, and Adaptation for Socio-Economic Sector

Human and property loss were predicted as the highest impact of climate change in the future of Indonesia. These are the result of the sea level rise and floods due to heavy rainfall. Poverty level then shall increase, especially for the poor people, which will lead to the rise of malnutrition rate among children. Income loss from the agriculture sector may also affect the non-agriculture sector since demand for goods and services in the locality will decrease.

On the other hand, the crucial factors influencing vulnerability in the household level were identified as the total number of household members, time to be spent for coping with the events, and the total household loss. These factors became the basis for the

adaptation of the country. Building flood wall using sandbags, and recovering the house and facilities with hard and protective construction are some of the strategies formulated for the country.

Lao PDR

The country's climate is tropical and monsoonal, characterized by a rainy season from May to November and a dry season from November to April.[15] Erratic floods and drought historically has a significant effect on the agriculture industry of Lao PDR, which is one of the most important sectors for their economy.[16]

Water Sector

Lao PDR's land area is composed mostly of floodplains of the Mekong River where fifty per cent (50%) of their population lives. According to the Helsinki University of Technology and the Southeast Asia Global Change System for Analysis Research and Training (SEA START), water greatly determines the severe impact of climate change on ecosystems and people's livelihood. This makes an assessment of the impacts of Climate Change within the periphery of the river and its tributaries an essential part of the study.

Water in the country is greatly used for agriculture. Forty six per cent (46%) of the rural population of the country are farmers which makes them highly vulnerable to drought. On the other hand of hydropower plants creates a conflict in the management of water resources. The government of Lao PDR aims for a sustainable water resource that shall reduce poverty and foster economic growth in the past years.

The SEA START presented various methods and models to study the extreme hydrological events and changes for Southeast Asia. For Lao PDR, SEA START used the Variable Infiltration Capacity Hydrological Model, wherein water and energy balances at the land surface atmosphere interface were solved. On the other hand, Eastham (2008) handled the climate change projections for individual sub basins of

[15] Gass et al., 2011.
[16] Gass et al., 2011.

Mekong River. A compilation of the climate data and statistics for temperature and rainfall from 1995-2005 and regionally produced climatic data since 1980 and climate change predictions from Mekong River Commission was made for the National Adaptation Programmeme of Action (NAPA) to Climate Change.

Longer hot periods in future summers, and shorter cold periods, as well as increasing precipitation are expected to occur in eastern and southern Lao PDR. Climate change will increase the water levels in the tributaries of the Mekong River that will increase the risk of flooding in the water bodies' periphery. Projections for the year 2030 show an increase of twenty one per cent (21%) annual basin runoff due to increase in precipitation season. This occurrence will maintain or increase the availability of water despite potential increase in water withdrawals. Flooding, on the other hand, is expected in the downstream catchments due to the cumulative effect of water runoff. Climate change will, on the other hand, increase the dry season precipitation in Northern Lao PDR and will only have a minor effect in the central and Southern part of Lao PDR.
In order to adapt to climate change and attain sustainable water resource management, institutional and legislative measures were implemented by the Lao Government. An Integrated Water Resource Management (IWRM) was promoted and a Water Resource Coordinating Committee was established. This contains reinforcing links and synergies between water, land use and environment. However, insufficient coordination from central agencies and provincial departments impedes successful implementation. Hence, this has been included in the priorities in the reduction of vulnerability of the water sector and a part of overcoming barriers in the formulation of adaptation strategies and building mechanisms for effective implementation. The institutionalization and integration, of IWRM for central and provincial levels as one of the main long-term objectives in the water sector, and Mekong River Commission (MRC) as an essential institution in the regional level, has been identified as key to the management of water resources, research activities and agenda setting.

Agriculture and Food Security

Forty percent (40%) of Lao PDR's GDP in 2007 came from agriculture, suggesting its importance to food security and income. The study on the impact of climate change for this country thus, relied on the extreme hydrological events and changes in water

resources. Rain-fed rice production, particularly in the Savannakhet Province, shows only a slight reduction. Lao farmers have been cooperating in the climate change adaptation measures, by adopting the government's prescribed techniques. However, while this may be the case, the country still has problems of food security and malnutrition. This indicates that mitigation measures are insufficient and may have to be scaled up given the effects of climate change.

Farmers in this country rely on adaptation methods readily available in the area, such as simple farm level measures and natural system to improve livelihood. This has become a key limiting factor in managing climate risks. On the other hand, based on the result of the research, an early warning system, accompanied by accurate risk communication techniques, may improve the on-farm adaptation measures of the affected population.

Socio-Economic Sector

Lao PDR experienced its most damaging natural disaster in 2008. A flood resulted in economic, arable land and human loss. Climate change, either strong or weak, occurrences will greatly affect this country due to its high degree of poverty. Moreover, since food and forestry from the locality will decline, citizens will rely on imports.

The country is one of the four Least Developed Countries (LDC) in Southeast Asia; its citizens are mostly dependent on natural resources which make it greatly vulnerable to the impacts of climate change. Public health, income, employment and food security due to water and forestry resource decline are the most affected aspects of climate change. On the other hand, enhanced livelihood, diversification of activities and availability of credit systems for the village communities will help lessen the vulnerability, according to the study in 2005. The government of Lao PDR sees Poverty Reduction as the main goal to combat climate change. This is their present basis for government policies.

Malaysia

As a country that is subject to monsoon seasons, it is particularly vulnerable to changes in weather patterns and rainfall variability and intensity[17] Seasonal variations in climate are more evidently marked by rainfall patterns, which in turn closely mirror changes in the monsoon winds blowing at different times of the year.[18] While temperatures are projected to rise, no significant changes in the patterns of rainfall or weather can be identified. More predictable was the potential for sea level rise, which could have a significant negative impact on the country.[19]

Water Sector

Malaysia is located in the humid tropic of Southeast Asia where water resources are abundant. However, climate change can impact the country through an increase in storm magnitude that would result in double the storm frequency or shorter return period. This will produce more floods, and increase erosion and sedimentation rates. Longer drought periods in the country are expected in the future.

Urban developments in Malaysia are mostly located in the low lying areas which are prone to floods. Also, growth relies on industries and agriculture; water demand and water stress will increase as the effects of climate change intensify. With this, the government intends to increase education and awareness to promote conservation and protection among its citizens as a long term strategy to mitigate climate change. Peak discharge control at source to prevent floods is another measure that was implemented.[20]

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[17] Gass et al., 2011.

[18] Ministry of Science, Technology, and Environment. (2000) http://unfccc.int/essential_background/library/items/3599.php?rec=j&priref=2745#beg

[19] Gass, Philip, Hove, Hilary, Parry, Jo-Ellen. (2011). Review of Current and Planned Adaptation Action: East and Southeast Asia. International Institute for Sustainable Development

20 Malaysia has integrated policies to mitigate climate change in their Third Perspective Plan and Ninth Malaysia Plan.
Urban Storm Water Management Manual for Malaysia, 2000. (*Manual Saliran Mesra Alam,* MSMA.) http://redac.eng.usm.my/EAD/EAD512/MSMA.pdf

Agriculture and Food Security

Crops in Malaysia, specifically the production of rice and crude palm oil, will decline due to climate change. The yield variations due to changes in rain and temperature will affect the sustainability of food supply. This can also introduce pests and diseases to the country particularly in communities situated in the northern Peninsular Malaysian Region. Paddy farmers have suffered in the past wherein, planting and cultivation were delayed due to water shortages. Moreover, sea level rise, in the previous years, has pushed farmers to abandon lands that were used to cultivate rubber trees and oil palm. Thus, climate change in this country will have severe effects in the future.

The government of Malaysia crafted national policies on adaptation and mitigation measures for the agriculture sector. They developed measures including agro-climatic classification in agricultural planning, use of soil suitability criteria for crop production and plant variety development.

Socio-economic Sector

Flood intensity and frequency will have an effect on the flood mitigation plans, as well as damage to the economic, social, and psychological aspects of the people in Malaysia. Dams and reservoirs may become incapable of holding surface runoff which is essential in the dry season, but which could be in excess supply during the rainy season. Most of all, sea level rise, damaging the coastal communities and facilities, has the highest impact among the identified effects of climate change.

The country has successfully implemented programmes to decrease poverty rate, thus enabling the government to focus on other concerns of the country to mitigate the effects of climate change. Infrastructure improvement, education and awareness programmes, and food sustainability are among the focal areas identified to lessen the socio-economic impacts of climate change in the country.

Climate Change, Vulnerability, and Adaptation for Socio-Economic Sector

Flood and intensity and frequency will have an effect on the flood mitigation plans, as well as damage in the economic, social, and psychological aspect of the people in

Malaysia. Dams and reservoirs may become incapable of holding surface runoff which essential in the dry season. Most of all, sea level rise, damaging the coastal communities and facilities, has the highest impact among the identified effects of climate change. An estimate of RM 46 million losses for Western Johor Agricultural Development due to eroded and inundated lands has been accounted by the Initial Communication on the impacts of the sea level rise. Furthermore, displacement and relocation of people affected by floods are accounted to cost RM88 million for Peninsular Malaysia and RM12 million for Sabah/Sarawak based on the 1980 price level.

Fortunately, the country has successfully implemented programmes to decrease poverty rate and create a favourable economic growth. Thus, enables the government to focus on other aspects in the country to mitigate the effects of climate change changes. Infrastructure improvement, education and awareness programmes, and food sustainability are among the focal points identified to lessen the socio-economic impacts in the country. These reflected on the percentage of incidence of poverty and hardcore poverty wherein it was previously accounted to 8.5% and 1.9% in 1999 and lowered to 5.7% and 1.2% in 2004.

Myanmar

Climate change indicators in Myanmar, and in the Bay of Bengal, are decreasing rainfall, increasing temperature, cyclonic storm movements, and southwest monsoon parameter. Myanmar is one of the countries in Southeast Asia at high risk of coastal sea-level rise.[21] Since 1976, there has been marked increase in the number of storm surges in the months of June to October. In May 2008, Cyclone Nargis, considered the deadliest and most destructive that ever hit Myanmar at that time, passed over the densely populated Ayeyarwady River deltaic region, and resulted in flooding of coastal plains. The cyclone track eastwards is the lowest latitude ever taken by cyclones before[22]. In October 2010,

[21] Gass, Philip, Hilary Hove, Jo-Ellen Parry. Review of Current and Planned Adaptation Action: East and Southeast Asia. International Institute for Sustainable Development. November 2011. p. 11. Accessed at http://www.adaptationpartnership.org/

[22] Myint, Than and Hla, San. Climate Change Adaptation in Myanmar. Natural Disaster Mitigation Committee, Myanmar Engineering Society (MES). SecondMyanmar-Climate change.pdf. Accessed at http://ebookbrowse.com/secondmyanmar-climate-change-pdf-d79092702

super cyclone Giri, the strongest cyclone that ever hit Myanmar, having a speed of 120 km to 128 km per hour, triggered a tidal wave of 3.6 meters, and caused widespread damage to lives, villages and properties.[23]

Water Sector

Myanmar is rich in natural resources including water sources. However, the impact of climate change to the country affects the water cycles. This is in the form of either long periods of rain or drought. It is hard to maintain the inflow of water to their reservoirs, thus causing water shortages during the dry season. Floods also affect the country with sea level rise, specifically in the coastal communities.

Ayeyarwady River, which is the major water body in Myanmar, is the identified area affected by climate change. This river extends from north to south leading to the Indian Ocean. The intense change in rainfall, temperature and cyclone will increase flood occurrences in the country. Drought in the country was previously observed years after El Niño / La Niña Southern Oscillation events. This has been a result of the changes of rainfall patterns, groundwater extraction and in combination of management flow regimes.

The Asian Disaster Reduction Center (ADRC) introduced flood prevention measures which are practiced with the multi-level participation of state and local authorities. On the other hand, dam construction projects are implemented in the national level to adapt to the projected rainfall pattern changes.

Agriculture and Food Security

Agriculture sector is highly dependent on irrigation. In Myanmar, the Irrigation Department (ID) developed and introduced new types of irrigation other than storage reservoirs. It is important to protect this sector against the impact of climate change because it is a significant contributor to the country's GDP, and employs 63% of the labour force. However there are studies that GHG emissions increase because of the

[23] People's Daily Online. "170,000 people affected by cyclone Giri in Myanmar." November 1, 2010. Accessed at http://english.peopledaily.com.cn/90001/90777/90851/7183629.html.

large agricultural industry in the country. Field burning and improved manure handling are measured to address this issue

Forty one per cent (41%) of their GDP in 2008 came from the agriculture sector. However, it is prone to natural disasters making it highly vulnerable to the impacts of climate change. Some crops sensitive to temperature will have a declining yield, rice genotypes which are temperature tolerant will increase. Reduction on rainfall within the river area will also impose risks in their livelihood sources, which will make their food security unstable and unsustainable.

Neither the NAPA (National Adaptation Programme of Action) nor Initial National Communication (INC) is yet available to address the vulnerability and adaptation for Myanmar's agriculture sector. However, they have recognised some long term and short term initiatives including some improvement on the access to irrigation water, and resource and knowledge-based sustainable agriculture and livelihood.

Socio-Economic Sector

Myanmar is highly vulnerable to the impacts of climate change, it being a developing agricultural country. However the manufacturing industry is also growing, which needs to be monitored because (according to surveys made), manufacturing companies are not aware of their GHG emission, and their impact. At the same time institutionalizing climate change adaptation and mitigation is crucial for their agriculture sector which significantly contributes to their economy.

Researches on the socio-economic aspects of climate change impacts in Myanmar are few. Economic and mortality rates due to floods, drought and cyclones and storms are identified as the main units of concern in the country. GIS data sets from the study of Dilly *et al.* (2011) and Columbia University Center for Hazards and Risks Research's Hotspot (2011) were employed to assess areas that need adaptation and mitigation measures. Social conflicts arise in areas near the Ayeyarwady River after flooding events.

The government of Myanmar recognizes long term and short term mitigation measures for the socio-economic sector focusing on infrastructure, disaster prevention in the community level, and enhancement of livelihood.

Climate Change, Vulnerability, and Adaptation for Socio-Economic Sector

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Philippines

Climate change in the Philippines manifests in the following forms of threats or hazards: increase in temperatures as expressed by higher annual mean, maximum and minimum values; increase in annual mean rainfall since the 1980s; increase in number of rainy days since the 1990s; changes in extreme events and severe climate anomalies such as increased occurrence of landslides and floods; occurrence of droughts normally associated with El Niño Southern Oscillation (ENSO) years causing massive crop failures, water shortages, and forest fires; and sea level rise which is projected to increase the annual number of people flooded in coastal populations.[24]

[24] Sajise, Asa Jose, Mercedita Sombilla, Rico Ancog. Socio-economics of Climate Change in the Philippines: A Synthesis Approach (1990-2010). Philippine Council for Agriculture, Aquatic, Forestry and Natural Resources Research and Development (PCAARRD). Accessed at http://beta.searca.org/kc3/index.php/rokdownloadables/437-socioeconomics-of-climate-change-in-the-philippines/download

Water Sector

The study of the impacts of Climate Change in the Philippines was conducted along the coasts of Manila Bay, where it converges with municipalities of the provinces of Cavite and Bulacan, and the cities/ towns of Las Piñas, Parañaque, Malabon, and Navotas. The Angat Water Reservoir and Lake Lanao from the other regions of the country were also studied. It shows that the identified areas along the coast will be largely affected by sea level rise that leads to flooding. The already degraded state of the salt water body can even become worse due to severe storm surges, warmer temperature and reduced light penetration. These will eventually cause more coral bleaching. It will also affect the salinity and sediments of the water bodies connected to the bay that can limit the growth of mangroves. On the other hand, the socio-economic implication of this is the decline of agricultural productivity and water quality that may also affect human health. In the case of Angat Water Reservoir and Lake Lanao, both resulted to a decrease and increase of water runoff, respectively. This implies that an insufficient water supply will occur in the future. The whole island of Luzon, including Metro Manila, Panay, Negros, and Mindanao were identified as vulnerable to flash floods, droughts and water shortage due to their topographic and topological limitations especially during dry seasons.

The Initial National Communication (of the Philippines), and Jose and Cruz (1999) identified options for climate change adaptation. They proposed construction of new Infrastructures, modification on the existing ones, comprehensive watershed management and reallocation system of water supply. They see conservation and improved efficiency and technological change as also essential in the adaptation measures. This includes enhancement of irrigation efficiency, lining canals to reduce water losses, building drainage reuse system, usage of low water consuming crops, and improved farming practices.

Adaptation and implementation for this country is hindered by the need for financial and technical support; and socio-cultural behaviours and traditions.[25]

[25] Manila Bay encompasses various political units with various priorities and needs which largely affects the speed of formulation and mitigation measures proposed.

Agriculture and Food Security

Cyclones and droughts significantly affect the agriculture sector of the Philippines. The province of Cagayan Valley, according to the assessments made, acquires the most damage due to flash floods, typhoons, and droughts. Moreover, after such events, recovery is slower which delays the sowing date, narrows the planting period and generates unnecessary water stress.

The Philippines can lose its arable lands due to sea level rise, decrease in soil fertility due to soil erosion, and decrease in crop productivity. The Department of Agriculture has strategies to combat these problems through improved coordination of basic services offered by various government agencies, introduction of least cost technologies; introduction of new rice species; and crop and yield intensification.

Socio-economic Sector

Economic and domestic losses due to cyclone, floods and droughts are the most evident effects of climate change in the Philippines. Rice production declines while the production costs escalate during the dry season. Enrolments of students were observed to decline in the provinces in the aftermath of flooding and lahar flows. This is correlated to the increase in child labour and urban migration.

Effects of climate change in the country, though it may only affect some sectors, can lead to a chain reaction. Farming problems may lead to losses in the household level and productivity of each individual.

In the Bicol Region, local strategies were adapted to combat changes in climate. These include increasing rice species cultivated in upland areas (now with 14 varieties), planting of fruit trees, digging canals for fish farming and planting root crops. Marginalized farmers who have no access to new farming technologies became a recipient of a mobile coconut shredder and are being encouraged to participate in faming group to form an agribusiness in the locality.

Singapore

Singapore has a relatively high uniform temperature and abundant rainfall. For the past 3 decades, however, it has been experiencing a decrease in annual rainfall, affecting its water supply which relies on water catchments for its reservoirs, and water imported from Johor, Malaysia through a pipeline system. There is no observable trend toward higher mean sea levels so far.[26] A relatively low-lying, densely populated island in the tropics, much of the island is less than 15m above sea level, with a generally flat coast. Considering the circumstances of Singapore, the potential impacts of climate change are: increased flooding, coastal land loss, water resource scarcity, heat stress, increased energy demand, and impacts on biodiversity. In addition, being situated in a region where communicable diseases such as dengue are endemic, there is public health impact from resurgence of diseases.[27]

Water Sector

As a low lying country, Singapore is highly vulnerable to climate change. The country foresees that when sea level rises, there will be a proliferation of floods in various areas. Most part of the island is less than 15 meters above sea level, moreover the country experiences high levels of rainfall. One of the most crucial problems Singapore experiences is when there is sea level rise, it is difficult for the rain water to drain into the sea. To address these issues Singapore developed reclamation projects that must be 125cm above the highest record tide level and establish various coastal defence systems. The efficient drainage system of the country also helps a lot in reducing floods. There is constant widening and deepening of the drainage systems, as part of the improvements the country makes. Moreover redevelopment proposals are looking into raising low-lying areas. A rise in sea level could also affect the water supply in the

[26] Ho, J. 2008. Singapore Country Report—A Regional Review on the Economics of Climate Change in Southeast Asia. Report submitted for RETA 6427: A Regional Review of the Economics of Climate Change in Southeast Asia. Asian Development Bank, Manila. Accessed at http://www.adb.org/publications/economics-climate-change-southeast-asia-regional-review

[27] Singapore's National Climate Change Strategy. National Climate Change Committee, Singapore. 2008. p.7. Accessed at http://app.mewr.gov.sg/data/ImgUpd/NCCS_Full_Version.pdf.

country. Salt water intrusion could be a problem which is addressed by the reservoir dams that are built higher than the projected sea level.

Agricultural and Food Security

Singapore is a small country with few physical and natural resources. Agriculture sector is not significant for this country. Their economy depends mostly on the export industry, therefore there is more pressure to put safety nets to ensure that they are at par with climate change requirements.

Socio-Economic Sector

The country advances in competency building in climate change adaptation and mitigation; they believe it has to be an individual, corporate, and governmental effort. Public health concerns and increase in energy demand are viewed as other impacts of climate change to the country. To address this issue, urban planning suggestions are to build more parks and to use efficient technologies such as energy efficient air conditioning, and implementing green architecture. An impact to the county's economy is the need to control their GHG as part of the climate change mitigation efforts.

Thailand

From 2004 to 2005, Thailand suffered from a catastrophic drought. Main water reservoirs dropped below minimum storage levels, and the eastern seaboard, where the prime industrial estates are, faced severe water shortage. Data from the Meteorological Department showed that there has been a decrease in rainfall trends in Thailand and an increase in maximum and minimum temperature during 1951-2002. [28]

[28] Boonprakrob, K. and S. Hattirat (2006). Crisis or Opportunity: Climate Change and Thailand. Greenpeace. 2006. p. 11. Accessed at: http://www.greenpeace.org/international/Global/international/planet-2/report/2006/7/crisis-or-opportunity-climate.pdf

Water Sector

The country had an increase in temperature of 2.5°C in the northeast region and 3.35°C in the central, north and west regions, based on three regional circulation models, comparing a baseline scenario versus a doubling of CO_2 in 1999. Rainfalls vary in the country; one notable increase is an account of forty per cent (40%) in the southern part. Annual runoffs, though, will decrease by fifty per cent (50%) in the lower basin. This will then result to water scarcity in these regions. On the other hand, a change in the hydrological and biogeochemical cycles will result in the imbalance of fresh water ecosystems, river flow changes, ground water recharge, water quality, and watershed. Rainfall, drought, floods and storm surges may become a common occurrence.[29]

As an agricultural country, Thailand relies a lot on their water supply. Climate change will greatly affect their agricultural development. On the other hand, Thailand has been implementing mitigation and adaptation measures long ago. They have been doing interventions on water management such as large scale irrigation and flood protection and warning systems in the past. This is because the country has faced the threats of natural resource and energy security in the past. They see climate change measures as a new reason to continue what they have been doing. They have identified previously the development and conservation projects for water sources, streams, and drainage. An integrated water resource planning includes promotion of participation by local administration agencies and communities in the country, as a priority in implementing their water projects. These have helped them address immediate problems and adapt to climate change. However, qualitative researches and assessments of the physical property of the water resource are few, so that gaps in their water resource management are evident.

Agriculture and Food Security

Crops with higher sensitivity, according to researches made for Thailand, are more vulnerable than other crops cultivated. Rain-fed rice and maize yields will decrease due to their temperature sensitivity. Also, livestock in this country relies on natural pasture

[29] Boonprakrob, K. and S. Hattirat (2006).

and leftovers from agriculture which may result to food scarcity and new disease outbreak. Sea level rise also affects aquaculture particularly the mangrove and mudflat production areas.

The location, crop, and farmers ability to diversify crops predetermines the impact rate of climate change. To combat these vulnerabilities, Thailand has been exploring planting vetiver grasses for topsoil preservation, drought resistant plant and animal species, and construction of dams and irrigation systems. They also have been implementing traditional practices such as mixed cropping, agro forestry, and animal husbandry. Moreover, ADB has included Thailand in their projects on Climate Risk Management Assessment for Agriculture, which focuses on innovations in agricultural institutions, crop and resource management, the role of women, social capital, and social networks.

Socio-economic Sector

Research has shown that vulnerability is a site specific condition and is dependent on the degree of climate impact and socio-economic condition as well as physical condition of each site. Farmers of rain fed areas in Thailand are the most affected group by climate change. Cities and economic activities in this country are mostly located in the coastal area which will be highly affected by sea level rise.
Farmers' adaptation measures are focused: on income diversification activities that are not climate sensitive; and seasonal migration, to work in the cities. Furthermore, Bangkok Metropolitan Administration (BMA) reported that adaptation measures for Bangkok include land use planning, construction or improvement of levees and dykes, water reservoirs and waste discharge designs, coastal protection phased retreat, harbour / port operation and engineering for business and commercial and ecosystem protection.

Vietnam

Vietnam experiences climate change both in fundamental climatic elements and in extreme weather phenomena such as storms, heavy rains, and droughts. In the last 50 years, annual surface temperature has increased by 0.5-0.7°C from South to North, frequency of cold fronts decreased by 2.45 events per year, and sea level has risen by

20 cm. There were more severe and frequent occurrences of natural disasters such as cyclonic storms, floods and droughts. The El-Niño and La-Niña phenomena have caused increasingly adverse impacts. At the Mekong River delta, sea water has increased salinity of irrigation water and has affected rice yield.[30]

Water Sector

Vietnam is situated in the Tropical Monsoon Region with an annual run off of 843 Billion m^3 and groundwater resource reserve of 1,500 m^3/s. Although, these resources are unevenly distributed in the area throughout the year, the geographic location still makes great potential for hydro-electricity and water storage for the country. However, due to deforestation and pollution, water resources are being degraded. The country experiences frequent drought, flooding and erosion especially in the most populated areas. The changing rainfall pattern affects water supply and creates water use conflicts.

These occurrences, according to the Human Development Report (2010), will intensify due to the effects of climate change. Vietnam has been identified as one of the most vulnerable countries to sea level rise due to its long coast line. This may lead to sinking deltas, coastal degradation, loss of coral reef, drop in ground water level and a threat to the country's water security. There will also be an increase in coastal storms, inland hydrologic changes, and changes in temperature and precipitation. Increase in variability in temperature and precipitation will affect the northern part of Viet Nam more and less, the central highlands and the southern part.

The Initial National Communication has recommended conducting long-term water studies and management / controls to mitigate the effects caused by climate change. It includes building reservoirs, upgrading and raising scales of drainage and dykes, reclaiming areas, controlling population and implementing sustainable use of water.

Water scarcity in the country resulted to a proposal of inter basin transfer of water, wherein reservoirs with excess water supply will be connected to other water deficient

[30] Viet Nam Assessment Report on Climate Change (VARCC). Institute of Strategy and Policy. Hanoi, 2009. p. vi. Accessed at http://www.unep.org/pdf/dtie/VTN_ASS_REP_CC.pdf.

reservoirs. It has also been suggested that a shift to improved water management with increased water efficiency and re-prioritizing current water use will help combat the country's woes from the changing climate and water shortage. The Ministry of Environment has also formulated short and long term adaptation plans for the country, wherein sub sectors such as water resource, domestic water, irrigation water, industrial water and coastal water will have various programmes in order to reduce the effects of climate change to the activities under these.

Agriculture and Food Security

Vietnam identified the water resources impact, temperature and rainfall changes as the key points in understanding the effect of climate to their agriculture and livelihoods. Climate change in this country will significantly affect the growth and productivity of plants, which has an effect on the cropping season and appearance of pestilent insects. Livestock growth and reproduction, increased risk of pathogenesis and spread of dangerous disease may also become pertinent with climate change. Plants in various land forms will also be affected due to temperature rise. Lastly, many agricultural lands near the coast will become exposed to salt water -- decreasing the area suitable for production.

The Initial National Communication has included 6 measures to combat climate change in Vietnam. It has identified the development of crop patterns suitable to climate change, effective use of irrigation water, upgrading of irrigation system for agriculture, development of new varieties that could withstand severe environmental condition, reserve and storage of local crop varieties, establishing crop seed bank, and development of farming techniques appropriate to climate change.

Socio-Economic Sector

Climate Change has become a "real threat" to the economic development of Vietnam. The population of Vietnam, out of all the developing countries, showed the highest percentage affected by sea level rise. Export products, particularly water dependent products, will decrease due to salt water intrusion, and coral reef degradation. In an overall assessment of impact, infrastructure, income generation of the community and

livelihood will most likely suffer if the country is unable to respond to climate change impacts.

Urban poverty and the growing gap between the rich and the poor citizens hinder the capacity of the country to respond to climate change. Floods in the past years have destroyed several houses and people recovered very slowly. In this regard, poverty became the central target of activities to combat climate change. The government included diversification of incomes, respect of common property rights, and promotion of collective security in their adaptation measures.

2.3 Development of sustainable parameters for adaptation technology policy framework

The development of sustainable parameters for adaptation technology policy framework on climate change necessitates that all of the following are in place: a policy and a government body mandated by said policy, responsible for the policy for the management of the environment, agriculture and natural resources; for climate change; for disaster risk reduction and management, for social and economic development planning; and local government units (LGU) mandated, enabled and which have the mandate and resources to effectively implement adaptation measures. In addition, the logical next step would be a policy, including an institution on sustainable consumption and production. For the LGUs, a specific challenge would be the integration of climate change adaptation (and mitigation) measures, along with disaster risk reduction into the Comprehensive Development Plan (CDP), and the Comprehensive Land Use Plan (CLUP). The other elements which were identified include the following:

- A sub-regional hub functioning as knowledge management organization for capacitating local government units, which have national presence in each country, in the field of climate change adaptation and mitigation. Based on the experience of Albay, Philippines and the other local government units which presented their case studies, capacity of local government units should also include local development planning.

- A facility for funding various local government units adaptation and mitigation measures, which should be operating in the region, with individual or cluster country presence.[31]

- A national apex organization on water resources which addresses free loader issues, protects the rights of the marginalized, optimizes the limited resources of government and private sector by ensuring proper allocation of resources and regulation of private sector to ensure optimal use of water resources, secondary to profit margins.

  Prior to all of these, there is a requirement for policy alignment and a correct framing of climate change and adaptation measures. Framing is important in going through the process of understanding, communicating, and arriving at a shared meaning about the issue of adaptation. In social framing, the social process is defined, identifying the groups involved and their roles, aside from the community and government. In political framing, the issue on ownership and authority over the problem/opportunity of adaptation is defined. In conceptual framing, various lenses or perspectives are used in looking into adaptation (e.g., as hazard, vulnerability, risk or resilience). In operational framing, integration of adaptation policy is explored with respect to mitigation measures, and with respect to the components of an integrated climate change strategic plan (i.e., to integrate departmental strategy, financial management and organizational policy).[32]

2.4 Integrating climate change in development planning[33]

In line with the decentralization mandate of the Local Government Code of 1991, development planning in the Philippines is done on several levels. On the national, regional and provincial levels, there is the requirement for physical framework plan (National/Regional/Provincial Framework Plan) and the development plan (National/Regional/Provincial Development Plan).

[31] As a matter of good practice adaptation and mitigation measures are to be integrated with local development initiatives, for example in agriculture, it could be shifts in the timing of rice planting and harvesting, or crops, or it may include adjustments in irrigation system or technology.

[32] Gawler, Steve, 2012. "Framing Climate Adaptation and Mitigation in Asia." Training Workshop for National and Local Governments in Southeast and South Asia on Climate Change Adaptation and Mitigation. February 10-11, 2012, Manila, Philippines. ICLEI, UNEP, APAN.

[33] Deocariza, Mariano, 2012. "Integrating Climate Change in Development Planning." Training Workshop for National and Local Governments in Southeast and South Asia on Climate Change Adaptation and Mitigation. February 10-11, 2012, Manila, Philippines. ICLEI, UNEP, APAN.

On the local level, city or municipality, the Comprehensive Land Use Plan (CLUP) and Comprehensive Development Plan (CDP) are required. An integration example is the Tabaco City CLUP 2012-2027. Tabaco City is in the Province of Albay, and sits at the foot of an active volcano, is at risk of landslides, and is in along the path where post storms pass by every year, in the Philippines.

Five development sectors are covered in the local planning (CLUP and CDP): environment, social, economic, infrastructure and institutional sectors. Mainstreaming means the inclusion or integration of a concept or principle into existing structures such, processes, plans, and systems. The strategy is mainstreaming all the concerns of this development sectors into the CLUP: CCA, DRR, MDG, gender and development, sustainable development, biodiversity conservation, people empowerment, poverty alleviation, good governance, people with disability, etc.

In mainstreaming DRR management into the generic planning process, the initial stage of planning, which is profiling and analysis, must gather DRR information, and trigger a process for hazard characterization, frequency and consequence analysis, risk estimation and vulnerability evaluation. The identified risks and vulnerabilities information will then be considered in the next planning stages. In mainstreaming climate change, climate change assessments from data gathered on risks and hazards are fed into the profiling and analysis stage of planning. Information on vulnerabilities and climate change adaptation and mitigation interventions are fed into the spatial strategies formulation stage. Climate change information such as sea level rise, coastal erosion, and extreme weather events such as typhoon, flooding, landslides will be maintained as an information system.

In the CLUP, the following CCA strategies are employed: plan elements such strategy, programme, project should follow climate adaptive siting principles of protection of investment and people from hazards; protection and management of valuable and natural resources and environmental processes; and protection and management of natural resources for economic reasons such as tourism.

In the CDM, also considered as elements are the CCA/CCM strategies spelled out by the United Nations Framework Convention on Climate Change (UNFCCC): restricted development or no development in hazard-prone and environmentally critical areas (coastal zones, flood plains,

slopes, etc.); hazard mitigation measures (if feasible) in hazard-prone areas; removal or relocation of buildings in floodplains to safer grounds; protect critical facilities such as schools and government buildings; economic incentives (such as tax relief) that encourage or discourage development in high hazard areas; government acquisition of properties in hazard-prone areas; climate adaptive farming (calendar, technologies, crop varieties, etc.); green growth including green technologies, green energy and eco-tourism; and smart growth such as compact development, walkable cities and transit-oriented development.

2.5 Mainstreaming climate change adaptation (CCA) and disaster risk reduction (DRR)

From the experience of the Province of Albay, one of the most vulnerable provinces in the Philippines, a model for CCA and DRR can be derived. Albay is visited by three to five direct hits of typhoons per year and faces constant threats of volcanic eruption, having an active volcano that had four explosive eruptions since 2000. The challenge of combined climate and geological hazards, persistent poverty and net resource haemorrhage during natural disasters, a serious threat to the attainment of its millennium development goals (MDG), induced the provincial government to seriously take on the responsibility of saving the vulnerable by meting out social justice through CCA and DRR. When the state is unable to reduce exposure and to increase adaptive capacity, there is relief, recovery and rehabilitation as compensatory measures.

As consequence, two national laws on DRR and CCA were based on the Albay model, The Philippine Disaster Risk Reduction and Management Act of 2010 that mandates to institutionalize a Disaster Risk Reduction and Management Office, and The Climate Change Act of 2009 that creates the Climate Change Commission mandated to lessen the impact of climate change in the country. Zero casualty was recorded since 1995 except in 2006 and 2011. There was a surge in private investment. The local economy showed the fastest growth in the Bicol region. MDGs were achieved ahead of 2015. The province gained wide recognition for its DRR accomplishment.

The province of Albay employs the following CCA strategy: make the millennium development goal (MDG) as the goal for climate change and let adaptation follow; ordain policies; allocate budget; and execute programmes and projects. It made adaption an integral part of its MDG

and focused on the attainment of the MDG. This was done by changing the goal to "safe and shared development," safe development being defined as climate-proofing and disaster-proofing of development; and shared development being defined as achievement of MDG and improvement in human development index (HDI). A budget of 9% is dedicated to adaptation, this budget being considered the best articulation of public adaptation policy and instrument for its execution. Along with the body of policies and ordinances passed, there is provision for incremental budget on top of the calamity fund. Programmes and projects on DRR and CCA are underway, with a strategic shift to human capital formation (i.e., health and education) from physical capital formation.

The DRR strategy is anchored on the "zero casualty during disaster" goal that is added to the MDG, as part of the overall goal on safe and shared development. The DRR strategy is to build institutions, and nurture partnerships and mobilizing resources. Three institutional disaster management offices (DMOs) were built: Albay Public Safety and Emergency Management Office (APSEMO) for emergency research and disaster management; Center for Initiatives on Research and Climate Action (CIRCA) for advocacy, knowledge management and integration of climate change in school curricula; and Albay Millennium Development Goal Office (ADMGO) for overseeing MDG performance and manage social services such as relocation.

CCA and DRR programmes of the province feature the following elements: integration into Provincial Development Plan (PDP), Provincial Development Investment Programme (PDIP), Annual Improvement Plan (AIP), and Provincial Procurement Management Plan (PPMP); geostrategic intervention; relocation; engineering interventions; risk mapping; social preparations; capacity build-up (e.g., mobility assets and permanent evacuation centers); pre-emptive disaster response; and cluster approach to early recovery. Social preparations include community training and seminar, community drills, training of emergency paramedics, training of rescue team, and orientation of children through games and magic. Disaster preparedness is achieved through close coordination with warning agencies (e.g., weather stations and Doppler Radar station), community-based warning systems and evacuation planning, and a warning communications protocol reaching the villages.

2.6 Global and local climate change mitigation Indicators[34]

From the technical perspective on mitigation, on the global level, the indicators are: future emission and climate change; requirement of GHG reduction to keep temperature below 2 degrees (peaking and decline); and mechanisms on baseline, additionality, leakage, etc. On the national level, the indicators are: GHG accounting, including reporting methodology and emission co-efficient; design and development of Clean Development Mechanism CDM projects; and institutional capacity in terms of technical skill and human resource.

From the policy perspective, on the global level, the key mitigation indicators are: the Kyoto Protocol and its continuation; UNFCCC and legally binding agreement under the Ad Hoc Working Group on Long-term Cooperative Action (AWG-LCA) for developed and developing countries; developed countries' commitment for their own reduction and supporting countries on finance, technologies and capacity building; and developing countries' commitment for Nationally Appropriate Mitigation Actions (NAMA). On the national level, the indicators are: the National Policy and Strategy (e.g., CDM, MANA); and the UNFCCC: Copenhagen Accords of 2009.

From the perspective of mitigation performance, on the global level, the key indicator is emission reduction targets for industrialized countries. Annex 1 Parties commit to implement, individually or jointly, quantified economy-wide emissions targets for 2020. Pledges are not close to the 25-40% reduction by 2020 from 1990 baselines – a reduction that is likely to be needed to remain temperature increase below 2 degrees. On the national level, the indicators are: developing countries implementing mitigation actions, and listing their voluntary pledges; and countries like China and India to meeting their own proposed "carbon intensity" targets.

[34] Babu. "Technical and Policy Perspective:Climate Change Mitigation and Adaptation." Training on Climate Change Adaptation and Mitigation Technologies. February 10-11, 2012, Manila, Philippines. ICLEI Oceania.

2.7 Analyses of gaps based on the existing policies and programmes

Climate Change[35] Adaptation and Mitigation has been foreseen years earlier, however only in recent years have countries started to be aggressive with it, by way of integrating the issue to their development objectives. There is still much to be done in terms of gaps to be filled, and lessons to be learned in this specific field.

First is institutionalizing climate change adaptation. In recent times climate change impacts have become palpable to various countries, thus providing the impetus to integrating CC to national policies. Representatives from Myanmar, and Lao PDR, for example identified their adaptive capacity to be low. This suggests that institutions of these countries need to further develop their policies and experiences in climate change adaptation.

Institutionalizing climate change adaptation precisely means integrating it to the broader national strategic plans of the country. Hence there is a need for decrees to allocate resources and tasking, communications plan, stakeholder engagement plan, entailing an overall governance scheme wherein the public and private sector work together. There is a need to conduct a stakeholder analysis to identify who are going to be involved and to assess the levels of interest.

Another concern is when climate change adaptation and mitigation is viewed at the international level, is how international policies are translated and implemented to the national and eventually local level.

Last pertinent gap identified is the need for programmes and policies that are both for (climate change) adaptation and mitigation. Integrated climate action planning should be done; one which plans mitigation and adaptation measures in parallel. This will help the countries become resilient while reducing greenhouse gas emissions/ carbon footprint. An example given is sanitation and waste water management; proper management reduces emissions and prevents water shortages at the same time puts in place technologies that will reduce the risk of flooding in countries. While some actions are purely adaptation or purely mitigation, actions which cover

[35] Hansen, J., et al., 1981. Climate Impact of Increasing Atmospheric Carbon Dioxide. Science. 213(4511):957-966.

both leads to the action plan. Managing institutions is important for successful climate change adaptation and mitigation actions.

For Southeast Asia, some of the gaps identified can be classified into technical knowledge and managing this knowledge. In discussions with some Southeast Asian countries such as Cambodia, and Lao PDR, the results for gaps in climate change adaptation and mitigation is the lack of analytical tools specially in identifying the direct and indirect impact of climate change. Lack of knowledge such as using GIS mapping systems and land use mappings and plans, are seen as gaps to Climate Change Adaptation and Mitigation actions. On the other hand knowledge management is also identified as a gap, citing the need for awareness programmes and knowledge management systems. There is a need for a monitoring and evaluation systems complimented by strategic communications plans for knowledge management to succeed.

The following table provides an overview of the institutional capacity of Southeast Asian countries in relation to climate change risk. In practically all cases the climate change risk is high, but the institutional capacity is low to medium at the national level. The conditions at the local level are likely to be more difficult.

Table 2: Institutional Capacity of Southeast Asian Countries vis-à-vis Climate Change Risk

Country	Climate Change Risk	Institutional Capacity
Thailand	High	Low
Brunei	High	Low
Indonesia	Medium	Medium
Myanmar	Low	Low
Philippines	High	High
Cambodia	High	Low
Malaysia	High	Medium

The gaps identified practically covers all of the sectors; the capacity building encompassing; most of the proposed priority activities initially are in the area of knowledge management, from assessment to project development, monitoring and implementation, including tools, methodologies and models of good practice which the participants can use or emulate. (A complete listing of the responses can be found in the following table.)

Table 3: Gaps Identified

Priority Sectors	Capacity Building Priority	Proposed Activities
Forest Watershed	Customize country driven development strategy	Adopting Geographic Information Systems
Water Security	Monitoring and Evaluation	Land Use Mapping
Disaster Preparedness	Policy Formulation	Conferences, Expos, Forums
Agricultural Sector	Mainstreaming Mechanism	Climate Change Impact Assessment
Infrastructure Planning	Forming of Networks	Planning of District level with country and
Biodiversity	Financing Adaptation and Mitigation	Sharing of experiences
Integrated Coastal Zone Management	Community Mobilization	National Climate Coordination

Here the role of science and technology becomes apparent. The participants indicated that there is a need to link science (and technology) to policy, and management, both operations and projects, from the national to the local level. It was acknowledged that science is important not only in policy making at the national level, but also at the local level, including in the area of developing local interventions. [36] Examples cited in the case studies include: the establishment and use of meteorological stations for weather forecasting, nowcasting and event forensics; the use of mobile technologies to notify the citizenry about events as well as to feed in information to a command center; the use of modelling, remote sensing and geographic information science, to provide the spatio-temporal perspective to aid in planning, decision making and policy, including land use mapping, risk and hazard mapping, and siting of facilities; a platform to integrate data that is available from various sources to link with the spatio-temporal data; a software not only for greenhouse gas accounting, but also one that can be used for scenario planning; and a platform for knowledge sharing specifically for the needs of the sub-region. One of the key concerns of the participants is the investment required to underwrite projects of these type and magnitude, for which there was no ready answer available during the consultation and training.

[36] It is possible that there may be local knowledge that could be utilized for specific responses such as an alarm system for example.

3. Analyses of current developments in the international platforms on adaptation technology[37]

This section tackles the context and the gains of the Durban Climate Change Conference, including the Durban Platform and its relationship to Nationally Appropriate Mitigation Actions, available support, and registry; the Adaptation Committee; financing, including the Green Climate Fund; the Standing Committee; Long Term Finance; Technology Transfer and Capacity Building; the Durban Platform and the urgency of lowering emissions.

It has been almost 2 decades since the establishment of the UNFCCC in 1992. Yet a global treaty that legally binds major emitters to reduce their emissions, at the scale required by science in order to avoid irreversible climate change, is still not in place. It has yet to facilitate the flow of financing into developing countries at a magnitude capable of assisting vulnerable countries adapt to climate impacts.[38] At the least the Durban Conference "..reached agreement on a roadmap towards a new legal instrument that encompasses all countries as opposed to a voluntary mechanism[39]".

While the 2011 "Durban Platform", promises a comprehensive deal which would include major emitters by 2015, it would only be enforced by 2020.[40] In addition to this requirement for major emitters, the Durban decision includes a "requirement" for developing country Parties to submit Biennial Update Reports (BURs) on their NAMAs by December 2014 in accordance with their capabilities and level of support for reporting. Least developed country Parties and small-island developing states may or may not submit BURs. Parties agreed to develop and finalize a web-based NAMA registry by COP-18 to record actions seeking international support and to facilitate the matching of actions with available support.[41]

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[37] This section borrows from the work of La Viña, A. G.M., et al., 2012. The UNFCCC after Durban: Recognizing limitations and calling for a multi-track approach to climate multilateralism and action. Working paper. Foundation for International Environmental Law and Development.
[38] Ibid.
[39] Statement from Mary Robinson on the Closing of COP17/CMP7. Mary Robinson Foundation for Climate Justice. http://www.mrfcj.org/press/releases/statement_from_mary_robinson_on_the_closing_of_cop17_cmp7.html?gclid=CJPp36Si9q8CFfFV4godKRa-TA
[40] La Viña, A. G.M., et al., 2012.
[41] Op cit.

Information provided by developing country Parties on NAMAs seeking international support may include, as appropriate, a description of the mitigation action and the national implementing entity, estimated full cost of the implementation, estimated emissions reduction, co-benefits for local sustainable development, and others. At the same time, developing country NAMAs not seeking international support may also be listed in a separate section of the registry for recognition.[42]

The Durban decision also invites developed country Parties, entities entrusted with operating financial mechanisms including the Global Environment Facility (GEF) and the Green Climate Fund (GCF), public donors, private and non-governmental organizations, to submit information on financial, technological and capacity-building support available and/or provided to prepare or implement NAMAs.[43]

The *Adaptation Committee*[44] has given developing countries the majority of the seats on the committee and has left decision-making to consensus[45]. Least developing countries were provided with a process that enables them to formulate and implement National Adaptation Plans that shall facilitate country-owned and country-driven actions.[46] Furthermore, *all* interested developing countries, and not only LDCs, are now eligible to formulate national adaptation plans (NAPs) and hence access funds for their implementation[47]. Lastly, an official work programmeme on approaches to address loss and damage was passed on to succeeding negotiations[48].

To guarantee *financing* that would help developing countries adapt to climate change impacts and transition to a low-carbon, climate-resilient development pathway, three main issues were

[42] Op cit.
[43] Op cit.
[44] The coordinating body on all adaptation efforts under the Convention.
[45] World Resources Institute, 2011. Reflection on COP 17 in Durban. http://insights.wri.org/news/2011/12/reflections-cop-17-durban.
[46] Environmental Negotiations Bulletin, 2011. Summary of the Durban Climate Change Conference: 28 November – 11 December 2011. International Institute for Sustainable Development. (12)534. http://www.iisd.ca/download/pdf/enb12534e.pdf.
[47] United Nations Framework Convention on Climate Change (UNFCCC), 2011. National Adaptation Plans. *Advance Unedited Version*. Bonn, Germany. http://unfccc.int/files/meetings/durban_nov_2011/decisions/application/pdf/cop17_nap.pdf
[48] World Resources Institute, 2011.

resolved in Durban: (1) the approval of the Transitional Committee's report on the Green Climate Fund and its operationalization; (2) the establishment of the roles, functions and composition of the Standing Committee; and (3) the preparation of a road map for long-term finance.[49]

The following decisions were adopted by the COP regarding the Green Climate Fund: (1) The GCF is an operating entity of the Financial Mechanisms of the Convention with arrangements to be concluded between the COP and the GCF at COP-18 to ensure that it is accountable to and functions under the guidance of the COP; (2) It will have judicial personality and legal capacity so that it can effectively operate internationally; (3) The secretariats of UNFCCC and the GEF shall serve as the host of the interim secretariat performing the necessary administrative steps to organize the interim secretariat which shall be an autonomous unit within the UN office in Geneva—a complex compromise of the three options; (4) A transparent "no-objection" procedure that ensures that funded activities are consistent with national climate strategies[50].

The *Standing Committee* is tasked to advise the COP on the financial mechanisms of the Convention. This includes improving coherence and coordination in the delivery of climate change financing, rationalization of the financial mechanism, mobilization of financial resources, and Measurement, Reporting, and Verification (MRV) of support provided to developing country Parties. From these activities, a work programmeme is to be developed for presentation at COP-18. The Standing Committee shall directly report to the COP. The agreed composition of the committee includes equal membership from developed and developing countries with open participation from observers from the operating entities of the financial mechanisms of the Convention, as well as funding entities and accredited observer organization from the private sector and civil society[51].

COP-17 welcomed the fast start finance of USD 30 billion for 2010-2012 as provided for by developed countries while also urged for increased transparency in reporting towards fulfilling

[49] La Viña, A. G.M., et al., 2012.
[50] United Nations Framework Convention on Climate Change. 2011. Green Climate Fund- Report of the Transitional Committee. *Advance Unedited Version*. Bonn, Germany. http://unfccc.int/files/meetings/durban_nov_2011/decisions/application/pdf/cop17_gcf.pdf.
[51] United Nations Framework Convention on Climate Change. 2011. Outcome of the work of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention. *Advance Unedited Version.* Bonn, Germany. http://unfccc.int/files/meetings/durban_nov_2011/decisions/application/pdf/cop17_durbanplatform.pdf

commitments [52]. A one-year work programmeme towards detailing the mobilization of finance post 2012 is to be outlined this year.

Technology transfer is a vital support mechanism for the implementation of mitigation and adaptation plans. The Durban platform has decided that the Climate Technology Center and Network (CTCN) shall be governed by an advisory board whose constitution has been deferred to the succeeding Subsidiary Body for Implementation (SBI) meeting. Without this advisory board, the implementation of the Technical Mechanism maybe delayed until 2013 [53].

The Durban Forum was established to facilitate in-depth discussions on *capacity building* through the sharing of country experiences, best practices and lessons learned [54].

The result of the above negotiations paved the way for the establishment of the Ad Hoc Working Group on *the Durban Platform* for Enhanced Action (ADP). The Durban Platform specifically recognizes the grave urgency of lowering emissions in accordance to the 2C goal and ultimately decides to launch a process to "develop a protocol, another legal instrument or an agreed outcome with legal force under the Convention applicable to all Parties, through a subsidiary body under the Convention," the ADP [55]. The Durban Platform complements the decision of the AWG-KP[56] in Durban that the second commitment period of the Kyoto Protocol shall begin on 2013 and end on either December 2017 or December 2020 [57].

The ADP is then supposed to complete its work by 2015 in view of putting the protocol, legal instrument, or agreed outcome into force by 2020 when Parties are expected to complete their own ratification process of approving the instrument's legal elements. It is clear that this new instrument shall include major emitters such as the United States, China, India and possibly other BASIC countries (such as South Africa and Brazil) to commit to emission reduction obligations—the first time these countries have been included in any "obligatory" emission

[52] Ibid.
[53] World Resources Institute, 2011.
[54] UNFCCC. 2011a. Capacity-Building.
http://unfccc.int/cooperation_and_support/capacity_building/items/1033.php.
[55] United Nations Framework Convention on Climate Change. 2011. Establishment of an Ad Hoc Working Group on the Durban Platform for Enhanced Action. Advance Unedited Version. Bonn, Germany.
http://unfccc.int/files/meetings/durban_nov_2011/decisions/application/pdf/cop17_durbanplatform.pdf.
[56] Ad Hoc Working Group for the Kyoto Protocol.
[57] La Viña, A. G.M., et al., 2012.

reduction regime. It is also implied that between 2012 and 2019, there will be no new legal instrument with improved targets governing the climate other than the Kyoto Protocol, and the latter could expire by 2017 which would leave a gap between 2017 and 2020[58].

A work plan is to be launched under the Durban Platform on enhancing the level of ambition to close the "ambition gap" and ensure the "highest level of mitigation efforts by all Parties"[59].

Current international platforms seem inadequate for the requirements of the current and projected climate change situation. Looking at the international financing scheme for example, if business as usual prevails, emissions will continue to rise. It is apparent that international platforms still do not permeate translation into national level policy sufficiently. However it may not be because the international law is inadequate, it could be that the country itself is still not ready, or does not have the capacity for such adaptive and mitigation technology.

Therefore it is important to get the commitment of the different parties participating in the overall international climate change adaptation and mitigation policies. However this is not simple. Looking at the international policy regime – in terms of where we are, there needs to be an increase in the ambition of country targets. For instance, in the national emission performance targets, the mitigation of sectors not yet targeted is a significant task. The aviation and maritime sectors are two areas where there is a lot of opportunity to reduce carbon footprint. Another issue international platforms can look at is addressing other gases that are more persistent in the atmosphere than carbon dioxide.

Interventions for the adaptation and mitigation happen at different levels: national, sub-national, and local. International platforms serve as overall guide for countries that need to iterate it in their development goals. Sub-national and local institutions' interventions should manifest the detailed implementation of international policies. Different tools vary at different levels and sectors depending on their base line condition and adaptive capacity of each LGU.

There are different responses delivered at the global level which vary at the local level. Models and scales (space and time), and conditions vary, thus the need for a suitable entry point, especially given the different planning systems for each country.

[58] Ibid.
[59] Ibid.

3.1 Linking international development with Southeast Asia: assessment of possible policy impact on Southeast Asia from international technology platforms

Climate change adaptation and mitigation technology platforms impact on Southeast Asian countries. This can be through knowledge sharing or increasing awareness about climate change impacts. International platforms encourage countries in the sub-region to push for climate change adaptation and mitigation policies in their development framework. However international platforms can only influence so much, because of the different situations of each country, so that the policy is translated in each country differently.

As for REDD+, which is meant partly to mitigate climate change impacts, its impact in countries is more visible because its focus is forest projects targeted to act as carbon sinks, via protection, reforestation, or aforestation. At the local level it is easy to see the hectares of trees planted, and guarded by the community. The number of trees planted and how many people were employed, and their salary is easily quantifiable. At the national level, impacts on policies made by the institutions that work with this project are seen as adaptive technology that they learned through the programme. At the regional and international level, the impact is how much carbon dioxide is absorbed by the carbon sink.

The two international technology platforms have different approaches, but still create impacts on countries. The level of cooperation is important in such platforms. At the international level extensive political processes are needed, accompanied by strong political will, to push forward certain programmes and for them to succeed.

4. Key challenges, areas of cooperation, and suggestion for future thematic priorities

As discussed above, climate change adaptation and mitigation technologies priorities were assessed in terms of possible areas of cooperation and improvements. As there are many opportunities for cooperation priorities need to be set.

This paper views these technologies at different levels, from the international to local level, which aid in identifying areas of cooperation.

One important opportunity is information sharing/ knowledge management. There needs to be a stronger information campaign on the impacts of climate change. This was an emerging issue before, but now that a lot of studies have been made by different nations given their particular experiences, the next step is to share the information.

The international technology framework as mentioned above can be strengthened in ways such as increasing the target outputs of the international platforms. Another area that can be considered is concentrating on sectors such as maritime and aviation to reduce carbon foot prints.

Although international platforms are contested, it can also serve as a safeguard where countries hold other countries responsible to adapt and mitigate. These can be in the form of reports for their projects, or when funding is given for aid or for loans, climate change mitigation and adaptation can be part of the condition.

Moreover one of the most crucial priorities in Climate Change Adaptation and Mitigation are the storm surges and the people living in the coastal areas. If there is one thing that is of utmost priority, it would be this, mainly because these areas and the people living in them will be the primary affected communities of climate change impacts. Hence if the question is what is to be prioritized, efforts should be placed here. (It should also be notable that a significant population in the region live in the coastal zones, and that most developments are also found in the coastal zone.)

The gains from the Durban Conference are laudable but much still is desired and remains to be achieved, as illustrated in the closing statement of the Irish Prime Minister, Mary Robinson:

> "Now, we must ensure that the necessary political will is mobilised to meet this deadline and to increase the ambition of emissions reductions targets in order to protect the most vulnerable people whose most basic rights to food, water and health are undermined by the impacts of climate change. Going forward, issues of equity and the right to development - principles underpinning the climate justice approach - will be core to agreeing a new legally binding regime."[60]

To manifest their political will the Irish Parliament on March 2012 debated and passed a motion which calls for the redoubling of effort of the Scottish Government in addressing climate change impact, to wit[61]:

> ".. welcomes the Scottish Government's commitment to ensuring respect for human rights and action to eradicate poverty and inequality, which are at the heart of Scotland's action to combat climate change both at home and internationally and strengthening Scotland's support for developing countries on climate change as part of Scotland's international profile; calls on the Scottish Government to redouble its efforts to reduce emissions and target climate change in Scotland by working with local authorities, public services, business and individual communities to ensure that all are equipped to respond to this growing threat in a manner that puts environmental justice and equality at its heart, developing new and transferable skills and encouraging the sharing of knowledge internationally to benefit the world, and further calls on the Scottish Government to announce a timescale for the creation of a Scotland-wide climate adaptation fund as outlined in the SNP manifesto and for the development of a system of consumption-based reporting targets as specified in section 37 of the Climate Change (Scotland) Act 2009."

[60] Statement from Mary Robinson on the Closing of COP17/CMP7. Mary Robinson Foundation for Climate Justice. http://www.mrfcj.org/press/releases/statement_from_mary_robinson_on_the_closing_of_cop17_cmp7.html?gclid=CJPp36Si9q8CFfFV4godKRa-TA

[61] The Scottish Parliament. 2012 March 01. Official Report. Meeting of the Parliament. Session 4. http://www.scottish.parliament.uk/parliamentarybusiness/28862.aspx?r=6878&mode=pdf

The challenge for Southeast Asian Countries thus is to set up the required Institutions (both policy and organizations, including structure and capacity). The interventions necessary range from formulating policy at various level, each aligned and strengthening the other, and linked to DRR; setting up the institutions, capacitating the individuals, ensuring the availability of financing

The models for: policy, institutions and interpretation of policy; for assessments; for capacity building and financing to a large extent exist; the major task is transferring learning within the region, across the organizational hierarchy and down the levels from the national to local, including communities. Some usually overlooked and difficult areas would be alignment of policy and organizational functioning; differentiating and integrating DRR and CCA; mainstreaming CCA; and engaging various stakeholders, especially the private sector[62], whose capacities have not yet been harnessed for adaptation and mitigation, especially in Southeast Asia.

[62] La Viña, A. G.M., et al., 2012, call for a multi-track approach to climate multilateralism and action, including tapping the private sector as partners of the public sector, and adopting a business orientation to climate change financing, action, and innovation – mitigation and adaptation; this is termed as track 2 in the abovementioned approach.

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