

theory; the Entwurf (draft) theory that he worked on with Marcel Grossman and Michele Besso, and the emergence of the correct field equations. The story, while generally known, has many twists and turns and matters of detail, and involves several distinguished players who worked with Einstein and some others who competed with him. Renn ends with a description of how understanding of general relativity developed after 1915, the early history of gravitational waves, the renaissance in their understanding which began in the 1950s and the search for gravitational waves.

Collins in the 'Detection of gravitational waves – a reflection', provides a sociologist's view of the experimental search for gravitational waves, the development of ideas by many talented experimentalists, their conflicting approaches and the social dimensions of the whole long and expensive process. He describes in detail the influence of Weber's attempts to detect gravitational waves with resonant bar detectors on the development of LIGO. Collins argues that Weber's work led to the understanding that short-duration burst events which produce short-wavelength gravitational waves could be detected from the Earth, and but for Weber, all efforts could have concentrated on spaced-based detections which are still in the future. Weber's experiments and influence are also mentioned in several other locations in the book.

In 'Einstein at Caltech', Buchwald describes the many attempts made by Robert Millikan to bring Einstein to Caltech; how Einstein arrived in Caltech for his first visit in 1930; his later visits and eventual acceptance of a position at the Institute for Advanced Study in Princeton, USA.

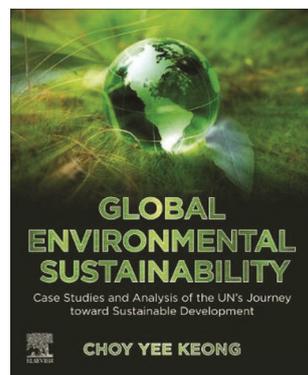
The concluding article by Howard is on 'How general relativity shaped twentieth-century philosophy of science'. The author discusses the profound influence that the theory had on shaping the philosophy of science in the first decades of the 20th century. Special relativity had already caused a stir by introducing the concepts of four-dimensional space-time, the equivalence of all inertial frames and the consequent constancy of the speed of light. The influence of the general theory on the philosophy of science was much greater, because of the dynamical nature of space-time introduced by the theory, and the requirement of general covariance. The latter had caused difficulties to Einstein and Grossman in the development of the Entwurf theory, who

came to believe that general covariance should not be a requirement for a theory of gravitation, since it prevented the theory from leading to reasonable physical results. Howard (as well Renn in his article) discusses this point in some detail. Howard describes how Einstein, even during the early years of his first investigations in physics, was knowledgeable about the philosophy of science (he was presented Immanuel Kant's *Critiques* when he was 13 years old), and interacted constructively with philosophers, who in turn had deep knowledge of physics.

The book is in general well written and the articles are all interesting and informative. In spite of my decades-long acquaintance with the subject, I found much material that I was not familiar with and which was enlightening. I strongly recommend the book to libraries as well as individuals with interest in the history of general relativity and gravitational waves.

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Global Environmental Sustainability: Case Studies and Analysis of the UN's Journey toward Sustainable Development. Choy Yee Keong. Elsevier, Radarweg 29, P.O. Box 211, 1000 AE Amsterdam, The Netherlands. 2021. xxviii + 435 pages. Price: US\$ 140.00. ISBN-13: 978-0128-224199; ISBN-10: 0128224193.

Conservation and sustainable management of the natural environment, including its biodiversity, is critical for sustaining long-

term human existence¹. Indian scriptures emphasize harmony and the human connection with nature, ecological balance, and the need for ethical treatment of nature by humans to sustain natural resources for posterity. The concept of sustainable development has evolved, focusing on key concepts of environmental, social and economic sustainability. However, this environmentally sustainable and morally justifiable development ideology gradually eroded with the advent of the Industrial Revolution in the 1800s in western Europe, characterized by massive capitalist modes of production and consumption. The dominant Western industrial culture and the neo-liberal capitalist expansion came at the cost of depletion of natural resources and environmental impoverishment globally. In the wake of the severe global environmental deterioration caused by uncontrolled human economic activities, and acknowledging the increasing threat of environmental degradation, in 1949, a United Nations (UN) Scientific Conference examined the conservation and sustainable management of natural resources².

The UN, committed to addressing this challenge, has made continuous and unrelenting efforts by convening a host of international environmental meetings and conferences to advance its core mandate of bringing about wiser use of our natural environment. The UN convened a paradigm-breaking global environmental conference³, the Stockholm Conference in 1972, intending to call upon the international community to reverse the environmental decline by implementing environmental protection measures and launch a new liberation movement to free humans from the threat of their own thralldom to environmental perils of their own making. Declarations, agreements, regulations and action plans were adopted at such conferences⁴ to facilitate and guide the global community to effectively address the challenges of balancing its three core values of sustainable development, namely environmental protection, economic growth and social equity.

This book conceptually and theoretically analyses the ethical constraints for sustainable development by considering human responsibility towards the natural world, and provides a philosophical framework for rethinking our relationships with nature. The publication takes a multidisciplinary and interdisciplinary approach, considering science, environment, ecology, economics, politics, philosophy, anthropology and

empirical studies. The philosophical implications of pro-environmental behaviours are empirically reified based on field-research evidence from forest-dwelling indigenous communities. The publication consists of seven chapters addressing global environmental problems in the contemporary world.

Chapter 1 introduces the concept of sustainable development. In this regard, it presents a critical analysis of the efforts undertaken by the UN to decisively break the vicious circle of environmental degradation for the past 45 years. Declarations, agreements, regulations, protocols, agendas and action plans adopted at these conferences facilitate and guide the global community to efficaciously address the challenges of balancing its three core values of sustainable development, namely environmental protection, economic growth and social equity. However, the schemes of environmental protection were too much in dissonance with the dynamics of the ethical link between the economy and the environment.

The second chapter evaluates the impact of the UN on the evolution of global environmental regimes in promoting environmental sustainability. It comprehensively explores the evolution of the concept of sustainable development since the 1972 Stockholm Conference as the main framework, for understanding the relationship between the economic, social and environmental problems in accordance with the evolution of global environmental regimes in promoting environmental sustainability. The Convention on Biological Diversity (CBD) serves as an essential international, legally binding agreement to help address all aspects of biological diversity, including complex global ecological degradation issues. It focuses on human impacts on the degradation of global biodiversity and seeks to conserve biodiversity at all levels – genetic, population, species, habitat and ecosystem, which underpin the integrity of the life-support system of the biosphere. The main goals of CBD were (i) conservation of biological diversity (or biodiversity), (ii) sustainable use of its components, and (iii) fair and equitable sharing of benefits arising from genetic resources.

The main thrust of the Stockholm Conference was on ways to manage the natural resources to sustain economic and social development, rather than from a conservation perspective. The Conference led to establishing the United Nations Environmental Program (UNEP), which serves as

a catalytic agent for promoting and coordinating global environmental activities.

The Kyoto Protocol, a legally binding treaty adopted in Kyoto, Japan, in 1997, commits industrialized countries to limit and reduce greenhouse gas (GHG) emissions by 5.2% below the 1990s (base year) carbon dioxide emission of 22.7 billion tonnes. It stipulates GHG emission reduction through (i) clean development mechanism, (ii) investment in sustainable development projects and (iii) implementation of emission reduction projects jointly by industrialized and developing countries.

Chapter 3 presents the UN journey to global environmental sustainability. The UN, through its series of high-level summits and conferences followed by waves of ecological thought and environmental information, has not only provided a continuous means of raising global environmental awareness, but also added momentum to the process. This is reflected by an unprecedented show of collective global concern over the confluence of threats arising from growing environmental degradation, especially deforestation and habitat fragmentation, biodiversity decline and climate change. The chapter first examines the state of global forests, especially in the biodiversity-rich, tropical rainforest regions, before discussing the biodiversity and climate change issues. The global forests, especially tropical rainforests, are home to the most significant percentage of terrestrial biodiversity and play an essential role in carbon sequestration. Their irreversible destruction can have far-reaching impacts on biodiversity loss and climate change. The participating countries (198 in number) in the Paris Conference vowed to commit to slow down and reduce GHG emissions by formally ratifying the Paris Climate Agreement. These countries pledged to keep emissions-cutting targets well below 2°C above pre-industrial levels and pursue efforts to limit the increase to 1.5°C.

The unprecedented scale of environmental problems with unsustainable development practices is presented in chapter 4. The case study based on field research in the tropical rainforest region presented in this chapter provides essential evidence of practical importance to reify the practical and paramount importance of environmental ethics in promoting a sustainable world.

Chapter 5 discusses the nexus of environmental ethics and environmental sustainability with the indigenous world views of the moral relationship between

humanity and the natural world based on field research and empirical evidence of the land ethics practiced by indigenous communities in the Borneo tropical rainforests in Sarawak, Malaysia.

Chapter 6 presents the United Nations environmental education (EE) initiatives and explores the scope for enhancing the culture of environmental ethics. The concept of EE encompasses developing the skills and attitudes necessary to understand and appreciate the inter-relatedness among biotic and abiotic components of ecosystems with insights to humans with the biophysical surroundings and culture. This forms the basis for unifying the dynamic, complex and diverse aspects of the functional properties of ecosystems and their inextricable relationship to the long-term existence of humans. EE promotes prudent decision-making and self-formulates a code of behaviour concerning environmental quality. It ensures that individuals have a holistic understanding of our global ecosystems and their life-supporting functional properties, which underpin long-term human existence. EE aids in enhancing the environmental literacy among citizens through the acquisition of environmental knowledge and environmental awareness with the functional properties of the natural world as well as its associated problems; understanding of the life-support system functions of the natural systems; the environmental tipping points and their associated challenges as well as the capacity to appreciate the intrinsic value of nature. EE promotes behavioural changes and commitment to environmental protection, and resolves to translate this commitment into real action. Thus, environmental literacy is concerned with acquisition of problem-solving skills and motivation to make informed decisions to respect, protect and sustain the well-being of the natural systems, which eventually leads to actions framed by awareness and attitudes.

The last chapter (chapter 7) provides an overall assessment of the efforts by the UN in addressing global environmental problems through international agreements, treaties and guidelines. It is concluded that in contrast to the ecological history of naturally induced environmental disasters over the past billion years, contemporary environmental problems are fundamentally caused by humans and the consequences are severe. This is evident from the irreversible disruptions in the global socio-economic system with the recent coronavirus (COVID-19) pandemic, which has

demonstrated an unprecedented existential threat. Frequent occurrences of disasters during the last decade with catastrophic effects on humans and the natural environment at incalculable economic costs demonstrate the lacunae of the present developmental path leading to the degradation of fragile ecosystems.

This book emphasizes the need for ethical and moral change in public attitude and policies toward more environmentally sustainable resource use and management methods. This could be enhanced through the promotion of environmental and moral education. The philosophical implications of pro-environmental behaviours are empirically reified based on field-research evidence with the indigenous forest-dwelling people.

This book serves to supplement contemporary publications in sustainable de-

velopment, environmental ethics and environmental value systems. Through a multidisciplinary study and interdisciplinary approach, it presents a critical analysis of the efforts undertaken by the UN to decisively break the vicious circle of environmental degradation during the past five decades. Sustainability can be achieved only by putting environmental ethics and moral philosophy at the forefront of the development discourse, which helps in recasting the hitherto adopted anthropocentric concept of sustainable development and reorienting toward a sustainable future. This book with analytical insights would be useful to policymakers, researchers and practitioners of environmental law and sustainable development policies.

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