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Examining Cooperation for Climate Change Adaptation in Southeast Asia: The Case of Lower Mekong River Basin

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Contents

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ABSTRACT

A number of international initiatives on climate change identify cooperation as one of the means to addressing the changing climate. Cooperation also applies in the context of climate change adaptation. As one of the global hotspots for disaster risk, it is imperative for Southeast Asia to build its climate resilience through climate change adaptation. While there are a wide range of interventions that can contribute to climate change adaptation efforts, technology plays a particularly important role across different sectors. This paper is the first part of a series of work that examine the different mechanisms of cooperation for climate change adaptation in Southeast Asia. It takes Lower Mekong River Basin cooperation as a case study and it aims to assess the extent to which regional cooperation helps member countries to implement and expand technological solutions in climate change adaptation.

INTRODUCTION

Climate change adaptation, alongside with climate change mitigation, is often regarded as a means to dealing with the potential devastating effects of climate change. The Intergovernmental Panel on Climate Change (IPCC) defines mitigation as "an anthropogenic intervention to reduce the sources or enhance the sinks of greenhouse gases."[1] Climate change adaptation is referred to as an "adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities."[2] In other words,

[1] Intergovernmental Panel on Climate Change (IPCC). *Glossary of Terms used in the Third Assessment Report*, 2001. p. 379. Accessed March 15, 2018. https://www.ipcc.ch/pdf/glossary/tar-ipcc-terms-en.pdf

while climate change mitigation has the general objective of reducing carbon emission, climate change adaptation aims to increasing resilience against possible future climate events. Unlike its climate change mitigation counterpart, however, climate change adaptation often receives lesser attention from policymakers.[3]

The uncertain nature of future climate events contributes significantly to the lagging behind of climate change adaptation initiatives vis-à-vis climate change mitigation. Furthermore, while carbon emission reduction can be measured with relative ease thanks to the availability of tools such as the Greenhouse Gas Protocol,[4] estimating the level of climate resilience built upon climate change adaptation interventions is not as straightforward. "Timeframe, uncertainty and reverse logic of adaptation, messiness and complexity of adaptation, lack of baseline data, no defined yardsticks for success, and lack of resources and coordination"[5] are some of the identified challenges that render climate change adaptation a less favourable option for policymakers.

Despite an apparent lack of preferences for climate change adaptation, its relevance will become more pronounced as disaster events are increasingly attributed to the changing climate. Working on pre-emptive measures to respond to climate eventualities will result in community preparedness and resilience against potential attendant disasters. As climate change impacts various aspects of human lives in different ways, building climate resilience is key to ensuring the continuity and sustainability of the society.

One way of operationalising climate change adaptation is through the applications of technology. The concept is not entirely new as local communities have long incorporated traditional practices to deal with climate-induced events such as flooding.[6] With technological advancement, options for adaptation measures become wider and solutions for building climate resilience in specific sectors can be better crafted.

In its report, the Asian Development Bank (ADB) listed down the different climate change adaptation technologies that can be applied in agriculture, coastal resources, human health, transportation, water resources and disaster risk management sectors.[7] It also identified the types of technologies that can answer various cross-sectoral needs as seen in Table 1 below.

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[2] *Ibid*. p. 365.
[3] Climate Change Secretariat (UNFCCC). *Technologies for Adaptation to Climate Change*. Bonn: UNFCCC, 2006.
[4] "Greenhouse Gas Protocol." Accessed December 19, 2017. http://www.ghgprotocol.org/
[5] Jennifer Ellis, Climate Resilience Indicator Literature Review: Prepared as part of "Using Columbia Basin State of the Basin Indicators to Measure Climate Adaptation." *Columbia Basin Trus*t, 2014. Accessed December 19, 2017. http://www.cbrdi.ca/wp-content/uploads/ClimateAdaptation_LitReview_15-03-15.pdf
[6] Climate Change Secretariat (UNFCCC). *Technologies for Adaptation to Climate Change*. Bonn: UNFCCC, 2006.
[7] Asian Development Bank. *Technologies to Support Climate Change Adaptation*. Mandaluyong City, Philippines: Asian Development Bank, 2014. Accessed December 21, 2017. https://www.adb.org/sites/default/files/publication/149400/technologies-climate-change-adaptation.pdf

Multi-need technology	New crop varieties with greater heat tolerance	New crop varieties with lower water requirements	Improved water collection, storage, and distribution techniques	Improved irrigation efficiency	New crop varieties with higher moisture tolerance	Improved drainage techniques
Agriculture						
Crop breeding	✓	✓			✓	
Floating agriculture			✓			
Fungal symbionts	✓	✓			✓	
Laser land leveling			✓	✓		✓
Pressurized irrigation			✓	✓		✓
Coastal and water resources						
Accommodation to flooding						✓
Structural barriers						
Coastal engineering						
Beach nourishment and dune construction						
Constructed wetlands and artificial reefs						
Geosynthetics						
Water resources						
Aquifer recharge			✓			
Desalination			✓			
Interbasin water transfer			✓			
Nonstructural barriers to flooding						
Rainwater harvesting			✓	✓		✓
Reservoirs			✓			
Stormwater management and bioswales						✓
Water demand reduction			✓	✓		✓
Water loss reduction			✓	✓		✓
Water storage			✓	✓		
Disaster risk management						
Early-warning systems						
Light detection and ranging (LIDAR)				✓		✓
Monitoring systems						
Social media in disaster response						

Agriculture needs						
New crop varieties with improved pest and disease resistance	Improved pest and disease management techniques	Barriers to saltwater intrusion	Increased sustainable aquifer recharge	New crop varieties with greater salinity tolerance	Improved extreme weather prediction and early warning systems	Improved crop and livestock protection from extreme weather events
✓	✓			✓		✓
		✓				✓
✓	✓			✓		✓
						✓
		✓				✓
		✓				✓
		✓				✓
		✓				✓
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						✓
						✓
						✓
					✓	✓
						✓
	✓				✓	✓
					✓	✓

Table 1: Types of Climate Change Adaptation Technologies and Their Potential Cross-sectoral Uses[8]

[8] Asian Development Bank. *Technologies to Support Climate Change Adaptation*. Mandaluyong City, Philippines: Asian Development Bank, 2014. pp. 160-161. Accessed December 21, 2017. https://www.adb.org/sites/default/files/publication/149400/technologies-climate-change-adaptation.pdf

While the table provides options for technological solutions in building climate resilience, the final choices will depend on various factors including climate risk assessment, available funding, and actors' preferences, among others. In light of technological development, it is important to note whether the technologies used in climate change adaptation are considered new technologies, or leading to new technological innovations, or a reuse and an improved version of existing technologies.

For Southeast Asia, a number of climate change adaptation strategies based on sectoral approach have been planned at the national level.[9] From resilience-building perspective, however, climate adaptation initiatives that look into the ecosystems as a whole are far more effective than those designed on a sectoral basis. A "geographically-focused perspective"[10] that possibly needs to be implemented across shared national borders will be better able to address climate vulnerability more holistically. Drafting regional climate adaptation blueprints is therefore key, especially because they are currently less common than national-level policies. In Southeast Asia, a regional climate adaptation plan is still absent[11] although at sub-regional level the Mekong River countries have got their climate adaptation acts together under the leadership of the Mekong River Commission.

Climate adaptation cooperation at the Mekong River presents a good point for review not only because it is one of the areas in Asia-Pacific that are most vulnerable to climate change impacts[12] but also because Lower Mekong River Basin region already has a mechanism to deal with climate change adaptation. Kranz, et al., (2010) even observed that its climate change adaptation initiatives are likely to stand on solid ground thanks to the Mekong River regime's high effectiveness in managing the transboundary river basins.[13]

Against this backdrop, taking the Lower Mekong River as a case study, this paper aims to provide a preliminary assessment of the role of regional cooperation in effecting technological solutions for climate change adaptation in member countries. It examines the processes involved, identifies practices and potential gaps, and assesses the contribution of such cooperation to national initiatives on climate change adaptation. This study argues that having a dedicated regional mechanism for climate change adaptation will lead to more effective implementations of technologies for climate change adaptation and recommends the Association of Southeast Asian Nations (ASEAN) to look into establishing a similar mechanism at Southeast Asia level.

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[9] See for examples the 2006 National Adaptation Programme of Action to Climate Change of Cambodia and the 2009 National Adaptation Programme of Action to Climate Change of Lao PDR.

[10] USAID, Asia-Pacific Regional Climate Change Adaptation Assessment Final Report: Findings and Recommendations, Washington, DC: International Resources Group, 2010. Accessed December 20, 2017.http://pdf.usaid.gov/pdf_docs/pnads197.pdf

[11] de Guzman, Emmanuel. "How Asean could pave way for a climate-resilient southeast Asia." *Inquirer.net*, November 10, 2017. Accessed December 20, 2017. http://opinion.inquirer.net/108609/asean-pave-way-climate-resilient-southeast-asia

[12] USAID, Asia-Pacific Regional Climate Change Adaptation Assessment Final Report: Findings and Recommendations, Washington, DC: International Resources Group, 2010. Accessed December 20, 2017. http://pdf.usaid.gov/pdf_docs/pnads197.pdf

[13] Kranz, Nicole, Timo Menniken, and Jochen Hinkel, "Climate Change Adaptation Strategies in the Mekong and Orange-Senqu Basins: What Determines the State-of-play?", *Environmental Science & Policy* 13(7)(2010): 648–59.

THE MEKONG RIVER BASIN AND CLIMATE CHANGE

The Mekong River runs for 4,800 km across six different countries namely China, Myanmar, Lao PDR, Thailand, Cambodia, and Vietnam (see Figure 1a). Out of the 795,000 km^2 of the total Mekong River basin area, Lao PDR, Thailand, Cambodia, and China are endowed with the largest share while much smaller parts are located in Vietnam and Myanmar as shown in Figure 1b.

Figure 1a: Mekong River Basin area[14]

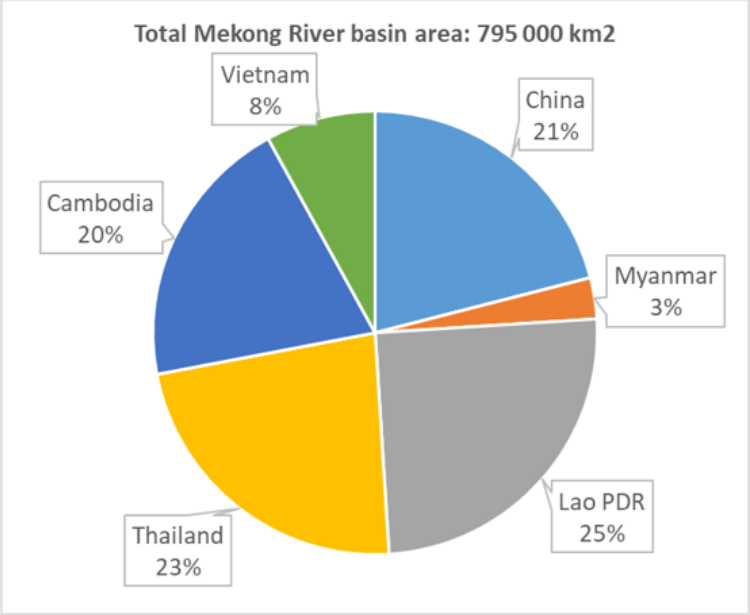
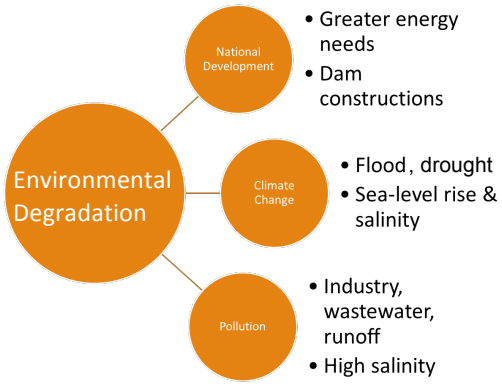


Figure 1b: % of basin area[15]

In terms of biodiversity, the Mekong River is the 2nd largest after the Amazon River. Its importance is highlighted with the fact that it supports the lives of more than 70 million inhabitants. In terms of the economy, the basin makes up of 15% of the world's rice production and sees USD17 billion worth of freshwater fish annually.[16]

The mean annual discharge of the Mekong River is 475km^3 and it provides 8,500m^3 of water for one person each year.[17] Although this quantity is considered abundant in comparison to other international river basins, water conditions in the Mekong River is threatened primarily by environmental degradation brought about by development needs, climate change, and pollution. Figure 2 below depicts the factors leading to environmental degradation, and their implications on water conditions in the Mekong River.

[14] Mekong River Commission. *IWRM-Based Basin Development Strategy for the Lower Mekong Basin.* 2009. http://archive.iwlearn.net/mrcmekong.org/download/programmes/bdp/IWRM-based-Basin-Dev-Strategy-1st-Incomplete-Con-Draft6Oct09.pdf
[15] FAO Aquastat. *Mekong River.* 2011. http://www.fao.org/nr/water/aquastat/basins/mekong/index.stm
[16] "New EIU Report: Mekong River Basin Water Security." *The Economist Intelligence Unit,* March 16, 2017. http://foodsecurity.dupont.com/2017/03/16/new-eiu-report-mekong-river-basin-water-security/
[17] Mekong River Commission. *IWRM-Based Basin Development Strategy for the Lower Mekong Basin.* 2009. http://archive.iwlearn.net/mrcmekong.org/download/programmes/bdp/IWRM-based-Basin-Dev-Strategy-1st-Incomplete-Con-Draft6Oct09.pdf



Source: Author

Figure 2: Factors leading to environmental degradation and implications on water condition

In recent years, much attention has been given to dam construction activities along the main Mekong River and their implications on people's livelihoods and displacement. Considering that the use of water in the Mekong River is mainly for irrigation-related purposes as seen in Figure 3 below, it is not surprising that concerns surrounding the Mekong River are primarily on livelihoods including agriculture and fisheries.

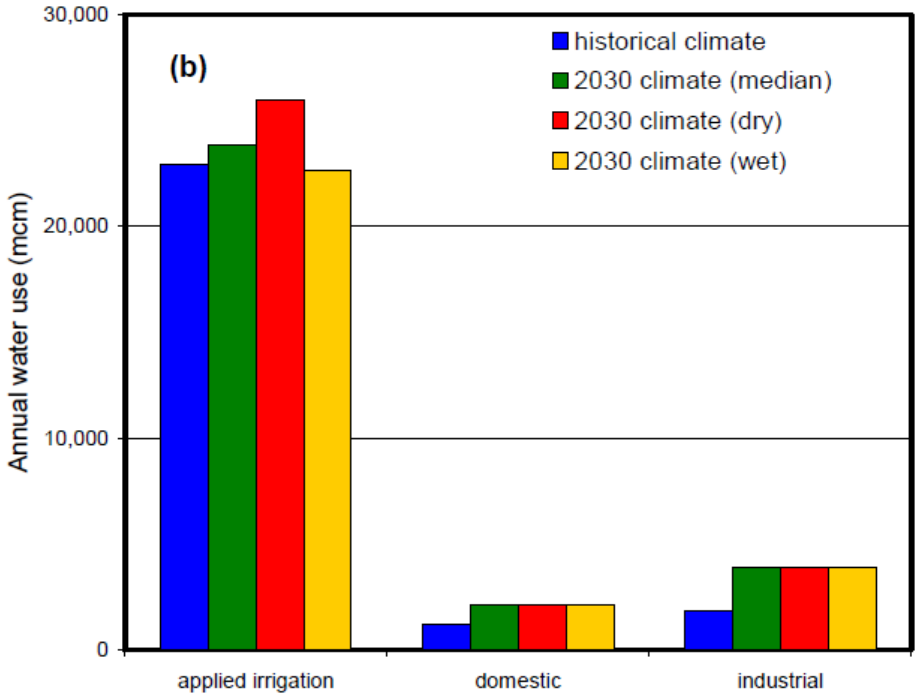


Figure 3: Water use along the Mekong River basin[18]

[18] Eastham J., Freddie Mpelasoka, Mohammed Mainuddin, Catherine Ticehurst, Peter Dyce, Geoff Hodgson, Riasat Ali and Mac Kirby. *Mekong River Basin Water Resources Assessment: Impacts of Climate Change*. Canberra: Commonwealth Scientific and Industrial Research Organisation, 2008. http://www.clw.csiro.au/publications/waterforahealthycountry/2008/wfhc-MekongWaterResourcesAssessment.pdf

While dam constructions driven by national development and greater needs for energy sources dominate the discussions surrounding the Lower Mekong River basin, climate change is also an issue that warrants attention. The major risks coming from climate change are increased frequency and intensity of floods during the wet season. Eastham et al. (2008)[19] predicted that the river runoff would increase by 21% and this may lead to a decrease in floodplain fish productivity by 18%.

Another climate-induced phenomenon is sea level rise and attendant increased salinity intrusion. Smajgl et al. (2015) estimated that sea level rise would stand at 30 cm by 2050, and this will bring significant detrimental impacts on agricultural production.[20] It may also cause some part of the land to disappear due to permanent inundation. Västilä et al., (2010) further suggested that the increasing severity of flood events will not only damage food crops, but it will also affect infrastructure, floodplain vegetation and reduce the fertile area.[21]

Given the potentially devastating consequences arising from climate change, countries in the Lower Mekong River have drafted their respective national climate change policies. Cambodia formulated its National Adaptation Programme of Action to Climate Change (NAPA) in 2006 and Lao PDR in 2009. Vietnam has multiple climate change-related policies that incorporate climate change adaptation framework such as the Central Party Committee's Resolution 24/NQ/TW (2013) on Responding to Climate Change,[22] National Climate Change Strategy 2011,[23] National Action Plan on Climate Change 2012-2020,[24] National Green Growth Strategy 2012,[25] and National Action Plan on Green Growth 2014.[26] Thailand's climate adaptation outlook is reflected in the National Adaptation Plan 2015-2023.

Additionally, these countries have established a regional mechanism for climate change initiatives under the Mekong River Commission (MRC). As it is argued that the existence of a dedicated regional framework on climate change adaptation may lead to better interventions in individual member countries, the next section examines the interactions between national and regional processes more closely.

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[19] Eastham et al., 2008.

[20] A. Smajgl, T. Q. Toan, D. K. Nhan, J. Ward, N. H. Trung, L. Q. Tri, V. P. D. Tri and P. T. Vu. "Responding to Rising Sea Levels in the Mekong Delta." *Nature Climate Change* 5 (2015): 167–74.

[21] K. Västilä, M. Kummu, C. Sangmanee, S. Chinvanno. "Modelling Climate Change Impacts on the Flood Pulse in the Lower Mekong Floodplains." *Journal of Water and Climate Change* 1(1)(2010): 67–87. Accessed December 22, 2017. http://jwcc.iwaponline.com/content/1/1/67?utm_source=TrendMD&utm_medium=cpc&utm_campaign=Journal_of_Water_and_Climate_Change_TrendMD_1

[22] Central Executive Committee of Vietnam Communist Party. "Resolution No.: 24-NQ/TW Active in Response to Climate Change, Improvement of Natural Resource Management and Environmental Protection," 2013. Accessed March 15, 2018. http://www.climatechange.vn/en/wp-content/uploads/sites/2/2017/04/Resolution-24NQ-TW-on-proactive-response-to-climate-change.pdf.

[23] The Prime Minister of Vietnam. "Decision 2139/QĐ-TTg on National Strategy on Climate Change," 2011. Accessed March 16, 2018. http://chinhphu.vn/portal/page/portal/English/strategies/strategiesdetails?categoryId=30&articleId=10051283.

[24] The Prime Minister of Vietnam. "Decision No. 1474/QĐ-Ttg on Issuance of National Action Plan on Climate Change Period 2012–2020," 2012. Accessed March 16, 2018. https://thuvienphapluat.vn/van-ban/Tai-nguyen-Moi-truong/Decision-No-1474-QD-TTg-on-issuance-of-national-action-plan-on-climate-change-182078.aspx.

[25] The Prime Minister of Vietnam. "Decision No. 1393/QĐ-TTg on Approval of the National Green Growth Strategy," 2012. Accessed March 16, 2018. https://www.giz.de/en/downloads/VietNam-GreenGrowth-Strategy.pdf.

[26] The Prime Minister of Vietnam. "Decision No. 403/QĐ-TTg on Approval of the National Action Plan on Green Growth in Vietnam for the Period of 2014-2020," 2014. Accessed March 16, 2018. http://cfovn.mpi.gov.vn/Portals/0/Upload/Decision_403-2014-TTg_EN.pdf.

CLIMATE CHANGE ADAPTATION MECHANISM IN THE LOWER MEKONG RIVER

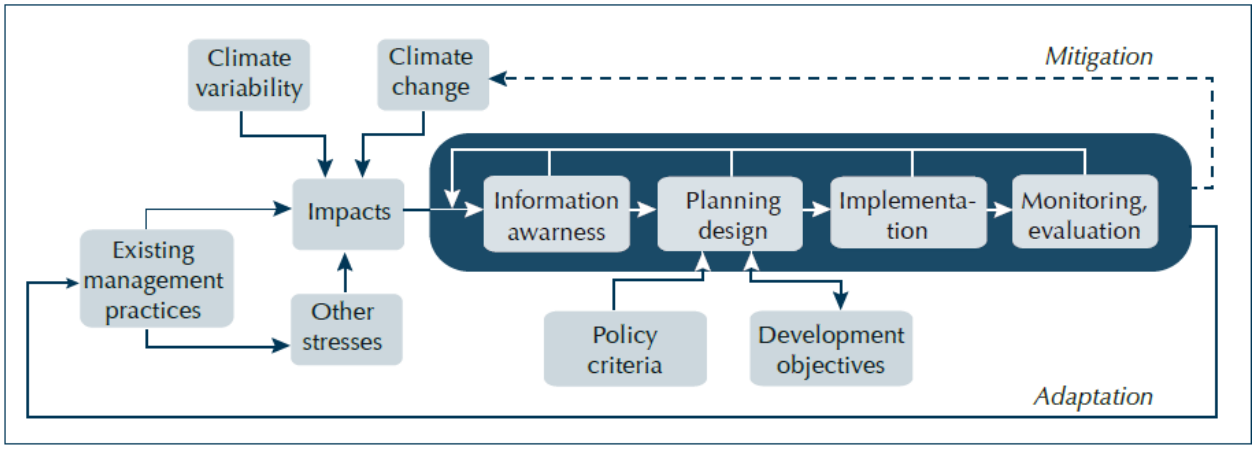

Figure 4: Steps to Plan for Climate Change Adaptation Measures[27]

The UNFCCC suggested a mechanism for climate change adaptation as seen in Figure 4, and climate change adaptation in the Lower Mekong River Basin generally follows the proposed model. It starts with a management, i.e. the MRC, that looks at the potential impacts of climate change in certain areas, and uses the findings to design relevant climate change adaptation policies and solutions. The MRC provides the institutional and financial supports for climate change adaptation efforts in the Lower Mekong River to function. The sub-regional grouping then established the Climate Change and Adaptation Initiative (CCAI) as a platform for Cambodia, Lao PDR, Thailand and Vietnam to formulate and share adaptation strategies. It has been instrumental in assessing the impacts of climate change on the Lower Mekong Basin.

The CCAI has implemented one demonstration project in each of the MRC member country and the extent of the climate adaptation work ranged from vulnerability assessment, awareness raising, capacity building, to actual implementations including irrigation extension, alternative livelihood activities and the use of flood-tolerant rice.[28] Through its findings and studies, the CCAI aspires to complement existing national climate adaptation policies of the MRC member countries and guides their climate adaptation efforts. The CCAI recognises that climate change adaptation will need continuous efforts. As such, monitoring progress and keeping track of trends are factored in as a key activity in ensuring suitable adaptation measures.

The presence of the CCAI serves as a good starting point for the MRC member countries to come together to work on climate change adaptation. Although specific adaptation strategies may differ from one place to another, the MRC member countries are essentially facing similar climate risks. These include the occurrence of more frequent drought and flooding and their impacts on agriculture and fishing productivity. By working on climate change adaptation collaboratively, countries can have better awareness of the challenges facing their neighbouring countries and better appreciation of the impacts of their neighbours' climate change adaptation initiatives, or the lack of such, on their own state of climate vulnerability. After all, climate change impacts recognise no borders and there is a need to respond to the issues from an ecosystem rather

[27] Climate Change Secretariat (UNFCCC). *Technologies for Adaptation to Climate Change*. Bonn: UNFCCC, 2006.
[28] Mekong River Commission. "Climate Change and Adaptation Initiative." Accessed December 4, 2017. http://www.mrcmekong.org/assets/Posters-leaflets/CCAI-leaftlet-final.pdf

than a sectoral perspective. Having a regional mechanism that directly informs national initiatives is therefore likely to result in the strengthening of the resilience of the Lower Mekong Basin as a whole.

To operationalise its cooperation, the MRC has drafted the Mekong Adaptation Strategy and Action Plan (MASAP) and taken into account existing relevant initiatives including the 2016-2020 Integrated Water Resources Management-based Basin Development Strategy (BDS), the 2016-2020 Strategic Plan, and the 2009-2025 Climate Change and Adaptation Initiative (CCAI) Framework Document. The MRC adopts a holistic two-pronged approach by formulating policy-based and vulnerability-based adaptation measures.[29] The former creates an enabling environment, such as policy and institution, financial and information system, human resource capacity, among others, whereas the latter addresses water, resources and socio-economic vulnerability through technical and infrastructure solutions. The MASAP focuses on seven priority areas namely the mainstreaming of climate change into national policies, cooperation and partnership, transboundary and gender sensitive adaptation framework, adaptation finance, monitoring, data collection and sharing, capacity building, and communication and outreach.[30] The comprehensive approach to climate adaptation initiatives is also reflected in the MRC's strategy to engage external partners such as ASEAN, the Lancang-Mekong Cooperation (LMC), donors, international financial institutions and the wider climate change stakeholders. The presence of regional policies and a vision to adopt technological solutions for climate change adaptation provide a strong building block for regional climate-resilience building processes to take place.

DONORS AND CLIMATE CHANGE ADAPTATION TECHNOLOGY

Guided by policies that determine adaptation strategies and priorities, countries then carry out risk and vulnerability assessments to identify potential problems and present a range of possible solutions, including technology interventions. Although solutions are already on the table, the uptake of such recommendations appears to be very much dependent on donor support. This can be observed from several planned activities under MASAP strategic priorities that suggest a heavy reliance on external financing. Examples include the identification of the need to foster partnerships especially for the purpose of securing funding for project formulations and implementations, the acknowledgment of the need to identify funding sources and develop proposal for submission to funding source, and the emphasis on securing access to adaptation financing.[31] Such extent of reliance on donor interventions may significantly influence the workings of the regional mechanism, including the choice of technology solutions for climate change adaptation.

Donors have indeed been playing significant roles in supporting many climate change adaptation initiatives in the Lower Mekong River Basin. In fact, 96% of the total USD 15,901,305 budget plan that the CCAI estimated for the year 2011-2015 was funded by donors[32] as seen in Table 2 below.

[29] Mekong River Commission. *Mekong Adaptation Strategy and Action Plan Version 3.0*. 2017. p. 42. Last accessed April 19, 2018. http://www.mrcmekong.org/assets/Uploads/MASAP-Ver-3.0.pdf
[30] *Ibid*., p. v.
[31] Ibid., pp. 48–50.
[32] Mekong River Commission. *Climate Change Adaptation Initiative 2011-2015 Programme Document*. Vientiane: MRC, 2011. http://www.mrcmekong.org/assets/CCAI-2011-2015-documentFinal.pdf

Funding agreed, committed and pledged	USD
Australia, agreement	2,260,000
Denmark, agreement	900,000
Germany, committed	1,950,000
Luxembourg, agreement	2,600,000
Sweden, agreement with EP	545,000
Finland, agreement with IKMP, ICBP	600,000
EU, pledged	6,500,000
Total	15,335,000
Funding gap	545,000

Table 2: CCAI funding for 2011-2015 agreed and committed[33]

While donors' involvements serve as an important enabling factor, their influence may extend to the choice of intervention measures. The ADB, for example, carried out climate change impacts assessments in Kien Giang and Ca Mau provinces and came up with a set of climate change adaptation recommendations. Of the long list of options encompassing various technological solutions such as the construction of irrigation and drainage systems, clean water supply system and environmental sanitation, the building of dykes and roads, the upgrading of canals, and drainage sewage and wastewater treatment in various cities and provinces, the ADB proposed a shorter list of climate adaptation actions in which the ADB priority was part of the evaluation criteria.[34]

German development agency GIZ has also contributed to climate change adaptation efforts in Lower Mekong River Basin. Focusing on flood management, one pilot project was conducted in each of the MRC member states. In Lao PDR's Khammouane province, the initiative has led to technological applications in the construction of new bore wells, communal water storage and filtration systems.[35] In Vietnam, the project carried out in Dong Thap province has focused more on non-structural interventions. The structural, technological intervention was reflected in the provision of water storage tanks and filters.[36] The extent to which GIZ had influence over the choices of such technologies needs to be further examined.

The USAID also conducted similar climate change adaptation projects in Thailand's Chiang Rai and Sakon Nakhon provinces, Lao PDR's Khammouane province, Cambodia's Kampong Thom Province and Vietnam's Kien Giang province.[37] Risks of flooding and drought were identified in Thailand, Lao PDR and Cambodia, whereas the threats of sea level rise, coastal erosion and salinity intrusions were highlighted in Vietnam. Of the various climate adaptation initiatives that the USAID implemented, technology applications were mostly evident in the water, agriculture, and livestock management sectors. On water-related concerns in Lao PDR, technological solutions were seen in the constructions of gravity-fed water harvesting systems, storage tanks, pipelines and taps, and wash platforms. In a bid to conserve water, they installed taps that only discharge water when in demand in some small-scale household pig productions.

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[33] *Ibid*.
[34] Buckle, Philip. *Climate Change Impact and Adaptation Study in the Mekong Delta TA7377-VIE Vietnam Final Report, an ADB Technical Assistance Consultant's Final Report*. 2013. https://www.adb.org/sites/default/files/project-document/80872/43295-012-tacr-04.pdf
[35] "Mekong River Commission and GIZ Conclude Adaptation Pilot Project in Khammouane." *GIZ*, May 23, 2016. Accessed December 15, 2017.https://www.giz.de/en/worldwide/38683.html
[36] "GIZ Conclude Adaptation Pilot Project in Mekong Delta." *VOV/GIZ, MRC*, May 5, 2016. Accessed December 15, 2017. http://english.vov.vn/society/mrc-giz-conclude-adaptation-pilot-project-in-mekong-delta-318937.vov
[37] DAI. *USAID Mekong Adaptation and Resilience to Climate Change (USAID Mekong ARCC) Final Report*, 2016. Accessed December 22, 2017. http://mekongarcc.net/sites/default/files/usaid_mekong_arcc_final_report_rev_2.pdf

Aside from these measures, the USAID also tried to improve climate resilience through non-technological solutions such as awareness raising, the introduction of black pigs and more robust crops such as fruit trees, Assam tea, pepper, bamboos, and edible rattan, the construction of fish ponds and compost pits, and the establishment of community forests.

Fundamental to the debates on donors influence is that their choices may not exactly match the priorities of recipient countries.[38] Although the observation is not completely unfounded, it also cannot be concluded definitively. Many of the climate change adaptation interventions begin with climate risk and vulnerability assessments and they provide the basis and justification for the choice of climate adaptation actions technologies. Any possible interventions in the final choices will warrant further examinations.

MRC'S REGIONAL CLIMATE CHANGE ADAPTATION INITIATIVES

The MRC has carried out pilot projects in some demonstration sites between 2010 and 2013. In Cambodia, the climate change adaptation project was implemented in Prey Veng Province, an area of high vulnerability to flood and drought, as seen in Figure 5.[39] The technology intervention implemented was the rebuilding of a reservoir to provide water to nearby communities in times of drought. Subsequently, climate adaptation interventions in the province focused on crop planting strategies, water management-related measures including encouraging responsible and efficient use of water, and other technological solutions such as the building and repairing of flood protection dykes, the upgrading of water gates and the building of culverts among others.

Figure 5: The estimated area within Prey Keng province where the 1st batch of MRC's demonstration projects were carried out in Cambodia. [40]

[38] See for example: Ayers, Jessica M., and Saleemul Huq. "Supporting Adaptation to Climate Change: What Role for Official Development Assistance?" Presented at DSA Annual Conference 2008 'Development's Invisible Hands: Development Futures in a Changing Climate,' Church House, Westminster, London, November 8, 2008. Accessed December 21, 2017. https://www.iied.org/supporting-adaptation-climate-change-what-role-for-official-development-assistance

[39] Mekong River Commission (MRC). *Results and Lessons Learnt from the First Batch of Local Demonstration Projects 2010-2013, Demonstration Project Series No. 1*. Vientiane: MRC, 2014.

[40] Ibid., p. 16

In Lao PDR, the climate change adaptation activities were carried out in Champhone District of Savannakhet Province seen in Figure 6.[41] Climate adaptation measures mainly aimed to increasing resilience against worsening flood and drought. Technological measures applied included the extension of irrigation canal, the use of flood-tolerant rice varieties, and the possible use of sandy soils for agricultural crops.

Figure 6: The estimated area within Champhone District of Savannakhet province where the 1st batch of MRC's demonstration projects were carried out in Lao PDR.[42]

In Thailand, the MRC's climate adaptation demonstration projects were carried out in Sai Na Wang community of Kalasin Province at the upper catchment of Young River Basin and Wang Luang communities of Roi-Et Province at the lower end of the Yang River Basin as seen in Figure 7.[43] The former was selected due to its susceptibility to drought and the latter due to its history of heavy floods.

Figure 7: The estimated area where the 1st batch of MRC's demonstration projects were carried out in Thailand.[44]

[41] Mekong River Commission (MRC). *Results and Lessons Learnt from the First Batch of Local Demonstration Projects 2010-2013, Demonstration Project Series No. 1*. Vientiane: MRC, 2014.
[42] *Ibid.*, p. 22
[43] Warnset, Prasit and Yanyong Inmuong. *Local Demonstration Projects on Climate Change Adaptation Final Report of the First Batch Project in Thailand*. Vientiane: Mekong River Commission, 2014. Accessed December 21, 2017. http://www.mrcmekong.org/assets/Publications/Reports/Local-demonstration-projects-on-CCA-final-report-of-1st-batch-project-in-Thailand.pdf.
[44] *Ibid.*, p. 47.

The activities carried out in the project sites were mostly on assessments and awareness raising through stakeholder meetings, surveys, research, and database building. The only climate adaptation initiative having technological spin in it was the devising and the installation of a low-cost climate telemetering system at four riverside stations of the Young River Basin. It functions as a data collection tool as the sensors gather climate data, rainfall wind speed and direction, temperature and humidity. It then transmits the information that has been stored in a data-logger to a server at the RMUTI via GPRS module internet network.

Although the low-cost telemetering system seems to be the only technological solution being introduced, the project uncovered existing local-based climate-resilient farming practices that include the applications of integrated farming, smart water management in the paddy, animal manure in place of chemical fertiliser, climate-tolerant native seed, farmland resource recycling, soil moisture conservation through the planning of fruits and trees, and fish and poultry farming in the paddy pond. Such discovery resonates with studies by Nyong et. al (2007)[45] and Anik and Khan (2012),[46] among others, that showcase local communities' capability to design their own adaptation methods. The identification of existing local knowledge signifies that solutions may not necessarily be designed from scratch and technology applications may only need to complement and optimise the outputs of existing adaptation practices. Regional cooperation can document and process such wisdom and experiences systematically, and utilise them to develop region's own technological solutions to climate change adaptation in Southeast Asia.

In Vietnam, the pilot project was carried out in Binh Giang commune of Kien Giang province seen in Figure 8. Just like other Mekong River states, the main climate-related concerns in Binh Giang commune are flood and drought.[47] Based on the findings, a combination of structural and non-structural measures is perceived to provide the best avenues for climate change adaptation. Structural measures entail technological interventions, for example in the construction of sea dykes and hydraulic works such as canals, sluices and embankments. Indeed, the project recommended that there is a need for more sluices, digging of some existing and new canals, and expansion of flood discharge areas. Non-structural measures emphasise on the social elements including forecasting capability, awareness raising, and warning system among others.

[45] Nyong, A., Adesina, F. and B. Osman Elasha. "The Value of Indigenous Knowledge in Climate Change Mitigation and Adaptation Strategies in the Africa Sahel." *Mitigation and Adaptation Strategies for Global Change* 12 (5)(2007): 787–97.
[46] Anik, Sawon Istiak and Mohamed Abu Sayed Arfin Khan. "Climate Change Adaptation through Local Knowledge in the North Easter Region of Bangladesh." *Mitigation and Adaptation Strategies for Global Change* 17(8)(2012): 879–96.
[47] Truong, Hong Tien and Nguyen Anh Duc. *Local Demonstration Projects on Climate Change Adaptation Final Report of the First Batch Project in Viet Nam*. Vientiane: Mekong River Commission, 2014. Accessed December 21, 2017. http://www.mrcmekong.org/assets/Publications/Reports/Local-demonstration-projects-on-CCA-final-report-of-1st-batch-project-in-Vietnam.pdf

Figure 8: Geographical location of Binh Giang commune[48]

At this juncture, it can be observed that the MRC's Climate Change and Adaptation Initiative (CCAI) has indeed enriched national adaptation plans through pilot projects in MRC member states. Through the projects, it also has facilitated the use of different types of technology in building climate adaptation capacity. The regional framework, therefore, provides a good platform to implement climate adaptation initiatives on the ground.

CLIMATE CHANGE ADAPTATION TECHNOLOGIES IN REGIONAL SETTING – CHALLENGES AND WAY FORWARD

Although the CCAI has successfully administered its functions to complement national adaptation efforts, the regional grouping is yet to exercise its full potential since the focus remains on individual countries. It has neither adopt an ecosystem lens in assessing the vulnerability of the overall Lower Mekong River Basin nor has it come up with joint projects where member states can share resources and work collaboratively to build climate change adaptation. There has yet, for example, climate change adaptation project that is designed along shared borders between MRC member states. Doing so is critical to ensure that climate adaptation is achieved in the Lower Mekong River Basin and not only in some select sites within member states.

In addition to the suggested regional-level ecosystem-approach, building regional resilience can also be done by replicating similar projects in other areas. The USAID suggested that this can be done through "ground-up pathways, knowledge products, financing pathways, and thematic scaling."[49] Ground-up pathways broadly refers to the efforts to influence national planning by local stakeholders whereas knowledge product means documenting lessons learned in a way that can

[48] *Ibid.,* p. 107.
[49] DAI. *USAID Mekong Adaptation and Resilience to Climate Change (USAID Mekong ARCC) Final Report*, 2016. p. 69. Accessed December 22, 2017. http://mekongarcc.net/sites/default/files/usaid_mekong_arcc_final_report_rev_2.pdf

be relevant and applicable in other areas. Financing pathways are particularly challenging because even if funding sources like international agencies, multilateral development organisations and multilateral climate funds, can be relatively easy to identify, meeting the conditions stated by the sources can serve as barriers to accessing the funding. Thematic scaling is another form of packaging the lessons learned from a particular site into broad themes that can be applied elsewhere.

In terms of institutional framework, aside from providing the institutional and financial space for climate change adaptation projects to operate, the extent to which such cooperation has resulted in increased regional climate resilience remains uncertain. Indeed, measuring the level of increased resilience brought about by adaptation initiatives is not a straightforward undertaking. The USAID report referred to it as "an emerging science, with new models arising from experiences around the world."[50] The efforts to develop climate adaptation indicators are essentially a recent phenomenon and there is yet a standardised guideline to follow. Similarly, although there are a number of attempts to theorise and formulate the indicators to measure resilience, consensus on measurement is yet to materialise. The absence of such standardised measurement makes evaluating the effectiveness of regional adaptation initiatives challenging.

In terms of technological applications, this study reveals that the technologies used for climate change adaptation in the Lower Mekong Basin are not entirely new. In fact, the majority of technology use is found in civil engineering or infrastructural applications such as the building or upgrading of embankments, dykes, and water storage and filter. This is in line with a range of technological solutions suggested by the ADB that are mainly on infrastructure except for agriculture and disaster risk management. The real question therefore appears to be whether or not existing infrastructure is sufficient in number and quality to face future climate stresses. Technology applications are frequently labelled as hard policy options and often face competitions from soft policy options like land use change, introduction of salinity-tolerant rice varieties and crops.[51] While civil engineering solutions seem to dominate the applications of technology in climate change adaptation, the emergence of modern technologies characterised by digitisation, lightweight, and mobility, may bring about the development of more innovative and effective technologies for climate change adaptation.

The insights from climate change adaptation initiatives in the Lower Mekong Basin provide a few important pointers for other regions to learn from. Institutional support from the sub-regional MRC grouping in the form of dedicated structure, functions and policies on climate change adaptation seems to act as a key enabler that allows member states to carry out concerted efforts to assess climate risks and obtain funding. Although the MRC has yet to fully utilise the potential of its mechanism to bring all member states to work collaboratively, establishing a dedicated regional mechanism for climate change adaptation provides the right platform for various region-wide climate adaptation cooperation to flourish.

Additionally, it has also been observed that technologies used for climate change adaptation need not necessarily be the ones that are too advanced or futuristic. Countries can tap into existing technologies, and this will potentially reduce the costs incurred to acquire such technologies. The regional mechanism will enable countries to come together and work collaboratively to perfect existing technologies, benefit from technology transfers and their spin-offs, and develop new technologies that better respond to the needs at local level. Lastly, although measuring climate adaptation and resilience is still a work-in-progress, an institutionalised regional approach to climate change adaptation is likely to be more effective in building overall resilience compared to efforts by individual countries. It will also make room for joint climate change adaptation initiatives along shared borders between countries in the region in the future.

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[50] *Ibid*, p. 94.

[51] A. Smajgl, T. Q. Toan, D. K. Nhan, J. Ward, N. H. Trung, L. Q. Tri, V. P. D. Tri and P. T. Vu. "Responding to Rising Sea Levels in the Mekong Delta." *Nature Climate Change* 5 (2015): 167–74.

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