Handbook of Environmental Impact Assessment

Handbook of Environmental Impact Assessment:

Concepts and Practice

Arjun Kumar A. Rathi

Cambridge
Scholars
Publishing

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By Arjun Kumar A. Rathi

This book first published 2021

Cambridge Scholars Publishing

Lady Stephenson Library, Newcastle upon Tyne, NE6 2PA, UK

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library

ISBN (10): 1-5275-6664-1
ISBN (13): 978-1-5275-6664-4

Dedicated to my significantly better half, Asha,
and
my professional fraternity.

Also, to you, the reader
in the hope that understanding of
good-quality EIA report preparation will improve.

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PREFACE

A huge amount of literature is available on the concepts and theory of environmental impact assessments (EIAs). EIAs have been performed for almost half a century now and in terms of the number and depth, there has been a phenomenal growth of EIA studies and EIA reports.

The growing awareness of the environmental impact on the ecosystem highlighted in various reports and protocols issued by international agencies has prompted governments in different countries to continuously update their environmental laws. In India, EIAs were mandated for development projects in 1994, re-engineered in 2006, and are proposed to be revamped in 2020.

For rapid economic growth and enhancing employment opportunities, the manufacturing sector, duly supported by the infrastructural sector, is considered to play a vital role in emerging economies. It is of utmost importance that good-quality EIA reports are prepared for development projects to facilitate decision-making with sustainability considerations. It is acknowledged that many professionals engaged in preparing as well as reviewing EIA reports in developing countries were not taught about EIAs while they were university students. Moreover, those who are being taught at universities may not be aware of the nitty-gritty of an EIA report.

In consideration of the above, an attempt is made in the book to include basic aspects of EIA, impact assessments on different components of the environment, and practical guidance on the process of preparing EIA reports for greenfield as well as brownfield projects. Whereas *what* needs to be included in a typical EIA report is described at length, the expected *output* of the study is highlighted, and *how* it can be done is broadly described. However, the detail of the methodologies is not attempted, considering that a deep understanding is required on each environmental component and that enormous literature is available on the same. Further, the book is not intended to serve as an EIA manual *per se* though it will facilitate an EIA consulting organization a great deal in preparing one. It need not be emphasized that EIA is project-specific and site-specific. Accordingly, the

depth of coverage of environmental issues in an EIA report will vary from project to project and location to location.

The book describes the basic principles and salient features of EIAs, based on the analysis of shortcomings observed in several EIA reports examined by the author, how the EIA for a project is conducted, and how a good-quality EIA report is prepared. The presentation in the book is in the form of numbering and bullets rather than long descriptive text, making it easily readable. EIA case studies are included in mining, thermal power, ports and harbors, chemical and allied, cement, cross-country pipelines, and area development and construction project sectors.

Even though the book focuses on the Indian context in its discussion of environmental regulations and the EIA framework, the concepts and techniques described are applicable universally. It should, therefore, be very useful to a wide range of stakeholders, *viz*. EIA professionals and consultants, project proponents, EIA review/appraisal authorities, and competent authorities, particularly in emerging economies where major developmental work is being undertaken and which is expected to continue in decades to come. Academics will also find the book useful for learning practical aspects. The book should also be useful for preparing EIA reports for the projects proposed to financial institutions and multilateral institutions for funding.

The terminology environmental management program is proposed in this book in place of the environmental management plan, generally adopted in the EIA reports, basically because a program is expected to facilitate a project proponent in the implementation whereas a plan, consisting of a set of objectives to be achieved in a longer time frame and setting the context for programs, could be conceptual, philosophical, or abstract to some extent. An environmental management program is an implementable program for which the budget is committed by the project proponent. It is the most important output of the EIA process, especially for developing countries where priority is on economic development by way of development projects and the EIA process has inherent weaknesses.

For continual improvement of EIA reports, EIA consultants may be assigned the task of implementing and operationalizing the suggested environmental management program for a certain number of years in addition to conducting an EIA study and preparing an EIA report. The system of peer review of EIA reports is also expected to improve EIA quality.

EIA will keep on transforming itself according to new knowledge acquired through research and worldwide experiences which will make this tool more and more versatile and dynamic. It is thus recognized that there will always be scope for improving the contents and expanding the coverage of the book to make it more useful to different users.

ACKNOWLEDGMENTS

I am very grateful to Mr. K. V. Bhanujan, former Chairman, Gujarat Pollution Control Board, for conducting a peer review of the manuscript and making several suggestions that have helped to enrich the book.

My grandson Aayush and son Ashish helped me in making some figures and tables, and editing the manuscript. My son Amar, brother Jagdish and nephew Somil helped me in getting print outs, some specific information, and documents from the literature. Their contribution is appreciated. My grandchildren Anuj and Aditi deserve a special word of appreciation for repeatedly offering their little fingers to type the manuscript.

The help extended by several professionals with whom I have interacted is thankfully acknowledged. Gratefulness is expressed to several authors, agencies, and publishers whose references are cited in the book. I thank Ms Eleanor Moore for proofreading the manuscript so meticulously.

Finally, I acknowledge with deep appreciation the support and patience of my wife Asha whom I deprived of my time even in the Covid-19 lockdown period because of long hours of work.

A K A Rathi
Ahmedabad, India
November 5, 2020

CHAPTER 1

ENVIRONMENTAL MANAGEMENT

Environmental management is a very broad and diverse subject that has been defined in a variety of ways. Environmental management is not about managing the environment *per se* but rather managing the interaction between people and their environment, especially the impacts of anthropogenic activities on their supporting environments (Ross *et al.* 2010).

Environmental management offers the additional capacity to reduce waste, wastewater, and emissions in the production processes of goods and services, and emissions due to transportation, and thereby improve the health and well-being of the people. It may also help to minimize the environmental burden of development and growth by reuse and recycling. Hartmann and Vachon (2018) found that "environmental management relates positively to corporate environmental performance; and the positive relationship between environmental management and corporate environmental performance is moderated positively by industry munificence and negatively by industry dynamism."

1.1 Environmental management

Environmental management is essentially internalizing the externalities arising from developmental activities*, i.e.* internalizing an informed concern of the environmental consequences of the actions of an enterprise in the policies and procedures of the management. An environmental management program is a tool for adhering to the compliance of regulations and standards, and also a course correction instrument when unanticipated issues crop up in the implementation and operation lifecycle phases of a project.

Environmental management can be defined as a set of activities through which an organization maintains awareness of and control over its interactions with the environment. It is a systematic approach to short-term as well as long-term environmental responsibility throughout an organization. For good environmental management, fundamental types of supporting

activities such as the following must be effective:

a. developing and maintaining awareness of the environmental performance of the environmental matters that are of importance to an organization
b. monitoring and improving environmental performance

Different organizations, depending upon their type of business and geographic location, may have specific environmental matters/issues which are more important to them. For example, the important environmental issues of more relevance to different projects may be as follows:

a. thermal power plants based on coal—air emissions and fly ash management
b. ceramic plants—air emissions and inert solid waste management
c. chemical and petrochemical plants—toxic emissions, wastewater, hazardous waste, explosion, and fire
d. ports—marine water quality, emissions and risks from material handling and storage
e. highways—vehicular emissions, noise, and accidents
f. mining—degradation of ecology, sediment transport, air emissions, and wastewater

1.1.1 Environmental management and corporates

Environmental management is considered to be an integral part of business management in an enterprise. Whereas disciplines like financial management, materials management, production management, marketing management, and human resource development form part of the curricula in business management schools and are a well-accepted agenda in business organizations for discussion at the Board of Directors level, environmental management is yet to receive the attention it deserves. A certificate confirming compliance with the applicable environmental regulations from the concerned executives often suffices for the agenda of most of the Board of Directors' meetings and it formally gets noted in the minutes of the meeting without any discussion. Several organizations consider the requirements of environmental approvals for setting up manufacturing, energy, and infrastructural projects to be impediments in the faster economic growth of the country. The top management of corporations, especially in developing economies, appears to be more concerned about profitability, net worth, and return on investment rather than issues related to environmental sustainability in the long run (Rathi 2016, 2018a).

Further, even though sustainability is positively affected by technology (Nasrollahi *et al.* 2020), technology is yet to be recognized as a driving force for improvements in environmental management. Suitable financial systems have not yet evolved at the national level to promote environmentally sustainable development. Financial systems of a country including aligning the financial sector towards a green agenda, restricting investments in highly pollution-potential sectors, and incentivizing private investments in green projects could help in bringing the environmental management agenda to the board level of corporations.

1.1.2 Audit and resource management

Managers are generally entrusted with the responsibility of resource management in an organization. Under existing management practices, such resources generally include financial, machinery, materials, and human resources. However, the optimal utilization of natural resources to sustain production in the manufacturing and energy sectors does not get the consideration it deserves. Further, while financial audits and cost audits are well-accepted tools for financial management and are mandated to be employed for ensuring the protection of the interest of shareholders, environmental audits lack proper understanding and acceptability as a tool for improving resource management. Environmental audits and safety audits are still considered as a financial burden on an enterprise. There is abundant professional expertise available and the practices are fairly well established for conducting financial audits and quality management system audits but environmental audits are yet to be established in a true sense in developing economies.

The scope of environmental audits is generally limited to environmental monitoring to verify compliance with the applicable regulations on the physical-chemical components of the environment. It is ignored that environmental audit reports, among other things, can highlight inefficiencies concerning the use of resources like raw materials, utilities, and energy, and hence offer the potential of cost reduction. If environmental auditors were encouraged to build their capacity to carry out audits religiously and suggest effective corrective measures and proactive actions, environmental audits would benefit the industrial as well as the service organizations, and society at large. Likewise, energy (electrical as well as thermal) audits are expected to reveal inefficiencies and hence offer the potential of saving power and fuel, and thereby help to improve the environmental quality. Environmental audits and energy audits could, therefore, be employed as management tools to improve resource management, ultimately leading to green productivity

as well as improving the bottom line of an organization. Such good management practices offer a win-win opportunity to the industry as well as the environment in the long run (Rathi 2001a).

The experience of business in developed economies has revealed that going beyond compliance helps to accrue several benefits and enhances the bottom line of the business. For example, increased profitability through cost reduction by, say adopting cleaner production practices, improves the balance sheet of an enterprise, and also helps it to achieve a competitive advantage by creating a better image as an environmentally responsible business while contributing to environmental protection at the same time. The major benefits in the long run are the achievement of sustainability through resource conservation and the minimization of future risks of environmental liability to the business. It is thus expected that it is only a matter of time before the corporate world and the shareholders of business enterprises, even in developing countries, will realize that there is a synergy between good environmental management and good financial management.

1.1.3 The scope of environmental management

The scope of environmental management is not limited to environmental compliance management. It includes integrated environmental assessments as an interdisciplinary process of identification and analyzed appraisals of all the relevant natural and human processes and their interactions that determine both the current and future state of environmental quality and resources on appropriate spatial and temporal scales (EEA 1995). Environmental management facilitates the framing and implementation of suitable policies and strategies (Boersema and Reijnders 2009).

Environmental management of operational manufacturing and fossil-fuel-based energy projects needs to include a way of devising systems (NRC 2003) to meet long-term challenges, like improving understanding of:

a. structure-toxicity relationships
b. biological and physical-chemical interactions in response to environmental stresses
c. fate and transport of the emitted or discharged anthropogenic chemicals
d. biogeochemical cycles
e. gas-to-particle conversion in the atmosphere
f. functional genomics and the chemical processes that govern organism-environment relationships

g. chemical-gene interactions in the real environment
h. persistent organic products; *etc*.

The new approaches of green chemistry and sustainable chemistry for new chemical processes require:

i. increased understanding of biogeochemical processes and cycles
ii. advances in industrial ecology—new attitudes about waste utilization
iii. development of environmentally friendly materials, *e.g.* bio-degradable packaging
iv. new methods for pollution prevention and waste management
v. green chemistry and biomass-based new chemical processes
vi. uncovering of unknown environmental issues and identification of their underlying causes and mechanisms
vii. development of improved modeling and simulation techniques for contributing to
    a) a fundamental understanding of the environment
    b) a remediation of the existing environmental problems
    c) prevention of environmental problems in the future
    d) protection of the environment

Thus, a systems approach is needed for environmental management in several areas including

a. actions that affect any of the three principal environmental sinks, *viz.* air, water, and soil media, and the biological systems with which they interact, with a clear understanding that managing each of them separately will invariably transfer environmental problems from one medium to the other rather than solving these; and
b. management of environmental impacts, spatial as well as temporal, arising from processing, manufacturing, handling, transportation, *etc*.

1.1.4 Approaches to environmental management

It may be recalled that approaches to environmental management, even in developed economies, were essentially limited to reacting to an environmental, rather pollution-related, problem by adopting end-of-pipe control until the 1970s. Thereafter, environmental management gradually started widening its scope with an increased emphasis on

a. proactive measures like anticipation and prevention of environmental problems
b. broadening of the aspirational horizon of the people from local to global
c. shifting from immediate and short-term perspectives to the needs of the next generation
d. environmental performance evaluations

The shift in the approach to environmental management was triggered by some of the major disasters including the Seveso explosion in 1976, the Bhopal tragedy in 1984, the Exxon Valdez oil spill in 1989, *etc*.

Environmental management, especially in projects of conventional sources of power generation and manufacturing sectors includes cleaner production (Rathi 2001a, 2003), waste minimization, green chemistry, development of cleaner technologies (Rathi and Bhanujan 2004), and the use of renewable energy and the enhancement of energy efficiency in addition to adopting key sustainability principles like anticipating and preventing the environmental consequences of an activity. It will, therefore, be in the interests of corporations to go beyond compliance with the applicable environmental regulations and focus on enhancing their environmental performance, which in turn will improve their financial performance as well.

It is being observed that an ever-increasing number of enterprises are recognizing the need to make their operations more sustainable, and governments, stock exchanges, markets, investors, and society at large in developed economies are calling on enterprises to be transparent about their sustainability goals, environmental performance, and impacts. Several companies have started voluntarily reporting sustainability following the G4 sustainability reporting guidelines (GRI 2015), and many more continue to join. A survey conducted by MIT (2012) revealed that sustainability started appearing on the management agenda of several organizations in developed economies from 2000 and that several of these companies are profiting from sustainability activities.

1.1.5 The cost of environmental degradation

It has been found that there is a strong correlation between environmental degradation and chronic poverty in developing and under-developed economies (Rathi 2001b). As per the World Bank report (2013), the annual cost of environmental degradation in India amounted to about Rs. 3.75