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Use of CBMS for Vulnerability Risk Mapping[1]

Marian Cunanan[2]

Marinduque is a small island province with a land area of 95,925 hectares. It is composed of six (6) municipalities and 218 barangays, and extends about 170 km. south of Metro Manila between the Bondoc Peninsula at the eastern portion of Luzon and Oriental Mindoro. It is bounded on the north by Tayabas Bay, on the northeast by Mongpong Pass, on the southeast by Tayabas Strait and on the south by Sibuyan Sea. Almost one-fourth (22,205 has.) of the land area are categorized as timberland or forestland while the rest are classified as Alienable and Disposable (A/D). In 2005, Marinduque occupied the 3rd rank in the Department of Environment and Natural Resources' (DENR) list of provinces with the most denuded forest cover. Meanwhile, the province's 2008 Community-Based Monitoring System (CBMS) data show that 48 percent of the total household population are living below the poverty threshold. There are also 710 households that are considered as informal settlers in the province, with homes mostly located along the coastal areas. Of the 218 barangays in the province, 81 are coastal barangays.

Marinduque is within the Pacific tropical storm path commonly known as the typhoon belt area. Available records show that from 1978 to 2009, there were 9 destructive typhoons that brought severe damages to the province, including loss of lives, properties, livelihood, and infrastructure.

Devastation caused by typhoon. Uprooted trees and debris carried by the fast flow of the river are a stark reminder of the devastation wrought by Typhoon Frank in the Province of Marinduque in 2008. *(Source: Provincial Government of Marinduque)*

Apart from being ranked as number 3 among provinces with the most denuded forest cover, Marinduque was also categorized as the 7th most hazard-prone province in 2006 by DENR. Available records show that Marinduque is susceptible to various hazards such as ground shaking, landslides, floods and storm surges since the province is surrounded by sea. Through

Inside

[1] An updated/revised version of the paper presented during the 9th Poverty and Economic Policy (PEP) Research Network Meeting held on December 3-9, 2011 in Siem Reap, Cambodia.

[2] Project Development Officer IV, PPDO-Marinduque. The author would like to acknowledge the expert technical assistance provided by Jasminda Asirot-Quilitis and Novee Lor Leyso of the CBMS Network.

the project, *Integrating Disaster Risk Reduction and Climate Change Adaptation in Local Development Planning and Decisionmaking Processes*, sponsored and coordinated by the National Economic and Development Authority-Regional Development Council Staff (NEDA-RDCS), in partnership with the United Nations Development Programme (UNDP) and the Australian Agency for International Development (AusAID), the provincial government of Marinduque was able to identify the level of susceptibility of a particular area or barangay to landslides and floods.

But while it is important to identify the susceptibility level of a particular area, it is also crucial to assess or determine the vulnerability of a community or barangay and/or the capability and capacity of the community to bounce back after a calamity. In partnership with the Economy and Environment Program for Southeast Asia (EEPSEA) and the CBMS Network, the province of Marinduque was able to come up with the Climate Change Vulnerability Index (CCVI) of a particular barangay and municipality. The data generated through this system will aid the province's local government units (LGUs) in mainstreaming the Disaster Risk Reduction Climate Change Adaptation (DRR CCA) in their respective local development planning, particularly as reference for the province's Disaster Risk Reduction and Management (DRRM) planning.

A total of 41 indicators which fall under 11 sub-categories subsumed under the following sub-indices comprising the CCVI were considered: (a) exposure to climatic hazards, (b) sensitivity, and (c) lack of adaptive capacity. The results of this project are discussed below:

Exposure Index

In computing for the Exposure Index, available susceptibility maps on landslide and flood were acquired from the Mines and Geosciences Bureau. Areas with high, moderate and low susceptibility to flood were divided by municipalities and barangays to compute for the areas of susceptibility. The same procedure was done for the landslide susceptibility maps. High, moderate and low susceptibility were then given weights of 0.5, 0.33 and 0.17, respectively. Meanwhile, the number of typhoons which crossed the province from 1948-2009 was also considered. The results showed that from among the province's six municipalities, the Municipality of Sta. Cruz, which is the largest municipality in terms of land area, has a high Exposure Index at 0.762. This means that many of the barangays in Sta. Cruz are prone to landslides, flooding and typhoon (Figure 1).

Located in the northeastern part of the province, Sta. Cruz is hilly and mountainous

Figure 1.
Exposure Index, by Municipality and Barangay, Province of Marinduque, 2011

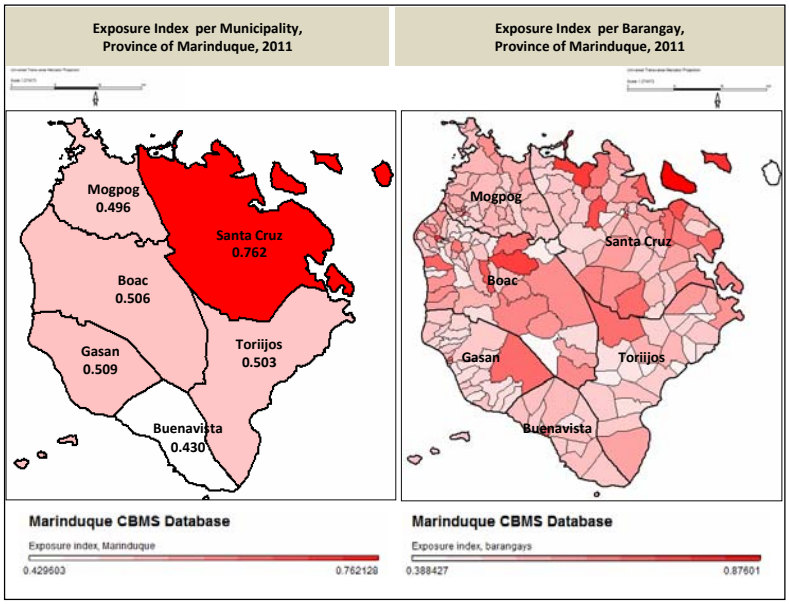


Figure 2.
Sensitivity Index, by Municipality and Barangay, Province of Marinduque, 2011

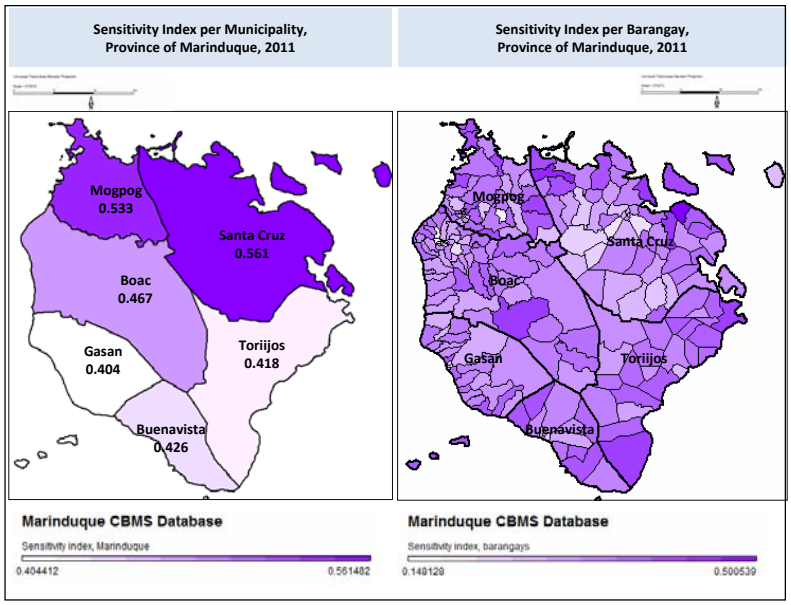


Figure 3.
Lack of Adaptive Capacity Index, by Municipality and Barangay, Province of Marinduque, 2011

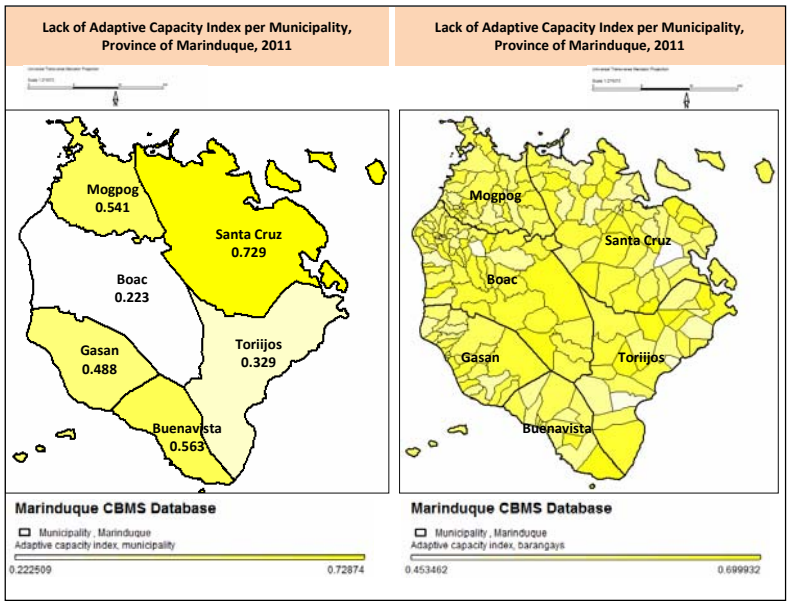
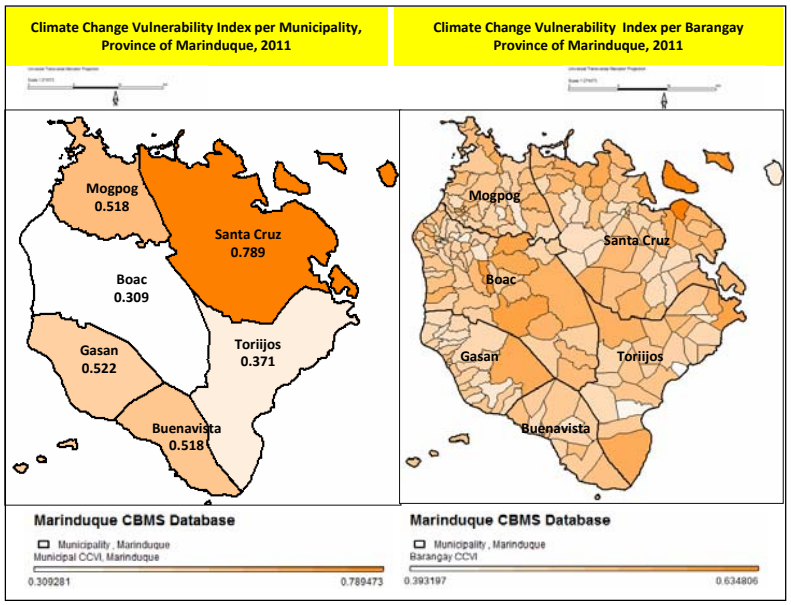


Figure 4.
Climate Change Vulnerability Index, by Municipality and Barangay, Province of Marinduque, 2011



with slopes ranging from 18 percent and above. More than half of the 55 barangays in Sta. Cruz are coastal barangays. There are ongoing reforestation projects in some barangays of this municipality, e.g., the Development Bank of the Philippines (DBP) Forest Project, the National Greening Project, and Adopt a Mangrove Project, among others.

It will be noted that except for Buenavista, the other municipalities also have relatively high Exposure Index. Moreover, some barangays which have high Exposure Index are either near or along the rivers and streams or coastal areas of Boac and Sta. Cruz, making them exposed not only to landslides and erosions but also to floods.

What the exposure index map shown in Figure 1 shows is that the darker the color is, the higher the vulnerability index is.

Some of the barangays that have high Exposure Index are Brgys. Polo, Maniwaya, Ipil, Landy, Biga in Sta. Cruz; Gitnang Bayan in Mogpog; and Brgys. Murallon, Bantay and Balagasan in Boac.

Flooding is normally caused by surface run-off due to typhoon and heavy rains coming from the adjacent upland barangays, and is worsened by the siltation brought about by erosion from the poorly managed watershed, and clogged river streams caused by uprooted trees and debris from the eroded river embankment. The flood plains of Boac were further worsened by the 1996 Marcopper Tapian Pit spill. Likewise, in Mogpog River, the river bed elevation is higher than the barangay built-up area due to the continued siltation from the overburden of the abandoned Marcopper stockpile.

Sensitivity Index

Sensitivity Index refers to the responsiveness of a system to climate change – the more sensitive a system is, the larger the rate or magnitude of an adverse response is to a given hazard. For Sensitivity Index, the following were considered in the computation: the land areas categorized as protected, agricultural, industrial/commercial; the presence of heritage sites; the socioeconomic status that concerns the livelihood at risk like those population engaged in fishing; the population-at-risk like the children, elderly, people with disabilities (PWDs); and the population density per barangay.

Based on the above, Sta. Cruz recorded the highest Sensitivity Index at 0.561 followed by Mogpog at 0.533.

Figure 2 indicates that the barangays with high Sensitivity Index are located either mostly in the interior portion or along the coastal areas.

It can be noticed that Sensitivity Index and Exposure index are relatively connected. For instance, municipalities and barangays with large protected areas such as those in the mountains and along the coastal areas, and agricultural land areas are the ones with high susceptibility to typhoons, floods and landslides.

Lack of Adaptive Capacity Index

Adaptive Capacity is defined as the ability of a system to adjust to climate change or to moderate the potential damage from it. In coming up with the Adaptive Capacity Index, the system required generating data/information on current barangay socioeconomic profiles like the number of health workers, health facility, good roads, dams and dikes, presence of DRR equipment, DRRM Plan, Early Warning System (EWS), and even access to household phones that can be used during calamities, among others. Lack of Adaptive Capacity Index was computed by subtracting the computed Adaptive Capacity Index from 1.

Figure 3 shows clearly that among the 6 municipalities, Boac has the best adaptive capacity index. Available data show that Boac, which is a 1st class municipality, has available health workers and barangay health facilities that can cater to the population in the area. It may not yet be adequate, but compared with the other municipalities in the province, it is better equipped and can address these particular service and facility requirements in the barangay. For instance, there are evacuation centers in almost all the barangays (usually, the schools and barangay hall/centers are being utilized as evacuation centers); most barangays have good roads; 100 percent of the barangays have DRR communication equipment such as cellphone; presence of EWS; and more than half of the household population have access to phones.

Climate Change Vulnerability Index

Summarizing the 3 categories or indexes, the result shows that the municipality of Sta. Cruz has the highest CCVI at 0.789.

Meanwhile, among the 218 barangays in the province, Brgy. Biga in Sta.Cruz has the highest CCVI at 0.635. Brgy. Biga is a coastal barangay, located at the northeast portion of the province; facing Tayabas Bay; and is open to northwest monsoon. The preliminary report shows that almost 74 has. in the barangay have high susceptibility to landslides while 64 has. are susceptible to flooding due to surface run-off and during high tides.

The Exposure Index of Brgy. Biga is 0.719. On the other hand, its Sensitivity Index is 0.501. More than half of Brgy. Biga's 360 household population are engaged in fishing and crops farming. A large portion of the barangay is hilly and rice production is rainfed, with farmers practicing upland farming. Its population density is 235 persons per sq.km., higher than that of the province's and slightly lower than that of the municipality's population.

Brgy. Biga also recorded the highest lack of adaptive capacity at 0.666. More than half of its household population live below the poverty threshold. Only 100 meters of the barangay's roads are concreted, with the remaining stretch made of either earth of gravel roads that easily scour and wash out during extensive rains and floods. For a population of 360, there are only three Barangay Health Workers, giving a health worker to population ratio of 1:1,080. It has no barangay health station (BHS), with the nearest being more than 2 kms. away, and the next higher health facility (in Brgy. Malabon) being 7 kms. away and can be reached by passing through rough roads.

The Barangay Disaster Risk Reduction Management Council's (BDRRMC) average DRR fund is PHP66,000.00 or PHP183.00/ per person. The barangay hall and primary school in the barangay are normally being utilized as evacuation centers but may not be adequate to accommodate the potential population who will be at risk during extreme weather condition.

Concluding Remarks

Studies show that small islands are considered the most vulnerable to natural disasters such as typhoons. This is true for the center of the Philippine archipelago, the province of Marinduque.

The Vulnerability Risk Mapping using CBMS is a tool to determine the level of vulnerability of a barangay or municipality which a province can use as its reference or guide in planning appropriately and acting accordingly to at least cope with any adverse impact or effect of climate change on its local communities.

For the province of Marinduque, climate change impacts such as those that come in the form of stronger and more frequent typhoons will increase the impact of natural hazards in many areas of the province, particularly those that are already highly prone to landslides and floods. Given this increasing vulnerability of many of its communities, the need for disaster risk reduction and climate change adaptation has therefore become more urgent for Marinduque. It will not only save lives but also protect assets and livelihoods and prevent more people from becoming poorer than they already are.

Rainfall-induced landslide. A portion of a road embankment slid several meters downslope due to heavy rains brought by Typhoon Frank.
(Source: Provincial Government of Marinduque)

CBMS conducts AHP workshop to generate weights for climate change vulnerability indicators

Experts from eight government and non-government agencies working on climate change-related initiatives sat down on February 6, 2012 to discuss and assign weights to the sub-indices, sub-categories and localized indicators of the climate change vulnerability index (CCVI) using the Analytical Hierarchy Process (AHP) method.

Organized by the CBMS Network in connection with its ongoing study on the application of the Economy and Environment Program for Southeast Asia (EEPSEA) framework and module on climate change vulnerability assessment and mapping, the workshop gathered experts from the Climate Change Commission (CCC), Department of the Interior and Local Government (DILG), Manila Observatory (MO), National Anti-Poverty Commission (NAPC), National Disaster Risk Reduction and Management Council (NDRRMC), National Economic and Development Authority (NEDA), Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), and the Philippine Institute for Development Studies (PIDS).

A total of 41 indicators which fall under 11 sub-categories subsumed under the following sub-indices comprising the CCVI were considered: (a) exposure to climatic hazards, (b) sensitivity, and (c) adaptive capacity. Sixteen of these indicators (e.g., proportion of households engaged in fishing, proportion of population living below the poverty threshold, proportion of households with access to landline or mobile phone, etc.) were directly sourced from the CBMS while the rest came from the Mines and Geosciences Bureau (MGB) and administrative records of the pilot local government units (LGUs).

The results of the AHP workshop show that among the sub-indices, experts deem adaptive capacity to be more important than exposure and sensitivity. In terms of sensitivity, population-at-risk was given more value than livelihood and ecological sensitivity which can be explained by the fact that the priority in disaster management is to save lives first, property second, and ecology last. For adaptive capacity, infrastructure and service facilities were considered to be the more important sub-categories. Meanwhile, in terms of exposure, typhoons were given a heavier weight than landslides and floods.

The AHP is a structured technique for organizing and analyzing complex decisions. Based on mathematics and psychology, it was developed by Thomas L. Saaty in the 1970s and has been extensively studied and refined since then. It has been used to assist numerous corporate and government decisionmakers in looking at options and alternatives. The technique involves the decomposition of information into a hierarchy of criteria and alternatives, after which the information is synthesized to determine relative rankings of alternatives.

Experts' Group Meeting. Acknowledging the variability in the degree of importance of the indicators included in the Climate Change Vulnerability Index (CCVI), experts from eight agencies sat down to discuss and assign weights using the Analytical Hierarchy Process (AHP) method.

The CBMS study aims to generate preliminary climate change vulnerability index and maps at the village level that would show empirical evidence and analysis on the impacts of climate change. After finalizing the indices and maps, the CBMS Network aims to recommend adaptation strategies which can then be integrated in the disaster and other environment management plans of LGUs in the pilot areas of Marinduque, Northern Samar and the Municipality of Carmona, Cavite.

CBMS research teams in Viet Nam and Indonesia are also conducting the same study in collaboration with their partner LGUs.

Indonesia expands adoption of CBMS for Women Empowerment in 18 provinces

Training of Trainors. The SMERU Research Institute conducted capacity-building activities for regional trainers of PEKKA on January 9-13, 2012, including a CBMS training on data collection and a pilot test of the CBMS questionnaire in two villages in Kabupaten Bangkalan, Madura Island, East Java Province.

Following the completion of the PEP-supported Community-Based Monitoring System (CBMS) Project in Indonesia, the CBMS Team based at the SMERU Research Institute is now providing technical support to the National Secretariat of PEKKA (Women Household Empowerment) in the adoption of CBMS in selected areas in 18 provinces in the country. Said initiative is being funded by the Australian Government.

PEKKA is a program in Indonesia which generally aims to strengthen capacities of women households to contribute to the process of having a prosperous, democratic, gender-fair and respected society. In particular, it aims to improve women household heads' welfare, organize and facilitate access of women household heads to various resources, facilitate active participation of women household heads in every phase of development, raise awareness among women household heads on their rights as human beings and as citizens equal to others, and empower women heads of households to have control of their lives and of the decisionmaking process within their families and society.

The CBMS-PEKKA collaboration officially commenced on December 19, 2011. The collaboration, which will last until December 2012, involves the conduct of a series of capacity- building activities on CBMS data collection, processing and analysis, and the development of training modules that suit the needs of PEKKA. Capacity building on CBMS for Seknas PEKKA (at the national level) started with the conduct of the workshop, "Planning and Capacity Building: PEKKA Community-Based Poverty Monitoring System" at the Santika Hotel, Bogor, West Java Province on December 19-21, 2011. Participants of this workshop included researchers of the National Secretariat (Seknas) PEKKA, the National Task Force for Poverty Reduction Acceleration (TNP2K), and the GRM International (Australian Government Initiative). CBMS training on data collection for regional trainers of PEKKA, and the pilot test of the questionnaire in two villages in Kabupaten Bangkalan, Madura Island, East Java Province were also conducted on January 9-13, 2012. Training of local enumerators, meanwhile, shall be conducted by the PEKKA regional trainers in March-April 2012.

The SMERU Research Institute, in partnership with PEP, had pilot tested the CBMS methodology and instruments in Indonesia in 2005. The project generally aims to promote the importance of conducting periodic local monitoring activity to local stakeholders. Said initiative is in line with the need to understand the regional dimension of poverty and the call for a monitoring system that is conducted and owned by the communities. The Project has demonstrated the reliability of survey results and has provided evidence on how CBMS can foster welfare of the people through better targeting and design of more relevant programs for communities. In 2008, the City Government of Pekalongan adopted and implemented CBMS as a tool for local planning and for monitoring the millennium development goals (MDGs). In addition, CBMS was also used in 2010 by SMERU for the conduct of the PEP- supported study on monitoring the impacts of the global financial crisis on poverty.

CBMS stakeholders set to converge anew for a 3-day confab

CBMS Stakeholders. More than 700 stakeholders-the biggest attendance as yet of practitioners, academicians and policymakers, including at least 7 governors and 143 mayors-of the Community-Based Monitoring System (CBMS) participated in the 7th CBMS Philippines National Conference held at the Sofitel Philippine Plaza in Pasay City on February 7-9, 2011.

An expected large number of around 800 community-based monitoring system (CBMS) stakeholders from all over the country is set to converge for the 8th CBMS Philippines National Conference which will be held at the SMX Convention Center, Mall of Asia Complex, Pasay City on March 19-21, 2012.

Designed to provide a venue for sharing best practices and recent developments as well as for tackling emerging issues in line with the implementation and use of the CBMS in the country, the conference also aims to showcase the rich, fruitful and meaningful experiences, primarily of local government units, in using CBMS for planning and budgeting, program formulation, policy impact assessment and poverty monitoring, among others.

The CBMS is considered as one of the country's widely used and locally based tool in acquiring a richer body of information and data on the welfare of the poor. Implemented in 66 provinces covering 20,671 barangays located in 776 municipalities and 51 cities in the country, the CBMS has enabled poor communities to assert their needs to local and national policymakers and program implementers as well as to influence budgetary allocations. As such, it has become a direct instrument for empowerment and actual poverty reduction.

The 8th CBMS Philippines Conference will feature 3 keynote speeches and sessions tackling urgent issues among development practitioners in the country today, including the following: Disaster Risk and Vulnerability Mapping and Assessment, Climate Change Adaptation, Impact Monitoring and Evaluation of Poverty Reduction Strategies and Programs, Meeting the Millennium Development Goals (MDGs), Evidence-Based Planning and Budgeting, Improving Governance, Information Technology Innovations through CBMS, Social Protection and Inclusive Growth, Women Empowerment, and Promoting Children's Rights.

Last year, the conference attracted over 700 attendees, with 78.5 percent of them coming from local government units (LGUs) and 12.7 percent coming from national government agencies. About 25 percent of the LGU participants were City and Municipal Mayors.

9th PEP General Meeting concludes in Cambodia

Group Photo. PEP Network researchers and stakeholders, together with His Excellency, Chhay Than, Senior Minister of the Ministry of Planning of Cambodia (10th from right), and Dr. Rohinton Medhora, Vice President for Programs of the International Development Research Centre (IDRC) (9th from right), gather for a group photo before the close of the conference which was held at the Angkor Era Hotel in Siem Reap, Cambodia on December 3-9, 2011.

More than 125 researchers and stakeholders of the Poverty and Economic Policy (PEP) Research Network gathered in Siem Reap Cambodia on December 3-9, 2012 during the 9th PEP Research Network General Meeting.

Organized by the PEP-Asia and CBMS Network Office in collaboration with the Ministry of Planning of the Kingdom of Cambodia, the conference was preceded by a PEP School on CBMS-Based Poverty Mapping and a Policy Conference where PEP research on impact evaluations, public infrastructure and inclusive growth were presented.

The conference papers and presentations are now available for download from the PEP website: http://www.pep-net.org

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The ***Updates*** may be downloaded free from the Project's website: http://www.pep-net.org.

For inquiries, please write or call:
PEP Asia & CBMS Coordinating Team
Angelo King Institute for
Economic and Business Studies
De La Salle University-Manila
10th Flr. Angelo King International Center
Estrada cor. Arellano Sts., Malate,
Manila 1004, Philippines
Tel No: (632) 523-8888 loc. 274
DL/Telefax No: (632) 526-2067
E-mail: cbms@benilde.edu.ph
cbms.network@gmail.com

Editorial Staff

CBMS NETWORK UPDATES
PEP Asia and CBMS Coordinating Team
Angelo King Institute for Economic & Business Studies
De La Salle University-Manila
10th Flr. Angelo King International Center
Estrada cor. Arellano Sts., Malate, Manila 1004, Philippines