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Editors
David James
Independent Consultant
Whale Beach, NSW, Australia

Herminia A. Francisco
Economy and Environment Program
for Southeast Asia (EEPSEA), WorldFish
Laguna, Philippines

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Foreword

Cost-benefit analysis (CBA) as a technique to help decision makers make investments, assess regulations, and assess difficult public policy tradeoffs has been around for over 50 years. What makes another book about cost-benefit unique and worth reading? What does a reader have to learn? This book is different because it focuses on pragmatic issues in Southeast Asia examined by researchers from the region. As sponsor of the research, the Environment and Economy Program of Southeast Asia (EEPSEA) mentors each researcher to help create studies that can be used in the classroom and help inform decision makers. EEPSEA researchers participate in workshops and training courses where they get valuable feedback on their work and hands-on experience working with international experts. The studies in this book should thus appeal to a wide audience who want to see how economic techniques are applied in practical settings and also learn about critical environmental and resource issues in Southeast Asia. A variety of economic tools are used: benefit cost analysis as well as cost effectiveness and multi-criteria analysis. In this way they "triangulate" on the benefit and cost estimates using multiple methods. Many of the studies examine policies rather than facilities or projects as is common in traditional benefit cost analysis. One area of particular importance is the estimation of the benefit side of cost-benefit analysis. Benefits create measurement problems for the analyst, and in many studies are ignored or measured very crudely. The result is an over-emphasis on the cost side amongst policy makers rather than a fulsome look at the total picture. This one-sided approach can lead to decisions that are not in the best interests of society.

Part I, Chap. 1, introduces the purpose of the text, the regional setting, and the role of EEPSEA. Chapter 2 provides the historical context for CBA and covers the core concepts and conceptual bases fundamental to a CBA study. Part II focuses on studies in the natural resource areas of agriculture, forestry, and fisheries. The first two chapters in part 2 compare the cost effectiveness of biofuels to conventional fossil fuels in reducing greenhouse gases (GHGs) and other pollutants. In Chap. 3, Wang explores under what circumstances biodiesel from a plant (*Jatropha curcas*) would be competitive with fossil fuels using a lifecycle analysis methodology.

A financial analysis shows that biodiesel is not competitive. But if yields of the plant are improved and/or carbon emissions from fossil fuels are priced in a more fulsome social cost and benefit accounting framework, biodiesel becomes more competitive. The study illustrates the value of undertaking a lifecycle approach as well as considering the environmental costs and benefits of alternative fuels. Thanh in Chap. 4 also compares the cost effectiveness of biofuels – ethanol and biodiesel – to fossil fuels in a lifecycle analysis for Vietnam and finds that improvements in biofuel productivity are needed to make biofuel as cost efficient as fossil fuels. Ethanol, however, can compete favorably with fossil fuels if used in a fuel efficient vehicle.

Turning to agriculture, Launio and co-authors in Chap. 5 also use cost effectiveness to assess methods to alter farm management practices. Rice straw, a by-product of rice production, is typically treated as waste by farmers, and when burned emits methane (a GHG) and nitrogen oxide. The authors use production functions to estimate the magnitude of the problem and assess the cost effectiveness of alternative government policies and farm management practices to reduce carbon emissions. Ranking the options, they find that on-farm practices of incorporating straw stubble into the soil, followed by composting, are the most cost effective.

Economic models of forest management traditionally focused only on maximizing the net value of timber harvests. In recent years, researchers have incorporated the benefits of sequestering carbon in timber into a theoretical model of optimal forest harvests. Nhung's paper in Chap. 6 finds that land holders harvest timber at a younger age than what the theoretical model yields when carbon sequestration is included. The challenge is to find policies that provide incentives for land owners to delay harvests. Payments to farmers to increase the rotation interval – a lump-sum payment of carbon benefits at the beginning of the rotation – and a planting cost subsidy are explored.

How can land be used to benefit both the land holders and the environment? Yem and co-authors in Chap. 7 compute the net social benefits of land managed as large scale rubber plantations compared to smallholder rubber plantations in Cambodia. Their study shows the importance of incorporating the social component – the impact of land conversion on the local population. Conversion from crop production (maize, soybean, cassava, and cashew) to smallholder rubber plantation provides the largest benefit to farmers involved in those conversion schemes. Removing the natural forest and converting the land to large-scale rubber plantation ranks last among their options.

The final chapter in Part II explores policies to reduce water pollution from inland aquaculture practices in Vietnam. Lang and co-authors compute the cost effectiveness of different waste management approaches and add an important component to their technical analysis – consultations with fish farmers on the practicality of different policies. The authors recommend three policy directions: the establishment of fish planned zones to help create concentrated wastewater treatment systems and reduce treatment costs; set and enforce emission standards;

and set up an environmental fund to provide long-term loans with preferential interest rates to fish farmers to enable them to build treatment systems.

Part III contains two papers on river basin management – developments of river basin resources. Project evaluation of such development projects typically entails evaluation of benefits and costs with and without the project. In Chap. 9, Thoradeniya examines a reservoir development project in this framework, but also includes stakeholder involvement and a range of nonmarket values. Limited information was available for the environmental valuation and demand analysis – but the researcher found various ways to approximate the values. The most novel aspect of this study is that the study incorporated stakeholders and communities in a validation/calibration approach to assess valuation and benefit cost analysis. Gunaratne also examines a resource development project and evaluates options for a sand mining project, but in addition to benefit cost analysis, he employs multi-criteria analysis to evaluate the options. As input into the analysis, the preferences of workers are incorporated (via choice modelling) and expert opinion is also employed. Both of these project evaluation examples use multiple methods, stakeholder input, and an array of other sources to inform project selection.

Part IV of the volume focuses on economic analysis of protected areas. Economic analysis of protected areas has been hampered by the lack of information on various benefit categories (non-timber forest products, recreation/tourism, threatened species benefits, etc.). The authors of these chapters recognize these limitations and either collect primary data or employ benefit transfer techniques. What is also admirable is that in many cases the papers augment the formal benefit cost analysis with stakeholder interviews as a form of "calibration" or as a method to include political feasibility or distributional aspects of the issue within the problem analysis. In Chap. 11, Baylatry et al. evaluate multiple outputs (market and non-market) including soil erosion, forest carbon, tourism and other economic outputs. In some cases they rely on benefit transfer while in others they collect primary data. Hou et al. assess community forestry policies in Cambodia in Chap. 12. Their analysis also includes multiple categories of outputs such as timber, water and other services and they obtain primary data in many of the cases. In Chap. 14, Roongtawanreongsri et al. examine the possible options for a suburban forest area of southern Thailand. In this case the range of benefits examined in assessing land use options includes timber, water supply, carbon, flood control and biodiversity. This study also discusses some rather unusual benefit categories that have not been addressed in much of the literature. While there are clearly limitations in the availability of information on biological and economic factors like biodiversity and flood control, this study, like most in this volume, uses various sources of data or benefit transfer techniques. This study also raises questions about benefits capture (is there a way to capture or monetize the nonmarket values) and the fact that the benefit cost analysis is only the first step in policy development. The discussion of the establishment of a payment for ecosystem services program to actually implement the protection program illustrates the role that benefit cost analysis can play in aiding policy design.

Jian et al. employ cost effectiveness analysis rather than full benefit cost analysis in their assessment of wetland conservation in Chap. 14. They also use multi-criteria analysis to compare the policy options. This interesting study recognizes the distributional aspects of benefit cost analysis or cost effectiveness analysis by engaging with stakeholders and searching for a policy option that results in a relatively efficient yet equitable outcome.

The last three papers in the volume in Part V examine adaptation to climate change and the evaluation of projects that may protect against adverse effects of climate change. Arias et al. in Chap. 15 examine the benefits and costs of construction of coastal infrastructure to protect against the impacts of sea level rise in the Philippines. A major component of the analysis is the assessment of areas affected. A set of advanced techniques are used to forecast the impacts. Values of properties as well as environmental values (measured using benefits transfer) were incorporated into the analysis. Danh examines a similar issue when investigating the benefits and costs of a sea dike. This study rigorously incorporated risk analysis and sensitivity analysis to identify the variability of benefits and costs over time. The timing of the construction of the dikes is also an issue in this case, suggesting the possibility of a real options analysis in future research. In contrast to the previous studies, Arias et al., in Chap. 17, use the demand for early warning services as valued by individuals affected to determine the benefits of climate adaptation projects. This set of three papers illustrates the wide range of methods, components of value, and a variety of technical approaches to sensitivity analysis to evaluate options for mitigating the effects of climate change. While all three studies find options that appear to be the best to use to combat the effects of climate change, such as building sea dikes, they all also recognize the sensitivity and uncertainty of these outcomes.

The papers in this volume illustrate the challenges in conducting benefit cost analysis in areas involving environmental values (e.g. nonmarket values), uncertainty due to a lack of information, or an inherently variable system (e.g. climate change). The researchers employ a number of different methods to address these challenges, including stakeholder input, methods that attempt to triangulate the benefit cost analysis, or other novel approaches. While there are many uncertainties about the accuracy of the value estimates and others aspects of these studies, as there often are with any benefit cost analysis, the papers in this volume are creative, attempt to use multiple methods and employ sensitivity analysis in various ways to do the best with limited data. The result is a set of informative examples of benefit cost analysis involving environmental challenges in Southeast Asia.

University of Alberta
Edmonton, AB, Canada
Vic Adamowicz

Simon Fraser University
Burnaby, BC, Canada
Nancy Olewiler

Preface

As a regional organization tasked with developing the capacity of Southeast Asian researchers in environmental economics research to inform policy formulation in the region, the Economy and Environment Program for Southeast Asia (EEPSEA) has supported a number of researchers over the years through its research grant program. Among the various methods used by EEPSEA researchers in conducting policy relevant studies is cost-benefit analysis (CBA). For this book, we selected 15 studies that highlight how CBA was used to understand and/or evaluate solutions to natural resource and environmental problems. The aim is to provide researchers with reference material that demonstrates how they can use CBA to support improved natural resource and environmental management in their own countries.

The studies were carried out in a developing country setting where data availability – and sometimes expertise to implement such research – has a bearing on the quality of the analysis. Hence, we were guided by two main goals in selecting cases for this book. Firstly, we wish to demonstrate that, despite such problems, researchers can still generate meaningful results that can help decision makers. Secondly, we wish to provide teachers in the region with useful discussion and case materials showing how they can improve the application of CBA to achieve a better environment. This latter objective is consistent with EEPSEA's mandate and with what our donors – the International Development Research Centre (IDRC), the Swedish International Development Cooperation Agency (Sida) – and our host organization, WorldFish, expect us to deliver as part of their development support for researchers in Southeast Asia and China.

I want to thank the people whose tireless efforts helped produce this book: our lead editor, Dr. David James, who also guided most of the researchers in this collection during the conduct of their studies; Dr. Canesio Predo for co-writing a chapter in this book and for his logistical support to the project; and Dr. Noor Aini Zakaria, Julienne Bariuan-Elca and Mia Mercado for their logistical support in communicating directly with the authors and in getting the book into its present form. Finally, we want to thank the various researchers for their contributions in transforming their studies into versions appropriate for inclusion in the book and for

agreeing that their studies could be used as teaching cases to train future researchers in this field.

Southeast Asia is endowed with rich natural and environmental resources. About half of the world's terrestrial and marine biodiversity resources are found in the region. Unfortunately, many of the region's resources are in varying states of degradation and depletion, clearly indicating the need to improve their management. To do so requires the use of various tools that different disciplines have to offer. In the case of economics, the field offers several tools capable of determining how to manage these valuable limited resources more efficiently or cost-effectively – CBA being one of them. As such, I hope this book provides useful insights into the importance of these CBA studies as a means of identifying best courses of management action.

Los Banos Laguna, Philippines Herminia A. Francisco

Contributors

Jaimie Kim B. Arias Department of Economics, College of Economics and Management, UPLB, Laguna, Philippines

Constancio A. Asis Soils and Plant Physiology Division, Philippine Rice Research Institute (PhilRice), Muñoz, Nueva Ecija, Philippines

Vicente G. Ballaran Jr Agrometeorology and Farm Structures Division, Institute of Agricultural Engineering, College of Engineering and Agro-industrial Technology, UPLB, Laguna, Philippines

Malabou Baylatry Greater Mekong Subregion Division, The Lao National Mekong Committee Secretariat, Ministry of Natural Resources and Environment, Vientiane Capital, Lao PDR

Sara Bumrungsri Department of Biology, Faculty of Science, Prince of Songkla University, Hat Yai, Songkhla, Thailand

Vo Thanh Danh School of Economic and Business Administration, Can Tho University, Can Tho City, Vietnam

Moises A. Dorado Agrometeorology and Farm Structures Division, Institute of Agricultural Engineering, College of Engineering and Agro-industrial Technology, University of the Philippines Los Baños (UPLB), Laguna, Philippines

Rowena A. Dorado Department of Economics, College of Economics and Management, UPLB, Laguna, Philippines

Herminia A. Francisco Economy and Environment Program for Southeast Asia, WorldFish, Los Banos Laguna, Philippines

Ngo Thi Lam Giang Tat Thanh Institute of Agrobiology, Nguyen Tat Thanh University, Ho Chi Minh City, Vietnam

L.H.P. Gunaratne Department of Agricultural Economics and Business Management, Faculty of Agriculture, University of Peradeniya, Peradeniya, Sri Lanka

Kalyan Hou The Center for People and Forest (RECOFTC), Forestry Administration, Phnom Penh, Cambodia

Maredi Im The Center for People and Forest (RECOFTC), Forestry Administration, Phnom Penh, Cambodia

David James EEPSEA Resource Person and Independent Consultant, Whale Beach, NSW, Australia

Evelyn F. Javier Soils and Plant Physiology Division, Philippine Rice Research Institute (PhilRice), Muñoz, Nueva Ecija, Philippines

Han Keam National Committee for Sub-national Democratic Development (NCDD), Kampong Thom Province, Cambodia

Quang Vinh Ky Climate Change Coordination Office of Can Tho City, Can Tho City, Vietnam

Cheryll C. Launio Socioeconomics Division, Philippine Rice Research Institute (PhilRice), Muñoz, Nueva Ecija, Philippines

Shushan Li School of Environment & Natural Resources, Renmin University of China, Beijing, People's Republic of China

Vuthy Lic Environment and Natural Resources Unit, Cambodia Development Research Institute (CDRI), Phnom Penh, Cambodia

Sivannakone Malivarn Greater Mekong Subregion Division, The Lao National Mekong Committee Secretariat, Ministry of Natural Resources and Environment, Vientiane Capital, Lao PDR

Rowena G. Manalili Socioeconomics Division, Philippine Rice Research Institute (PhilRice), Muñoz, Nueva Ecija, Philippines

Sothunvathanak Meas The Learning Institute, Phnom Penh, Cambodia

Maria Emilinda T. Mendoza Department of Social Development Services, UPLB, Laguna, Philippines

Thi Thanh Truc Ngo Department of Agricultural, Natural Resources and Environmental Economics, Can Tho University, Can Tho City, Vietnam

Nghiem Thi Hong Nhung Department of Public Health, University of Otago, Wellington, New Zealand

Kunyu Niu School of Environment & Natural Resources, Renmin University of China, Beijing, People's Republic of China

Canesio Predo College of Forestry and Natural Resources, University of the Philippines Los Baños, Laguna, Philippines

Saowalak Roongtawanreongsri Environmental Economics Research Unit, Faculty of Environmental Mangement, Prince of Songkla University, Hat Yai, Songkhla, Thailand

Chanty Ros National Committee for Sub-national Democratic Development (NCDD), Kampong Thom Province, Cambodia

Prakart Sawangchote Department of Biology, Faculty of Science, Prince of Songkla University, Hat Yai, Songkhla, Thailand

Chaisri Suksaroj Department of Civil Engineering, Faculty of Engineering, Prince of Songkla University, Hat Yai, Songkhla, Thailand

Loan Le Thanh Faculty of Economics, Nong Lam University, Ho Chi Minh City, Vietnam

Bhadranie Thoradeniya Division of Civil Engineering Technology, Institute of Technology, University of Moratuwa, Moratuwa, Sri Lanka

Neth Top Environment and Natural Resources Unit, Cambodia Development Research Institute (CDRI), Phnom Penh, Cambodia

Philayvanh Viravouth Greater Mekong Subregion Division, The Lao National Mekong Committee Secretariat, Ministry of Natural Resources and Environment, Vientiane Capital, Lao PDR

Thi Lang Vo School of Economics & Business Administration, Can Tho University, Can Tho City, Vietnam

Xiaoxia Wang School of Environment & Natural Resources, Renmin University of China, Beijing, People's Republic of China

Zanxin Wang School of Development Studies, Yunnan University, Kunming, Yunnan Province, People's Republic of China

Jian Wu School of Environment & Natural Resources, Renmin University of China, Beijing, People's Republic of China

Dararath Yem Environment and Natural Resources Unit, Cambodia Development Research Institute (CDRI), Phnom Penh, Cambodia

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Part I
Guide to Cost-Benefit Analysis and Case Studies