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Book Review

SUSTAINABILITY: Multi – Disciplinary Perspectives

Edited by Heriberto Cabezas, Urmila Diwekar

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The sustainability concept is inherently multy-disciplinary because it concerns the management of a complex system having economic, technological, ecological, political, and other perspectives. Consequently, any effort in the area of sustainability involves concept, principles, and methods from engineering, the social science including economics ans social psychology, the biological science including ecology, and physical sciences.

In this context, the book *Sustainability:Multi – Disciplinary Perspectives* edited by Heriberto Cabezas and Urmila Diwekar discusses, in a coherent and comprehensive manner, the salient concepts, principles and methods relevant to sustainability from the perspective of different disciplines.

The book is a collection of fourteen papers, written by 23 authors drawn from fifteen distinct disciplinary backgrounds ranging from engineering to public policy, from ecology to thermodynamics, from organizational behavior to social psychology, and from industrial ecology to economics.

Chapter 1, *Introduction*, by Heriberto Cabezas describes the general context, the aims and structure of the book. This chapter also provides the definition of sustainability: 'Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs'.

Chapter 2, *Principles of Sustainability from Ecology*, by Audrey L. Mayer, details what are the principles which support sustainability: resilience, desirability, temporal and spatial equity. Ecological theories and hypotheses have inspired new and creative ways to create more sustainable systems. In particular, the complex systems approach to understanding ecosystems have readily incorporated linked human systems into these models, and allowed for a greater understanding of the impacts of specific human activities on the entire socioecological system.

Chapter 3, *The Economics of Sustainability*, by Joshua C. Farley deals with a number of serious challenges, ranging from climate change and biodiversity. An economic system must use available energy to transform the raw materials provided by nature into basic necessities such as food, potable water, shelter, and energy.

Economics can no longer be left to ideologues who favor a single allocative mechanism for all economic problems.

Chapter 4, *Actualizing Sustainability: Environmental Policy for Resilience in Ecological Systems*, by Ahjond S. Garmestani, Matthew E. Hopton and Matthew T. Heberling suggest several possible policy instruments for dealing with the apparent intractability of economics, ecology, and the law. In order to actualize sustainability, it must develop new, or adapt established, policy to protect biological diversity. Such protection may guard against the loss of ecological resilience, thereby protecting ecosystem services, which are vital to sustainability.

Chapter 5, *Human Interactions and Sustainability*, by Michael E. Gorman, Lekelia D. Jenkins and Raina K. Plowright describes a framework for understanding and managing complex systems that couple human beings, nature and technology.

Moral imagination is a critical element: the different stakeholders need to be able to 'walk in each others shoes' regularly. When a civilization fragments into groups that do not care about and cannot communicate with one another, it collapses.

Chapter 6, *On the Matter of Sustainable Water Resources Management*, by W.D. Shuster attempts to develop the concept of sustainability and make it operational in the realm of water resources management. As the water resources management community move towards sustainability there are some avenues for moving towards a more cyclic approach that embraces reduction, reuse, and recycling. Water resources can be more sustainably managed through the recognition of exchangeable capitals and their relationships to different fluxes in the hydrologic cycle.

Chapter 7, *Sustainable Infrastructure and Alternatives for Urban Growth*, by Arka Pandit, Hyunju Jeong, John C. Crittenden, Steven P. French and Ming Xu, Ke Li focuses on increasing global population coupled with increasing emission of green house gases (GHG), provision of sustainable infrastructure that is of utmost importance. The goal of a sustainable and resilient urban infrastructure is not only to provide the infrastructure amenities, but also to develop the socioeconomic attributes of the urban system.

Chapter 8, *Engineering Urban Sustainability*, by Ke Li, John Crittenden, Subhrajit Guhathakurta and Harindra Joseph Fernando focuses on challenges of engineering urban system toward sustainability. A framework was built to study a subset of the engineered systems, to demonstrate the complexity that needs to be dealt with in an integrated urban systems study. The framework investigates the interactions between land use and built environment, construction material demand and consumption, as well as the synergistic local, regional and global environmental impacts. A life-cycle impact assessment was performed and captures the environmental effects of a product through the various stages of its life: production, transport, use, reuse (where applicable), recycling and final disposal.

Chapter 9, *Sustainability Indicators and Metrics*, by H. Cabezas discusses concept of sustainability, sustainability indicators and metrics are addressed in general, matrics suitable for local, regional, and global sustainability are expanded on, the use of sustainability metrics, and finally a summary brings all of these topics together. The author shows the framework idealized trajectory over time for a complex system with integrated economic, energetic, ecological, and social components.

The results showed that sustainability is essentially about preserving an environment that is supportive for human existence. To turn this vision into an actionable plan, one needs indicators and metrics of sustainability that can guide an adaptive management effort for keeping the system on a sustainable path.

Chapter 10, *Implications of Thermodynamics for Sustainability*, by Bhavik R. Bakshi and Geoffrey F. Grubb, describes and demonstrates the role that thermodynamics can play in assessing the sustainability of technological activities and in improving their design. This chapter also provides exergy analysis of industrial processes and life cycles that helps in identifying areas of maximum resource inefficiency and opportunities for improvement. This approach complements the insight obtained from assessing the impact of emissions.

Case studies based on the life cycle of biofuels and nanomanufacturings are used to demonstrate the important role that thermodynamics can play in sustainability engineering.

Chapter 11, *Industrial Ecology and Sustainable Development: Dynamics, Future Uncertainty and Distributed Decision Making*, by Jim Petrie, Ruud Kempener and Jessica Beck discusses ways to enhance the operational potential of Industrial Ecology. Attention is paid to specific challenges for sustainable development beyond the broad aims of achieving economic competitiveness, ensuring environmental stewardship, and promoting both intra- and inter-generational equity. In this chapter, the authors introduce an approach to sustainability assessment for industry networks which combines a systemic view of sustainable development with agent-based modeling and quantitative scenario analysis - to explore how perceptions of future uncertainty might affect the behavior of organizations.

Chapter 12, *Green Engineering and Sustainability: A Systems Analysis Perspective*, by Urmila Diwekar presents a systems analysis perspective that extends the traditional plant design framework to green engineering, green energy and industrial ecology leading to sustainability. In this capitol there are illustrated green engineering principles using a green energy sector case study. Decision making at various stages starting from green plant design, green energy, to industrial ecology, and sustainability for the mercury cycling are also discussed.

Chapter 13, *The Case and Practice for Sustainability in Business*, by Beth Beloff and Arnaud Chevallier describes the multiple meanings of corporate sustainability and explores the evolving practice of sustainability in business, introduces the drivers of sustainability, explains how key historical events have shaped it and reviews the typical path that companies have taken to incorporate sustainability into their business agenda.

Chapter 14, *Summary*, by Urmila Diwekar concludes all chapters from this book. The book offers perspectives from various fields, including ecology, economics, social science, policy, industrial ecology, engineering, and business wich shows different views about sustainability. Sustainability science is evolving and this book provides a current perspective.

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