Sustainability Matters

Environmental Management in Asia

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PREFACE AND ACKNOWLEDGEMENTS

The Master of Science (Environmental Management) [Msc (Env Mgt)] Programme was launched in July 2001, by the National University of Singapore (NUS). Often referred to as the “MEM” programme, it is a multi-disciplinary graduate programme to provide education in environmental management for senior and mid-level managers in corporations, institutions, and government and non-government organisations. It aims to equip graduates with the necessary inter-disciplinary and multi-disciplinary knowledge to properly manage the environment and to deal with the challenges of an environmentally conscious society and international market. It enables graduates to assume responsible and influential roles in the public and private sectors and to make environmentally sound decisions that support sustainable development and livelihoods.

The MEM Programme is jointly mounted by seven Faculties and Schools in the NUS, namely, the Faculties of Arts and Social Sciences, Engineering, Law, and Science; and the NUS Business School, the Yong Loo Lin School of Medicine, and the School of Design and Environment (SDE) which hosts the programme. It is administered by a Director, from the staff of the host Faculty/School, the SDE, under the leadership of a Programme Management Committee which comprises a representative from each Faculty/School. The Programme also draws on the talents of the teaching staff of the Lee Kuan Yew School of Public Policy which was established in 2004 with the mission of educating and training the next generation of Asian policymakers and leaders. The MEM Programme has formal links with the Yale School of Forestry and Environmental Studies (FES) and Duke University’s Nicholas School of the Environment and Earth Sciences, providing for collaboration in teaching and research as well as academic staff (faculty) and student exchanges. The program draws its inspiration from the Yale Master of Environmental Management (MEM) programme. Much as we would have liked to call our programme the MEM in a similar vein, we decided to name it more conventionally as an MSc programme, this being more readily acceptable by industries. And so the programme remains formally today as the MSc in Environmental Management, although we refer to it as the MEM programme.

It is a requirement of the MEM Programme that each student must pursue research in a chosen field and, under guided supervision, complete either a dissertation of 20,000 words or a study report of 10,000 words. This book is the first volume of a collection of some of the best research papers done by students in the programme for the initial years from 2001/2002 to 2006/2007. They have been edited and abridged for publication. In each chapter, the name of the student appears first, and that of the supervisor/s follows thereafter. Future volumes will soon follow. The programme wishes to acknowledge those students whose works do not appear in this volume, emphasizing that every student in this programme has contributed to its success.

Apart from the students, many people have also contributed to the success of this programme. We wish to thank them most sincerely. They are:-

1. Former NUS President Prof Shi Choon Fong, former Provost Prof Chong Chi Tat of NUS and the NUS Board of Graduate Studies for approving this unique programme in 2001.
2. The Deans of the seven Faculties and Schools in NUS who have joined us in this programme. They have supported us by mounting relevant courses in their faculties/schools and recognising the contributions of their staff in teaching, supervision of research and in examining our students.
3. Each and every member of the teaching and administrative staff.
4. The representatives of each Faculty, who serve on the Programme Management Committee. Their enthusiasm and passion for the environment and for this programme has helped in immeasurable ways to ensure its sustainability and its constant improvement.
5. The Deans of the School of Design and Environment (Prof Cheong Hin Fatt [2000–2007] and Prof Heng Chye Kiang [2008 to date]) for hosting the programme and giving it administrative and financial support.
6. The Directors of the programme, Dr Malone-Lee Lai Choo (2001–February 2009), Dr Ong Boon Lay (March 2009–31 December 2009) and Prof George Ofori (1 January 2010), who actually administer this programme.
7. The members of our Advisory Committee, particularly its Chair, Prof Tommy Koh.
8. Our partners in this venture, the Yale School of Forestry and Environmental Studies. Dean Prof Gus Speth signed an MOU with the programme at its inception in 2001, and was Lee Kuan Yew Distinguished Visitor to NUS in 2005. Each year, Assoc Prof Marian

Chertow, Director of the Industrial Management Programme teaches our students in the course “Business and the Environment”, and recently, students were also taught by Dr Weslynne Ashton, Director of the Yale programme on Industrial Ecology in Developing Countries.

Last but not least, the programme wishes to gratefully acknowledge the support of Shell Companies in Singapore. Since the programme’s early years, Shell has contributed financially, enabling us to fund bursaries for needy students and prizes for the best students. Shell also bears the costs of this publication. We wish to thank its Chairman Mr Lee Tzu-yang for his continued encouragement and support. Mr Lee has been a member of the MEM Advisory Committee since June 2002. Thanks are also due to Shell’s Mr Warren Fernandez, Regional Director (Asia Pacific), who is also on our Advisory Committee; Ms Mavis Kuek, General Manager, External Affairs & Communications, and Ms Caroline Loke, Head, Social Investment, External Affairs. They have taken a keen interest in our programme, attending our seminars and other events, sharing their expertise and facilitating internships for our students.

As has been mentioned, this is the first volume of student papers and future volumes will follow. It is hoped that these papers will be a contribution towards enhancing our knowledge and understanding of the many challenges that the environment can present, and the solutions that can be found by enlightened and responsible environmental managers.

Assoc Prof Lye Lin Heng

Chair, M.Sc. (Env. Mgt.) Programme Management Committee
School of Design and Environment, &
Deputy Director, Asia-Pacific Centre for Environmental Law,
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MESSAGE FROM SHELL COMPANIES IN SINGAPORE

Shell is honoured to have been able to contribute to development of the NUS Master of Science (Environmental Management) “MEM” Programme from its inception in 2001.

The MEM Programme arose out of a pressing need for an integrated and multi-disciplinary curriculum on environmental management. I am glad the MEM Programme is even more relevant today than when it was introduced nine years ago. The impact of this course has spread beyond Singapore with many alumni from the region. They return home with a better understanding of the inter-disciplinary approaches towards building environmental policies, and will have gained strong friendships and good personal contacts to support inter-dependence and connectedness between countries.

As countries in our region continue to grow, more and more of our people will come to live in cities and demand a better quality of life, thereby increasing energy demand and the impact on the environment. Government policies and blueprints and sustainability to meet these demands will be important, but governments alone cannot provide all the answers. The awareness, understanding and onus for action lie with every individual and organization in our societies to take responsibility for a more sustainable future.

In Shell, we believe in working with others to find shared solutions for a more sustainable world. On one level we look at how best to meet the growing demand for energy while minimizing CO₂ emissions in our own operations. From our upstream activities, we seek to develop and bring to markets cleaner and more carbon efficient energy sources such as natural gas. We develop cleaner fuels for millions of people, and we work with different customers like motorists on the road to help save energy consumption. There is much we learn and apply across our businesses from the different disciplines represented in the MEM Programme.

I applaud the MEM faculty for this initiative to produce a publication of the best research works over the years. I hope it will encourage many to

adopt a spirit of discovery and respect for our environment. I am sure you will find in these papers a common thread — that we each bring our unique talents but have a shared responsibility for managing and protecting our environment.

Lee Tzu Yang

Chairman, Shell Companies in Singapore

MESSAGE FROM CHAIR MEM ADVISORY COMMITTEE

This collection of essays, based on some of the best research theses of the NUS Masters of Science (Environmental Management) “MEM” students, is a worthy tribute to the success of the Programme. The 24 chapters in this book, based on the synopses of the students’ theses, provide important statements in three areas.

First, the multidisciplinary nature of environmental challenges and their solutions is strongly affirmed. The NUS Environmental Management Programme has, since its inception in 2001, maintained its multidisciplinary focus (based on the academic inputs of the Faculties/Schools of Arts and Social Sciences, Business, Engineering, Law, Medicine, Design and Environment, and Science) and the chapters in this book highlight this unique academic endeavour. Few environmental programmes in the world have been able to harness faculty members from so many disciplines to collaborate in the teaching of a graduate programme, and to sustain it over the years. In the face of our growing environmental crisis, the emphasis on interdisciplinary teaching and research is all the more pertinent and necessary in trying to understand the complex environmental interrelationships in society. While some students had initially expressed difficulties in understanding these complex interrelationships, however, as alumni, they are grateful to the Programme for this wide exposure which has enabled them to function more effectively as environmental managers and leaders.

Second, these essays focus on the many sub-regions, countries, cities, provinces and societies of Asia, and reflect on the environmental issues of the different national developmental agendas. Unlike other academic programmes which tend to be more conceptual and theoretical, the content of these papers demonstrate the practical orientation of the MEM Programme. Our students, resident or working in Asian environments, bring to the Programme the real world environmental realities of their own working experiences. The mix of students, who have prior working experiences from the public, private and non-government sectors, have enlivened classroom discourses and produced much mutual learning. These

essays are testimony to the pragmatic and realistic nature of the MEM Programme.

Third, as the environment and climate change challenges become more important and urgent, I hope the Programme will continue to remain, not only as a beacon of environmental research and teaching, but also as a foci for training new generations of environmentally conscious and competent leaders in administration, politics, business, industry and services. I hope that the graduates from this Programme will make a difference and lead their companies, organizations and governments towards a more environmentally sustainable world.

Prof Tommy Koh

Ambassador-At-Large

Chair, Advisory Committee

MSc (Env Mgt) Programme

National University of Singapore

MESSAGE FROM DEAN SCHOOL OF DESIGN AND ENVIRONMENT

The School of Design and Environment (SDE) was chosen to host the university-level M.Sc.(Environmental Management) programme when it was being considered for approval. Two reasons were given for this choice. First, the management of the environment has been the main mandate of the SDE after it was restructured from the former Faculty of Architecture, Building and Real Estate, and given its current name. Second, the school was the only one which was to offer two core modules on the programme. My predecessor as Dean of the SDE, Professor Cheong Hin Fatt, guided the programme through its initial years, and our faculty member, Dr Malone-Lee Lai Choo, was the first programme Director. Dr Malone-Lee stepped down in March 2009, and was succeeded by Dr Ong Boon Lay who left NUS in December 2009. Professor George Ofori is now Director of the programme as from 1 January 2010. The MEM programme is administered like our other taught master's programmes in the school, and we have found the synergies as well as differences between this special programme and the others quite instructive.

We at the SDE have been very pleased to see the programme grow from strength to strength, to become what it is today. We are gratified that it has been able to attract students from around the world. We believe the MEM is unique. The enthusiasm and genuine interest of the students in the subject of environmental management, the commitment of, and camaraderie among, the teachers on the programme, and the dedication of the alumni have been very special to see. Also special is the hard work which the programme director and the Programme Management Committee (PMC) puts into the MEM. Members of the PMC are dedicated staff members from the seven faculties/schools that are involved in this collaboration. They have enthusiastically and with great dedication, nurtured this unique programme. The Committee is chaired by Assoc Prof Lye Lin Heng of the Law Faculty, who has been the programme's chair since its inception; with Prof Ofori as Deputy Chair (till 31 December 2009). Indeed, the five editors of this publication are all members or former members of this Committee. Assoc Prof Ting Yen Peng was a member of the PMC until 2006, representing the Faculty of Engineering. Assoc Prof Victor

Savage is from the Department of Geography, representing the Faculty of Arts and Social Sciences; and is Deputy Chair of the PMC.

Another striking feature of the programme is the relationships which have been developed with collaborating institutions overseas, especially the Yale School of Forestry and Environmental Studies; and Duke University's Nicholas School of the Environment. We have had great advice and assistance from members of the Advisory Committee and in particular, its chairman, Professor Tommy Koh. We are indebted to Professor Koh for the help he has given us in our efforts to raise funds for the benefit of the students on the programme. It is evident that there is an MEM community which is held together by a very strong bond among its members. We at SDE are proud that we have provided the home and the administrative support which has enabled this to be realized. I would also like to recognize the contributions made by the Deans of the other schools and faculties at the NUS who have given us their support, and encouraged their staff members to contribute in teaching, supervision of research and examinations.

The chapters of this book provide a good illustration of the nature, features and strengths of the MEM programme. The works cover a broad area of environmental management. Each research study had a strong practical element backed by a sound review of the theory. Organizations and practitioners will find much in this book that is important to their work. The bond which unites the members of the MEM community is evident in the various examples of collaboration which led to the book. First, the relationship between the students and the supervisors enabled the research studies to be completed. The collaboration between these same persons, but this time, as alumni and former supervisors, resulted in the production of the chapters. Third, the editors of the book worked together to produce this commemorative piece. Finally, the generous sponsorship of the Shell Group of companies, with which the MEM programme has been associated almost since it was started, made the publication of the book possible.

This book marks the end of a phase in the development of the MEM programme. We at SDE would be pleased to contribute to efforts by the programme's management and advisory committees to take it to a higher level during the next stage of its life.

Professor Heng Chye Kiang

Dean, School of Design and Environment
National University of Singapore

CONTRIBUTORS

Ms M.S.T. Fardausi AKHTER holds a BSc (Class 1) Hons, Engineer Centre and School of Military Engineering, Qadirabad Cantonment, Natore, Bangladesh. She graduated with the MSc (Env Mgt) from NUS in 2005 and also holds an MSc in Soil Science from the University of Manitoba, Canada. She is now a PhD candidate in Biology at the University of Western Ontario, Canada. She is working closely with metals in the Human Environment Strategic Network (MITHE-SN, Canadian network of toxicology centres) to investigate the physiological mechanisms involved in cadmium uptake, localization and distribution in plants. Her main research interest involves trace element uptake in plants and mycorrhizal fungi. She has published several research articles and presented her work at international conferences. She was Associate Program Officer, Young Power in Social Action, Bangladesh

Ms ANBARASI Boopal holds a MSc in Life Sciences in Biotechnology 1st Class, from Bharathidasan University, Tamil Nadu, India. With a keen background in biology, having worked as Junior Research Fellow in the Salim Ali Centre for Ornithology, and work experience in wildlife protection in India, she joined the MEM programme, graduating in 2006. Her passion in animal welfare and environmental protection made her volunteer with a local animal protection charity called ACRES (Animal Concerns Research and Education Society). As a full-time staff at ACRES since 2007, she is currently the Director of the ACRES Wildlife Rescue Centre and runs the ACRES Wildlife Crime Unit, working towards tackling wildlife trade issues in Singapore and the region.

Mr R.S. ARUN Kumar holds a Bachelor of Engineering, Kuvempu University, Karnataka, India and graduated with the MSc (Env Mgt) in 2006. He then became Executive Director in the World Toilet Organization (WTO), Singapore and successfully completed a 2-year sustainable sanitation project funded by Tidal Waves Asia Fund in the tsunami affected towns in Indonesia. Before working with WTO, he worked as Team Leader, Enviro Group in Technology Informatics Design Endeavour (TIDE), an NGO based in Bangalore for 4 years and was involved in renewable energy

and water management projects for rural development. Arun relocated to India in September 2008 from Singapore. Since October 2008, Arun is also the CEO of Ecosan Services Foundation (ESF), Pune, India, a non-profit Foundation working in the field of ecological sanitation. He is Founder CEO of Energy and Environment Resource Group Inc. (eERG), a social enterprise based in Bangalore, INDIA. With the ideology of providing technically sound and meaningful solutions to issues faced by the common man, eERG is presently focusing on water management.

Mr Laxmi Dutt BHATTA has more than fourteen years in the field of sustainable natural resource management. He was Conservation Officer at the Mountain Institute, Nepal, and now serves as Livelihood and Biodiversity Advisor, SNV (Netherlands Development Organization). His research interest is the governance of biodiversity linking to sustainable community livelihoods in developing countries. Presently, he is working with SNV in Nepal where he provides strategic and programmatic advisory support to strengthen the capacity of timber value chains and payment for environmental services. In addition, Laxmi is involved with managing, facilitating and brokering knowledge on forests, biodiversity and ecological services in Nepal. He has presented in many international seminars and conferences. He is co-author of a book on Payment of Environmental Services in Nepal (in Nepali). His new work, *Unlocking the Eucalyptus for Poor — a Value Chain Analysis* is in press. Laxmi graduated with the MSc (Env Mgt) in 2004, and holds a BSc in Forest Science from Tribhuvan University, Nepal.

Mr Christian Rae P. BUSTAMANTE holds a BSc (Environmental Science) from the Ateneo de Manila University, Philippines. He graduated with the NUS MSc (Env Mgt) in 2006. In 2002, he started his career as an environmental professional in the power generation industry both in Philippines and Singapore. He was Environmental Technician/ Specialist, Mirant Sual Corporation. In 2008, he moved to Unilever Asia as its Environmental Coordinator. His work involves integrating environmental sustainability in Unilever's supply chain across Southeast Asia and Australasia. These initiatives range from manufacturing ecoefficiency, packaging sustainability, and energy efficiency. Christian hails from the Philippines but is currently based in Singapore with his wife.

Ms CHAN Yen Sen graduated with a Bachelor of Engineering in Environmental Engineering (2nd class Hons (Upper Division)), National

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Ms DANG Thuy Trang holds a BA (Class 1 Hons), University of Social Sciences and Humanities, Vietnam. She graduated with the MSc (Env Mgt) in 2004 and completed the Master's Programme in Urban Planning and Policy Design at the Politecnico di Milano, Italy in 2008. She is now Mekong River Eco-region Coordinator, WWF Greater Mekong programme, and leads the regional planning and management of WWF Greater Mekong Programme's effort to conserve the Mekong River running through China, Myanmar, Laos, Thailand, Cambodia and Vietnam. Prior to taking this position, Trang was working mainly in the development sector with the European Commission, the Asian Development Bank and the Norwegian Agency for Development Cooperation. She was also Interpreter and Translator, Department of Science, Technology and Environment Project of Hazardous Waste Master Plan for the Southern Focus Economic Zone in Vietnam.

Mrs DAO Mai Anh obtained the NUS MSc (Env Mgt) in 2002. She is currently a Ph.D scholar at the National University of Singapore. Her main research interests are in organizational behaviour and corporate environmentalism. She holds a Bachelor of Arts (English Studies), Hons. Class 1, School of Foreign Language, Vietnam National University, Hanoi, Vietnam. She was a Lecturer with the School of Foreign Languages in Vietnam.

Mr Timothy HROMATKA holds a BA in Biology and International Studies, University of Oregon. He was a member of the initial intake of the National University of Singapore's MSc (Env Mgt) Programme, studying on a part time basis and graduating in 2004. He has grown up with forests, timber, and woodworking and, having manufactured and exported furniture from Indonesia and Malaysia, has been keenly interested in tropical forest

degradation and conversion, and alternatives including sustainable forestry and plantations. After the Asian Tsunami, he was involved in the Aceh reconstruction using sustainable lumber for low cost housing initiatives which has led to green building projects in Singapore and the Middle East. He is President, Globex Green Company, Minnesota.

Ms Silvia IRAWAN is currently a PhD student at Crawford School of Economics and Government, Australian National University (ANU). Her research is focusing on decentralized forest management and the scheme of Reducing Emissions from Deforestation and Forest Degradation (REDD) in Indonesia. She holds a Bachelor of Animal Husbandry (Livestock Breeding) from the Udayana University, Bali. She was Technical Consultant, Directorate of Environmental Affairs, Ministry of National Development Planning, Indonesia. Following her graduation from the MEM program in 2004, she has worked as an individual consultant with a number of international organizations such as the World Bank, United Nations Development Programme (UNDP) and WWF in Indonesia. She also worked closely with several ministries in Indonesia including the Ministry of Development Planning, the Ministry of Forestry and the Ministry of Environment.

Ms Rawadee JARUNGRATTANAPONG is currently a PhD student at Ritsumeikan Asia Pacific University, Japan. She holds a BA (Hons) in Statistics from Srinakarinwirot University and an MA in Economics from the National Institute of Development Administration, Thailand. She graduated with the MSc (Env Mgt) from the National University of Singapore in 2003. She was a researcher for Natural Resource and Environmental Program at Thailand Development Research Institute (TDRI) since 1996 before she left for her PhD studies. Her specialization is Environmental Economics and her current research focuses on climate change adaptation and payment for ecosystem services.

Ms Mantazh KHANNA is currently completing her Masters in Business Administration at the Harvard Business School with a focus on clean energy investing and sustainability in corporations. With prior work experiences at Investment Banking at Credit Suisse, New York, and Energy Investing at Acumen Fund in India, she is particularly interested in the intersection of corporate valuation and environmental risk. She obtained her MSc (Env Mgt) from NUS in 2005 and joined SembCorp Industries, Singapore, where

she managed the company's multimillion dollar Carbon portfolio. Prior to that, she worked at the Ministry of Environment & Water Resources, Singapore, as a Policy Planner. She continues to find joy in learning how to link science, economics and law to create innovative, equitable and cost-effective solutions to our most urgent environmental problems. She also has a BSc.(Environmental Policy & Behaviour), from the University of Michigan.

Mr Pak-Juan KOE has worked with various organisations to establish regional operations, manage new businesses and meld different perspectives into decision-making. Besides being the management system controller with Shell Eastern Petroleum, he leads improvement and integration efforts in the management of health, safety, security, the environment and social performance. Pak-Juan serves on the Australian School of Business Alumni Advisory Board and volunteers as a guide at the National Museum of Singapore and Singapore Biennale. He has visited over 70 countries. He has a BEng (Electrical Engineering), MEngSc, and MBA from the University of New South Wales; and graduated with the NUS MSc (Env Mgt) in 2006.

Ms Gina KUM holds a BA from the National University of Singapore, and graduated with the MSc (Env Mgt) in 2003. Gina's love for the sea is a major reason to why she has been in the shipping and marine industry for over a decade. After graduating in 1999, she was a Senior Executive with the Chien Chun Fishery Co. Ltd, a Taiwanese long-liner company that captures the controversial bluefin tuna. She attended several international meetings of the International Commission for the Conservation of Atlantic Tuna. It reinforced her belief that sustainable solutions are necessary. Currently, she is Marketing Manager, ICSB Singapore, and passionate to reach out to the shipping and marine industry with various green and sustainable solutions. She is happily married with two beautiful children, Denzyl and Taryn and would like them to be able to continue to enjoy the beautiful underwater world.

Mr NG Chun, Justin holds a BSc (Real Estate), 2nd Class Upper Hons, National University of Singapore, and graduated with the MSc (Env Mgt) in 2005. As a young officer with the National Parks Board (NParks), Justin was involved in planning for Singapore's greenery and natural environment. He enrolled in the MEM programme to gain a better understanding of how global environmental issues and challenges have shaped governments'

policies. He credits the programme for providing unique opportunities for passionate students from the region to come together in pursuit of environmental interests. He was a former Planning Manager, National Parks Board and is currently Senior Assistant Director, Resource Division, Ministry of Trade & Industry. He is still keenly involved in the advancement of environmental sustainability in Singapore.

Ms NG Kay Leng is a chemist with PowerSeraya Ltd for 5 years and is currently heading its Multi-Utilities Services (MUS) Department which handles all water treatment and environmental issues. PowerSeraya Ltd is a utilities company in Singapore supplying electricity, steam and water to industries, and MUS manages and operates the seawater desalination plant, water treatment plants and a laboratory that carries out fuel, water and environmental testing. It also handles all environmental issues such as the maintenance of ISO 14001 management system, ensuring the company meets all environmental requirements, monitoring of plant emissions, air quality, groundwater quality, wastewater discharge, and waste management. Prior to joining PowerSeraya, she was a consultant with IRM Consultants, Singapore, specializing in environmental law and ISO 14001 management system. She holds a Bachelor of Engineering from NUS and graduated with the MSc (Env Mgt) in 2003.

Mr Ashok Prasad OJHA a Nepalese citizen, holds a BSc (Hons) Forestry (First Division), from the Institute of Forestry and Environmental Sciences, University of Chittagong, Bangladesh. He graduated with the MSc (Env Mgt) in 2005. During the course of study and work in Nepal, he has published over a dozen articles in national and international journals and newspapers in the field of biodiversity conservation, participatory planning, and community development. Professionally, Mr. Ojha has more than 8 year's progressive work experiences in the field of biodiversity conservation, alternative livelihood and community development in Nepal. He is Natural Resources Conservation Officer, King Mahendra Trust for Nature Conservation Project in Nepal. Currently, he has been involved in the Western Terai Landscape Complex Project as a Manager. The project is the joint undertaking of the Government of Nepal, GEF, UNDP, SNV, WWF, Bioversity International, NARC and LIBIRD.

Ms Amanda ONG Hwee Fang holds a BSc (Hons) (Real Estate) from NUS and graduated with the MSc (Env Mgt) in 2004. She will complete

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Mr Manoj Kumar PUTHIA holds a Bachelor of Veterinary Sciences and Animal Husbandry, First Class, from the G.B. Pant University Agriculture & Technology Pentagon, India. He graduated with the MSc (Env Mgt) in 2003. He was a former Veterinary Officer, Animal Husbandry Department, Rajasthan, India. He is now a PhD student, Laboratory of Molecular and Cellular Parasitology, Department of Microbiology, Faculty of Medicine, NUS.

Mr Gunawan TANUWIDJAJA holds a Bachelor of Architecture (ST) from Bandung Institute of Technology (Institut Teknologi Bandung). He graduated with the NUS MSc (Env Mgt) in 2006. He has practiced as a professional urban planner, architect and researcher in Indonesia and Singapore since 2001. He is currently lecturing in the Department of Architecture, Petra Christian University and managing Green Impact Indonesia, an Integrated Urban, Drainage and Environmental Planning & Design Studio. His research interests are in Sustainable Urban Development, Eco-Cities, Integrated Ecological Planning and Sustainable Architecture.

Ms TEO Wen Jing, Jasmine Ann obtained the NUS MSc (Env Mgt) in 2006, and was awarded the Shell Prize for Best Dissertation for her thesis, “The Challenge of Environmental Sustainability in Wafer Fabrication Plants: A Framework for Implementation”. Jasmine received her Bachelor of Science in Building from NUS in 2002, and also published a paper on “Implementing Total Quality Management in Construction Firms” in the Journal of Management in Engineering. Since 2002, she has been involved

in both environmental engineering and corporate social responsibility work in the telecommunications, real estate and semiconductor industries. She was Environmental Engineer & EHS Coordinator, STMicroelectronics Pte Ltd; Corporate Social Responsibility Manager for CapitaLand Ltd, and is presently Group Corporate Social Responsibility Manager for Singapore Telecommunications Limited.

Ms TRAN Thi Minh Hang holds a BSc (Class II) Hons from the National University of Singapore, and graduated with the MSc (Env Mgt) in 2005. Thereafter, she returned to Vietnam and took a position at Hanoi School of Public Health, teaching Environmental Health. Currently, she is pursuing a Ph.D at the Department of Biological Sciences, Faculty of Science, National University of Singapore. Her research interests are coastal management and marine conservation. She wishes, upon completing the programme, to be equipped with the passion, knowledge and skills to be able to take part in her beloved country's efforts in managing her coastal areas sustainably.

Dr Scott VALENTINE is currently Assistant Director of the Masters of Public Policy International Program at the University of Tokyo's Graduate School of Public Policy. He has over 20 years of diverse international business experience, specializing in business development and organizational development. Past positions include Executive Vice-President of Vektor Multimedia in charge of Japanese operations, Managing Director of Asia Pacific Development International, Dean of the British Education College in Tokyo (affiliated with the UK Northern Consortium), and Director of the British Council Training Centre in Taiwan. He has a BA from Lakehead University, Ontario; MA in Advanced Japanese Studies, University of Sheffield; MBA (International Management), Asia Pacific International Institute, Thailand; Doctor of Business Administration, University of Southern California and graduated with the NUS MSc (Env Mgt) in 2006.

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Audrey CHIA is Associate Professor of Management and Organisation at the NUS Business School. Her research and teaching interests are multi-disciplinary. For the UCLA-NUS Executive MBA and the NUS MBA, she offers courses in Leadership, Change Management and International Management Strategies. She has published in various journals such as the Academy of Management Executive, Science Communication, Jurimetrics and the Journal of Business Ethics. She has also co-authored two books, *The Three Paradoxes: Working Women in Singapore and Culture and Management: A Casebook*. Her research has been presented at international conferences on Management, Applied Psychology and Socio-Economics. Her current interests are in workplace diversity, and the repair of reputation and relationships.

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INTRODUCTION

SUSTAINABILITY MATTERS: ENVIRONMENTAL MANAGEMENT IN ASIA

VICTOR R SAVAGE, LYE LIN HENG and GEORGE OFORI

I. Introduction

Ten years ago it would have been hard to imagine that environmental issues would be a subject of discussion in major global leadership meetings, but in the last two years they have been tabled at the G20 2009 meeting in Pittsburg and the 2009 APEC meeting in Singapore. In addition, the United Nations has held climate change conventions in Bali (2007) and Copenhagen (December 2009). Even in bilateral meetings between major developed countries, environmental and climate change issues have been part of the agenda. Clearly the deteriorating global environment arising mainly from climate change issues has precipitated global concern and action. Each month, new scientific material and visible natural catastrophes seem to underscore the growing impact of climate change and its consequences on the global economy, livelihoods, food security and cities. We have arrived at a critical crossroad on the environment and at all levels (global, regional national, local) there is now an urgent need for public awareness, government forward planning, cultural adaptation, mitigation efforts and implementation of national environmental management systems. Yet unfortunately the global community still remains divided in terms of the scientific veracity of climate change and its impacts. In the United States, a country with much access to global information, recent survey results show a reduction in believers in climate change on two fronts. In 2008, 71 percent of Americans believed there was solid evidence that the world is warming, but by 2009 only 57 percent believed this. In 2008, 47 percent of Americans believed global warming was caused by human activities, in 2009 only 36 believed this (Begley, 2009: 38–39). Among the reasons for this American perception, ideological persuasion, economic problems, and conflicting scientific errors have undermined the public knowledge of climate change in the US. In Europe, a survey by the German Marshall Fund published in 2009 found similar dwindling public perceptions on climate change. One year ago, 3 in 4 Europeans (75 percent) felt climate change

was a “very serious” problem, today only 67 percent feel this way (EU Centre in Singapore, 2009:4).

Yet despite the skeptics in some quarters, the impact of climate change is already unfolding in many countries and cities. But the global and national communities have been slow in recognizing the connection between environmental impacts and growing natural hazards. In different parts of the global ecosystem, the frequency of cyclones, typhoons, floods, drought, heat waves and rising sea water seem to be causing havoc in many countries around the world. For many countries in Asia, the impact has been devastating: in 2004 violent storms in the Philippines killed 669 people and left another 695 people missing; Mumbai (India) received in July 2005 in 24 hours, 944 mm (37.2 inches) of rainfall that caused massive floods in the city; in Northern India the ground water has fallen by 20 percent between 2002 and 2008 which threatens agricultural output and millions of livelihoods; typhoon Nargis hit Myanmar in 2008 and killed 140,000 people and devastated the lives of another 2.4 million people; China suffered its worst drought in 50 years in 2008–09 which created water shortages for 4.37 million people; the drought in the Middle East and Central Asia has led to a 22 percent drop in wheat production in 2009; typhoon Ketsana in September 2009 killed over 330 people in the Philippines, Cambodia, Laos and Vietnam; and in November 2009, floods from monsoon rains wracked havoc for thousands of inhabitants in the Malaysian states of Terengganu and Kelantan and the Indonesian province of Aceh.

II. Asia: The Environmental Challenge and Prospect

If we are to believe Kishore Mahbubani’s (2008) thesis that the 21st century will become the new Asian Hemisphere in global affairs, then there is reason to believe that the node of human civilizational impetus and economic dynamics is moving back to Asia after going one cycle from Asia to Europe and then to North America. One indicator of Asia’s rising economic prowess is her increasing percentage in the world’s GNP — from 26 percent in 1990 to 38 percent in 2007. Obviously the notion of Asia as some organic constituent is more perception than reality. Asia was defined, formulated and commodified through western perceptions. As Edward Said (1979) argues, the West found its own identity in its sustained cultural development of *Orientalism*. In reality the term Asia only functions as a geographical demarcation. Europe is a more cultural holistic entity than Asia. Yet this large region is now the theatre of global economic impetus,

political muscle-flexing and cultural effervescence. The key regions in 'Asia Rising' are East Asia (China, Japan, South Korea), India and the Middle East with the Southeast Asian region riding on their coat-tails. Yet while there is cautious optimism about the 21st century belonging to Asia, the region is still embedded with major challenges economically, politically and environmentally.

In the environmental sphere, Asia is a cause, victim and benefactor of environmental problems and climate change issues and outcomes. In rising to the challenges of development, and securing better qualities of living and standards of life, Asian governments have not been equal to the task in delivering the best environmental goods for their communities and citizens. Among the top 10 poorest countries in the world, five come from Asia (China, India, Pakistan, Bangladesh and Indonesia) (Kotler and Lee, 2009:8–9). The challenges to sustaining environmental quality in countries and cities are products of traditional and new factors. Firstly, the demographic factor is a primary variable in the human-nature equation which will continue to scourge Asian countries for many decades ahead. Large populations still plague the environmental and developmental deliverables for China (1.3 billion), India (1.1 billion), Indonesia (240 million), Pakistan (172 million), Bangladesh (147 million), and the Philippines (90 million). In other Asian states, rapidly growing populations (Lao PDR, Cambodia, Timor Leste) and aging populations (Japan, Singapore, South Korea, Thailand) are causes of concern for their governments and these have different environmental implications and impacts. Small countries like Brunei, Singapore, and Kuwait which are wealthy oil producers or refiners have large per capita carbon impacts, much higher than large countries like India, Indonesia or Thailand. The neo-Malthusianists of the developed world are less sympathetic and patient to the way populations have exploded in many developing countries in Asia and Africa. Their response to this predicament is that it reflects the demographic choices of governments and communities within these large populous countries and hence they have to bear the consequences of their demographic challenges. The most well known advocate of this position is Garrett Hardin (1980) in his life-boat scenario, promethean ethics and 'triage' solutions.

Secondly, the shift from rural to urban living has created major environmental stress in many Asian cities. In 2007, the global population reached 50 percent in urban living. In Asia while many countries have not crossed the 50 percent threshold in urban population, the phenomenal

growth of capital cities has made urban living a major environmental nightmare for urban governments. The most challenging scenario is the development of mega-cities (10 million and above) which dominate many Asian countries: Bangkok, Calcutta, Dhaka, Mumbai, Jakarta, Manila, Osaka, Shanghai, and Tokyo. Apart from the Japanese mega-cities, none of the other mega-cities in Asia has followed the correct eco-logic; all have been unable to implement environmentally sustainable urban systems; and do not have the right urban governance to manage their brown issues. The urban environment, with its artificially controlled cultural landscapes, needs more attention. Much discourse has been in sustainable cities, the ecological footprint and now eco-cities. But environmental attention to urban arenas must be balanced. Attention to eco-cities cannot be based solely on intra-urban environmental issues because the survival and sustenance of urban populations depend more on extra-urban ecosystem relationships for water, food and natural resources (Savage, 2006). The cities of Asia will suffocate if hinterlands and the ecological footprints are not given sufficient environmental attention.

Thirdly, capitalism and globalization has widened the disparities of wealth of peoples between and within countries. Despite the fact that capitalism is a failed system for sustainability in the developed world, it is the model for development for the rest of the world. In the developed world, capitalism will increase the debt of the 10 richest countries from 78 percent of GDP in 2007 to 114 percent by 2014 (*The Economist*, 2009:11). The rich thrive on tapping resources from a global environment while the poor have to eke out a living from recycling and reusing goods. Ironically, it is the poor that are the best exemplars of the three 'R's in conservation: reuse, recycle and reduce. Given these disparities of wealth between and within countries, it seems difficult to enact policies to reduce carbon emission and pollution because both the rich and poor of cities and countries are contributors to environmental problems: the *rich* leave a massive ecological footprint around the world by their environmentally unfriendly conspicuous consumption; while the *poor* are denied usage of clean water, modern sanitation and proper refuse disposal systems which undermine the cities' general public health. Hence the continuing disparities of wealth and status in many cities in Asia will remain a challenge for the development of environmentally sustainable cities. Widening disparities of wealth amongst populations, underscoring capitalistic and globalizing processes are in the long run a destabilizing factor economically, socially and environmentally.

Fourthly, despite the rising standards of living in general, poverty still exists in many Asian states. Of the top 10 poorest (below US\$1 a day) countries in the world, five are in Asia (India; China; Pakistan, Bangladesh; Indonesia) (Kotler & Lee, 2009:8). In 1990, 29 percent of the world's population was classified as living in extreme poverty (less than US\$1 a day) and the UN's Millennium Development Goal (MDG) was to bring this down to 10 percent by 2015. By 2004, the figure seemed promising as extreme poverty had dropped to 18 percent (The World Bank, 2008:31) but since the 2008–09 global financial crisis, there is now pessimism about the MDG meeting its 2015 target. After all, support from the developed countries is likely to diminish over the next decade given that the 2008–09 global financial crisis has cost economic losses of an astounding US\$26 trillion according to the Bank of England (Laszlo, 2009:17). This is a tragic outcome for Asian states especially India and China aspiring to lead the Asian renaissance. Hence when developed Western countries pressurize China to upgrade its currency, they fail to recognize that the country has the second highest percentage of people living in extreme poverty in the world. As Philip Kotler and Nancy Lee (2009:xix) argue in their book, of all the problems facing mankind, poverty is “among the most persistent and shameful”. So long as poverty remains a major issue in developing Asian countries, the conflict and contestations of resources and environmental goods will never be equal and will never be managed in an environmentally sustainable manner. As Joan Martinez-Alier (2005:1) in her thought provoking book, *The Environmentalism of the Poor* argues, the environmental movement has grown as a reaction to economic growth and not as against economic growth. And Nicholas Stern (2009:8) notes climate change and poverty are “inextricably linked”. Hence in developed and developing countries, environmentalism has different meanings, embraced by both the wealthy and the poverty-stricken. The result is three environmental movements: the cult of the wilderness; the gospel of eco-efficiency; and the environmentalism of the poor.

Fifthly, most Asian countries are in the throes of developmentalism (economic development, modernization) and statism (national identity, nationalism) and are thus seeking trajectories like the developed countries in the west, even though such economic and political models have failed and are environmentally flawed. Hence while globalization is said to make borders porous, in reality new Asian states are cementing their national credos, developing nationalism and are hyper-sensitive to border infringements and contestations. As Paul Kennedy (1993: 134) argues, while

the autonomy and functions of the state have been eroded by transnational trends, there is no adequate substitute to replace the state in responding to globalization. Globalisation is thus a convenient term for selective usage whenever it suits individual governments. Indeed if states accepted the most globalised system, the global ecosystem, we could have a more concerted and effective basis of international cooperation.

The global economic system of capitalism is certainly a major driver of development in Asia but the environmental consequences are likely to be felt later. Development thus needs to ensure ecosystem vulnerabilities, Green risks and environmental sustainability considerations. As Nicholas Stern (2009:62) contends, development is a way to “strengthen a society’s ability to adapt” and hence development without adaptation is “misguided”. China’s appetite for natural resources around the world to feed her massive industrial output and consumer demands is a case in point. Unfortunately while the west dominated this unequal system for decades, without much sanction and criticism, the rise of Asia’s economic dynamos seem to be the target of increasing criticism, concern and containment policies. Suddenly there seems to be a frightening realization that the global powerhouses are changing, corporate buyouts and natural resource consumption is in new Asian hands, and that Gaia will not be able to support an American quality of life and standard of living without dire environmental consequences globally. Developing countries like China, India and the Southeast Asian states are all caught up in the *nouveau riche* frenzy for materialism and the desire for a better quality of living. Tata’s introduction of the ‘People’s Car’, the Nano at a rock bottom price of US\$2,500 might be a commercial coup for Tata but an environmental disaster for India.

The periodic warnings of the Worldwide Fund for Nature (WWF) that the world is already consuming 20 percent above its capacity and by 2050 will be 100 percent above what Gaia can support seems to be publicly unheeded. What are the boundaries of humanity’s load on our planet seems to be now a concern with some scientists trying to quantify the earth’s limits (Rockstrom, 2009). On the other hand, each country seems to accept a finite world in which every national stakeholder wants to maximize its share of the constant global pie. The end reality is what Hardin (1968) predicted four decades ago, the tragedy of the global commons. Unfortunately this scenario is delayed because the rich and wealthy in developed and developing countries have the political muscle and economic power to control and buy-in scarce natural resources. The global poor as Jeffrey Sachs (2005) notes still remain an embarrassing large number

(one-sixth of global population live in extreme poverty) despite 50 years of United Nations, World Bank and IMF poverty alleviation schemes and programmes.

The choices countries have before them in tackling environmental and climate change issues are not easy nor are they zero-sum options. In climate change, the most pressing environmental challenge for the 21st century (Rees, 2003; Martin, 2007), the general mantra for solutions lies in two areas: adaptation and mitigation. Given that few Asian countries have the economic clout, scientific capacity, and research and development abilities, the options for mitigation seems remote. Yet Asian states are large emitters of carbon dioxide. Globally, China is the largest emitter of greenhouse gases due largely to her rapid economic development, her massive industrialization and high reliance on fossil fuels for energy. The Chinese government will need to reduce coal-based energy supplies but the options for alternative energy are not without problems. Her large hydropower project, the Three Gorges Dam has been the butt of severe environmental and social criticisms. The dam has led to the displacement of 1.3 million people, and the flooding of 13 cities, 140 towns, 1,350 villages, while the environmental fallout is yet to be fully calculated and experienced. Furthermore China's proposed eight dams in the upper reaches of the Mekong River (Yunnan) has been seen as an ecological disaster for countries in the lower Mekong River (Lao PDR, Thailand, Cambodia and Viet Nam) and a likely cause of future political tensions between her smaller Southeast Asian neighbours.

The best prescription from James Lovelock (2007) for an interim halting of carbon emissions is the use of nuclear energy; which seems a controversial energy solution for the author of the Gaia perspective. But for the global community these have had mixed reviews. China is following the French model and racing towards building numerous nuclear energy plants across the country without much global attention. And India is equally interested in boosting its nuclear energy output with hopefully the help of the United States. Yet for other Asian states like Iran and North Korea, any attempt at nuclear energy developments is greeted with suspicion and fear. Nuclear power is a neutral issue, but countries have the choice for peaceful or belligerent usage. In Southeast Asia, Thailand, the Philippines and Indonesia seem bent on following a nuclear energy path but this raises other concerns because of the tectonic instability in the region.

Indonesia is another major Asian contributor of greenhouse gases but for different reasons from China. Indonesia's greenhouse gas emissions stem

from natural and landuse changes. Globally, Indonesia has the highest emissions of carbon dioxide arising from degrading peat – some 500 million metric tonnes released in 2008 excluding losses caused by fire. The country has also the third largest peat carbon stocks in the world after Canada and Russia. Much of Indonesia's carbon releases also stem from landuse changes due to forests fires, the spread of oil palm plantations, rural development and reforestation of commercial timber plantations. If Indonesia is going to reduce its carbon emissions it needs to rework its development strategies. At the moment the government hopes to be a major global biofuel supplier and its competition with Malaysia in this area seems to be misplaced and environmentally irresponsible.

To date one can list hundreds of adaptive suggestions by communities, cities and countries with regard to climate change. But all these micro and meso scale ad-hoc, piece-meal adaptive mechanisms seems unlikely to change the course of increasing carbon emissions towards 550 ppm, reducing the build-up of greenhouse gases, and slowing down global warming and its likely impacts on ecosystems and human populations around the world. For the smaller countries, local adaptive measures might provide temporary solutions and solace, but climate change is an environmental issue of global proportions that cannot be solved at the local levels. There are two fundamental guidelines in dealing with adaptive measures for environmental and climate change issues: i) adaptation must take place at the local and regional levels (Stern, 2009:60); ii) adaptation must be grounded in 'risk management' involving diversification, flexibility and education (Stern, 2009:61–62). Given its strong agriculture base, Asian states will need to adopt both 'hard' (drought resistant crops; seawalls; irrigation technologies) and 'soft' (crop rotation patterns) adaptive technologies.

Hence the December 2009 United Nations Framework Convention for Climate Change (UNFCCC) meeting had much global anticipation of delivering global solutions and a comprehensive action plan based on its 192 government members, but in reality the meeting betrayed mixed responses. There was the ugly confrontation between the US and China, the deadlock between the developing and developed countries over responsibilities, and on the other hand the European Union states' offer of monetary assistance to developing countries for their adaptive strategies. Clearly the Copenhagen meeting demonstrated deep divisions amongst states and global agreement on solutions seem much more difficult. In short, the global community demonstrated a lack of responsibility, poor leadership and selfish national motivations. Both India and China had different perspectives to

the Copenhagen meeting. Both countries are contributors and likely victims of climate change hence both India and China had vested interests in the Copenhagen meeting. The 2009 Copenhagen meeting as expected led to a clash of interests between the developed and developing states. Already the G77 (the Group of 77) in Bangkok made it clear they want to maintain the Kyoto Protocol which is binding for developed but not developing countries. The European Community and the US hoped to change that perspective in Copenhagen (Tolleson, 2000:1034), but as it turned out it was not an easy or acceptable proposition. India's position is for "common but differentiated responsibility" (Pachauri, 2009:1054) while China expected the developed countries to demonstrate leadership in Copenhagen especially in providing technical and financial assistance to developing countries (Pan, 2009:1055). Yet both the Asian powerhouses set aside their diplomatic differences and signed a five-year agreement in October 2009 to increase cooperation in tackling climate issues. As Raul Estrada-Oyuela (2009:1056) argues, any agreement at Copenhagen would require a strong negotiator with exceptional skill, knowledge and diplomacy. The Copenhagen dialogue has left the global community still divided and Asian states are likely to feel its impacts and implications in the coming decades. The bottom line at Copenhagen is that the Summit fell short of its goal to cut carbon emissions sharply enough to hold off a 2-degree-Celsius rise in global temperatures. Asian states and cities must now put greater emphasis in activating their adaptive systems in response to the increase in carbon emissions, rise in global warming, and varied environmental impacts it is likely to unfold on their communities.

III. Commentary on the Collection of Essays

This collection of 24 essays on Asia's environmental issues is not a *prescription* for environmental problems *per se* but reflects rather a broad spectrum of interdisciplinary interventions, processes and viewpoints on environmental management in the Asian region. Given that environmental problems are multi-faceted and multi-dimensional challenges, there can be no single 'one size fits all' explanation or solution. The environment, after all, covers all aspects of human endeavours, living environments, leisure places and work spaces. While studies in this book might use single variables and perspectives to analyse issues, these are done for the ease of analysis rather than a reflection of the complex reality people and communities confront in environments.

In this study, the idea of environmental management is a complex issue which requires definitions of three elements: what is meant by environment, what is the nature and process involved in management and who comprises and decides management. The question of environment is a general term which covers a range of associated terms and labels: ecology, ecosystem, nature, Green, natural resources, physical landscape, flora, fauna, environmental sustainability, urban environments and cosmos. In this book, we use the term “environment” in the way Ian Simmons (2008:3) defines it as “those elements of nature which are in an ecological relation with humans, that is, where there exists a possible transfer of energy and materials between them”. The use of the term ‘management’ tends to underscore the work places of business where organization and employees are involved. We manage corporations, shopping malls, hospitals, and restaurants. In nation-states and countries the word “management” is replaced by “governments and governance”. Hence depending on the scale of environment management in this book, the papers cover the corporate levels, specific bioregions and ecosystems, cities and national territories. In short, these articles address environmental issues at both the private and public sectors. At one end of the scale ‘*management*’ might be the appropriate term, but at national levels *governance* might be better suited. The people responsible for environmental management cover a broad spectrum from political leaders, corporate chieftains, national administrators, urban planners, to NGO personnel, pressure groups and the concerned public volunteer. Since the environment concerns everyone, the responsibility of the environment has to be shared. Every citizen is a stakeholder of the environmental health and sustainability within communities, neighbourhoods, cities, countries, regions and globally. We all have multiple citizenships at various scales and hence must exercise responsibility in what we do.

While few articles make cross comparisons between cities or states, one can make independent cross-comparisons because the varied articles cover a range of scales from regions (Southeast Asia; East Asia) to countries (Vietnam, Thailand, India, Nepal) and cities (Hong Kong, Singapore, Ho Chi Minh City) in Asia. The articles also cover a plethora of environmental management themes dealing with legal environmental issues, conservation methods, policy matters, Green planning, environmental measurements, enforcement matters, environmental education and environmental monitoring. There is also a wide range of ecosystems and Brown issues to meet the environmental interests of varied specialists, corporate honchos and Green activists dealing with forestry, water

issues, varied types of wastes (solid, hazardous, electronic), fisheries and aquaculture, agriculture, and energy in urban, rural, marine and pristine areas. Certainly no environmental management book would be complete without discussions on adaptive and mitigation strategies. And in this collection of essays one can find all sorts of environmental strategies from fiscal management to legal frameworks, from specific breeding programmes for endangered species to forest plantations.

While this collection of environmental essays are abridged and edited versions of the Masters' theses and Study Reports of the Masters in Environmental Management (MEM) students they cannot be viewed as purely academic conceptual statements situated in a vacuum and without experiential realities. Indeed, we would argue that these essays reflect important environmental statements in three ways.

Firstly, many of the students are locals from the countries and cities in Asia that they are writing about and hence have often a lifelong experience with their subject matter. Their writings demonstrate a candid sincerity of what is happening on the ground and often the topics picked underscore a certain familiarity that students have had over time. In short, students' theses are rarely random academic exercises but reflect the individual interest or familiarity each student has with an environmental theme of his or her country or environmental theme.

Secondly, many of the Masters students have working experience in the corporate, government and non-government organizational (NGO) sectors and hence are not discussing issues in a vacuum. The working experience of students more often reflects a working engagement with environmental issues and hence many are cognizant about the administrative processes, economic limitations and political underpinnings of managing environmental problems. This working knowledge with the environment provides a realistic and applied dimension to the analysis. In short, these papers are grounded in grassroots realism even though they are framed within academic-derived concepts and theories.

Thirdly, given that environmental issues are complex, holistic problems covering a wide array of issues, disciplines, and perspectives, these papers cover varied interdisciplinary as well as disciplinary perspectives and analysis. In these papers one will see evidence of the disciplinary dialogue and philosophy of the MEM programme which educates students to adopt interdisciplinary and multidisciplinary perspectives on environmental issues. Unlike the 'culture wars', the environmental themes in these contributions demonstrate that the scientific, social science, legal and policy perspectives need to be understood and analysed within a holistic and

integrated manner before realistic and pragmatic prescriptions, solutions and mitigation issues can be implemented. One of the tragedies of environmental debates is the lack of dialogue between the hard and soft sciences. In these papers there is glimmering hope of unlocking disciplinary territories between the sciences and non-sciences and a genuine and realistic dialogue of interdisciplinary perspectives.

IV. Reflections

Given the importance of environment and climate change issues to newly developing states in Asia, this book underscores the complex environmental themes which resonate in the academic literature as well as manifest themselves in grassroots realities. Environment is as much an integral component in the developmental processes of many Asian developing communities, cities and countries as it is an important variable which could undermine development programmes and trajectories.

The urgency of environmental attention caused by the speed of climate change issues unfolding globally warrants our immediate attention to how societies and governments need to manage their environments. Unfortunately Asia has its own spread of successful and failed states. Each failed state adds to the litany of accumulating environmental woes at the regional and global scales. Unfortunately unlike political issues, environmental factors do not observe political boundaries. The ecosystem issues transcend economic, political and cultural borders. Each variable of the environment cannot be studied in isolation, nor can they be addressed without a broader understanding of the complex forces in which they find expression. This collection of papers does not offer magic formulas for environmental solutions and mitigation, but hopefully, this collection of case studies can underline important correlations, present new data, identify areas for environmental monitoring, alert promising areas of research, define environmental problems, situate environment within development programmes of countries and companies, explore new areas for environmental engagement and innovation, and shed new light on promising areas for averting environmental catastrophes.

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