SUSTAINABLE DEVELOPMENT IN PRACTICE

Sustainomics Methodology and Applications

Mohan Munasinghe

Mimasinghe Institute for Development (MIND), Sri Lanka

Foreword by James Gustave Speth

Munasinghe Institute for Development (MIND) Colombo, Sri Lanka • Montreal, Canada • Gaithersberg MD, USA



The University of Manchester Sustainable Consumption Institute



CAMBRIDGE UNIVERSITY PRESS

Contents

	Foreword by James Gustave Speth				
	Pr	eface		xiii	
Part I	Framework and fundamentals				
	1	Overview and summary			
		1.1	Outline of the book	4	
		1.2	Rationale and motivations	9	
		1.3	Brief history and summary of sustainomics	20	
		1.4	Millennium development prospects and worldwide status	25	
	2	Sustainomics framework		31	
		2.1	Basic concepts and principles	31	
		2.2	Key elements of the sustainable development triangle	40	
		2.3	Integration of economic, social and environmental elements	46	
		2.4	Tools and methods for integrated analysis and assessment	55	
		2.5	Restructuring development and growth for greater sustainability	y 64	
	3	Eco	nomics of the environment	72	
		3.1	Human activities and the environment	72	
		3.2	Conventional project evaluation	73	
		3.3	Measuring costs and benefits	77	
		3.4	Basic concepts for valuing environmental costs and benefits	82	
		3.5	Multicriteria analysis	89	
		3.6	Discount rate, risk and uncertainty	91	
		3.7	Economy-wide policies and the environment	96	
		3.8	Appendix: Estimating and using shadow prices	106	
	4	Ecological and social aspects			
		4.1	Conceptual framework linking ecological and socioeconomic		
			systems	111	
		4.2	Property rights, governance and ecological-social linkages	118	
		4.3	Environmental and social assessment	128	

viii Contents

Part II	Global and transnational applications					
	5	Global analytical applications		137		
		5.1	Climate change and sustainable development	137		
		5.2	Applying the sustainomics framework to climate change	140		
		5.3	Climate-change adaptation and mitigation	150		
		5.4	Global-level interactions between climate change and			
			sustainable development	154		
		5.5	Greenhouse-gas-mitigation prospects in Sri Lanka	159		
		5.6	Real-options framework for carbon trading under			
			uncertainty	173		
	6	International process applications: multilevel, multistakeholder,				
		trans	transdisciplinary dialogues			
		6.1	Global transdisciplinary scientific dialogue on climate change			
			and sustainable development	180		
		6.2	Multilevel integration of millennium ecosystem assessment			
			results and millennium development goals	184		
		6.3	Using the AIM to analyse MA-MDG links at the national			
			and global levels	189		
		6.4	Dams and development: multilevel, multistakeholder			
			dialogue	193		
		6.5	Evaluation of the Dams and Development Project (2001-2004)	198		
		6.6	Dams and Development Project evaluation, conclusions and			
			results .	200		
Part III	N	ation	al and macroeconomic applications			
	7	Nat	ional economy-wide applications	211		
		7.1	Historical evolution of ideas	212		
		7.2	Empirical evidence	215		
		7.3	Framework for analysis	219		
		7.4	Case study of Brazil - making long-term development more			
			sustainable	225		
	8	Mat	thematical macromodel applications	243		
		8.1	Optimal growth models and sustainable development	243		
		8.2	Economic and non-economic costs and benefits of growth	244		
		8.3	An optimization model: Ecol-Opt-Growth-1	246		
		8.4	Ecol-Opt-Growth-1 model conclusions	253		
		8.5	Macroeconomic policies, second-best theory and			
			environmental harm	254		
		8.6	Developing country case studies	256		
		8.7	Appendix A: The Ecol-Opt-Growth-1 model	260		
		8.8	Appendix B: Second-best nature of macroeconomic policies			
			when environmental externalities are present	265		

Contents ix

	9	Com	putable general equilibrium modelling applications	269			
		9.1	Economy-wide cross-effects of social and environmental				
			policies in Chile	269			
		9.2	Review of economic, social and environmental issues				
			and policies	272			
		9.3	Interactions between social, environmental and economic				
			policies	280			
		9.4	Chile case study conclusions	288			
		9.5	Economy-wide policies and deforestation in Costa Rica	289			
		9.6	Modelling approach	292			
		9.7	Main findings of the Costa Rica study	299			
		9.8	Appendix A: ECOGEM-Chile CGE model summary	303			
		9.9	Appendix B: Costa Rica CGE model summary	306			
Part IV	Sub-national sectoral and system applications						
	10		rgy-sector applications	313			
		10.1	25	313			
		10.2		321			
		10.3		333			
		10.4		338			
		10.5	2 27 1	343			
		10.6		350			
	11	Trai	nsport-sector applications	355			
		11.1	Generic priorities for sustainable transport	355			
		11.2		357			
		11.3	Traffic congestion - economic and environmental sustainability	364			
		11.4	Other options for reducing traffic congestion	377			
		11.5	Sustainable transport policy in Sri Lanka	385			
	12	Wat	er-resource applications	391			
		12.1	Hydrological cycle and human actions	391			
		12.2	Water and development	395			
		12.3	Sustainable water-resources management and policy (SWAMP)	402			
		12.4	Management of groundwater depletion and saline intrusion				
			in the Philippines	406			
		12.5	Policy implementation issues	413			
		12.6	Simple water filtration method for cholera prevention in				
			Bangladesh	416			
		12.7	Appendix: Economic costs of producing water	420			
	13	Eco	logical and agricultural system applications	424			
		13.1	Sustainable management of tropical forests	424			
		13.2	Valuing forest ecosystems in Madagascar	434			
		13.3	Agriculture and climate change	441			

x Contents

		13.4	Climate impacts on agriculture in Sri Lanka	444		
		13.5	Appendix: Models used for tropical forest valuation	456		
	14	Resource-pricing-policy applications				
		14.1	Sustainable pricing policy (SPP)	460		
		14.2	Extensions of the basic model	467		
		14.3	Calculating economically efficient prices based on strict LRMC	475		
		14.4	Adjusting efficient prices to meet other objectives	480		
		14.5	Sustainable pricing of water resources	486		
		14.6	Appendix A: Optimal energy pricing	490		
		14.7	Appendix B: Demand analysis and forecasting	496		
Part V	Project and local applications					
	15	Proje	Project applications			
		15.1	Small hydro-projects and sustainable energy development			
			in Sri Lanka	503		
		15.2	Main findings of small hydro study	508		
		15.3	New and renewable energy projects: case study of solar			
			photovoltaics	512		
		15.4	Sustainable rural electrification based on renewable energy	519		
		15.5	Evaluating a typical water supply project in a poor African			
			village	535		
	16	Loca	d applications - hazards, disasters and urban growth	544		
		16.1	Sustainable hazard reduction and disaster management			
			(SHARM)	544		
		16.2	The 2004 Asian Tsunami - a preliminary assessment	554		
		16.3	Sustainability of long-term growth in Asian cities	569		
		16.4	Urban vulnerability, natural hazards and environmental			
			degradation	578		
		16.5	Making urban development more sustainable in North			
			America and Europe	583		
	Ref	erence	S	588		
	Index					