

Summary

OPiC: a framework for environmental management in developing countries

Chapter 7 of this study overviews the OPiC framework in a formal manner. The present summary provides a more narrative and chapter-by-chapter account.

Research questions and methodology

This thesis focuses on the development of a framework for environmental management, with a focus on pollution management, in developing countries. Most frameworks for environmental management are geared towards partial problem analysis and (rarely) problem explanation with little integration and no attention to positive opportunities that exist in the context of the problem. One hypothesis for the present study is that in almost any context, such opportunities do exist, and that these may enhance the efficacy of environmental policies.

The second hypothesis on which this study is based is that environmental management frameworks express underlying paradigms such as system approaches, causal chain approaches or evolutionary approaches, and that it therefore serves to go into these relatively fundamental issues in order to arrive at a more comprehensive framework that is not only multi-disciplinary but also grounded in a balanced view on these on these foundations.

The research questions which resulted from these hypotheses and explored in this thesis include:

- 1 How can the major scientific approaches, theories, principles and concepts be used as building blocks for the development of an Opportunity and Problem in Context (OPiC) framework for environmental management?
- 2 What are the major tools and approaches that can be used in pollution problem analysis and explanation, and how may these become part of a comprehensive OPiC framework?
- 3 What are the major tools and approaches that can be used to discover and realise opportunities, and how may these become part of a comprehensive OPiC framework?
- 4 How may a solution to an environmental problem be designed that integrates the options identified through problem-based and opportunity-based approaches to jointly serve comprehensive objectives such as sustainability and efficiency?

These questions have been focused on developing countries, with Ghana as example. These countries present special demands to a framework in terms of data availability, participatory potential and often a relatively weak state.

As detailed in Chapter 1, the dissertation has evolved through a series of studies conducted by the author in the period 2001 -2006. The explorations started as a wandering process with little expectation of leading to the desired outcomes. During the enquiry process, the why and how of the different steps taken in the study were slowly made transparent. The scientific and practical quality of the results have been under constant attention, using a variety of methods such as literature analysis, interviews with practitioners and focus groups, critical thought experiments and discussions with supervisors.

Research findings

The main findings of the study are provided as answers to the four research questions.

- 1 *How can the major scientific approaches, theories, principles and concepts be used as building blocks for the development of an Opportunity and Problem in Context (OPiC) framework for environmental management?*

The answer to this question is presented in Chapter 2 of the study where the conceptual basis and building blocks for the development of the framework are presented. I examine disciplinary approaches which include the monodisciplinary, multidisciplinary, interdisciplinary, transdisciplinary and holistic approaches to environmental management, and identify pillars for the development of a conceptual framework for opportunity-and-problem-in-context analysis. It is argued that despite the shortcomings of disciplinary and interdisciplinary approaches to environmental challenges, they have made major contributions in terms of expanding our knowledge base and some pollution problems can be solved simply by taking an interdisciplinary approach. However, a transdisciplinary approach helps to overcome the shortcomings of the disciplinary domains and the detailed complexity of the interdisciplinary approach in environmental management.

Environmental functions, the causal chain approach, the systems approach, the adaptive management of complex systems and the material flow analysis of systems are among the relevant first-order offspring (applications) from the disciplinary approaches. It is argued that their combination offers the broadest applicable approach to environment problems. A causal chain approach offers great flexibility in tracing the relationships between structures of society, actions of actors, changes in the environment and onwards to effects on stakeholders. A system approach al-

lows for dealing with the identification, analysis and control of these variables of a specific system phase based on the notion of a set of relationship between state variables capturing all relevant information about the state of the system, and others as flow or rate variables which include input, throughput and output. The adoption of adaptive management stimulates self-regulation of institutions to reach defined management goals through careful and limited guidance using existing diversity and complexity so as to adapt and be resilient during the management process. The use of material flow analysis will allow for the reduction of primary resource use through improved resource efficiency on a life cycle basis.

The concepts of governance decentralisation, subsidiarity, co-management, integrated environmental management, organisational learning and corruption abatement are identified as social building blocks for the OPiC framework. It is argued that decentralization by allocation of responsibilities across institutions and agencies will ensure effectiveness of policies related to environmental management in developing countries. The most important underlying condition for successful decentralization is serious commitment from the central state. It is also noted that not all pollution problems should be managed in a decentralised fashion because of the difference in complexity of the problem and the variation in factors in the context. While there is the need for devolution of authority in pollution management to the lowest possible level connected to the physical scale of the pollution problem, at the same time central governments should retain rights to instruct the lower-level governments when needed. The decision to decentralise pollution management should be made in the light of the spatial distribution of the problem and the actual strength and weaknesses of public and private sector organisations at different levels. Building blocks identified for the framework are the application of: **co-management approaches where the state and community negotiate to agree on shared responsibility for a range of pollution management functions, and integrated environmental management where all interested actors are involved to agree on a common vision, strategy and roles and responsibilities.** In all this, accountability and transparency are of utmost importance, as well as multilevel learning, habits of inquiry and shared understanding.

Also in Chapter 2, the concept of sustainable development is examined in an attempt to operationalise the concept in pollution management, with special attention to its precursors, the varied conceptualizations held in the scientific community, natural capital as a condition for sustainable development and the issue of its complementarity or substitutability. In view of the complementarity between natural and man made capital, achieving sustainability through environmental management requires that human beings maintain the ecosphere's source and sink functions and sustain the natural capital entering the production process. Moreover, human beings should protect the ecosphere's rich biodiversity in order to limit any irreversible damage inflicted on the ecosphere's functions. Strong

sustainability approaches, with their non-negotiable well-defined norms, values and standards, should be used for environmental functions provided by natural capital that are not or most likely not substitutable, whilst weak sustainability approaches, with their market-based and economic tools, may be applied for natural capital that requires major human management inputs. This requires a two-tiered approach to the evaluation of plans and policies, with one tier focusing on equity issues (including sustainability and other interests of future generations) and market-based cost-benefit analysis in the second tier. Finally, context analysis and macro-level analysis are identified as the key aspects of a realistic planning process.

Throughout this study, examples are given from developing countries. Chapter 3 presents this 'context of application' of the framework, taking into account the answers to research question 1. It starts with a review of constraints in developing countries that call for an adapted approach to pollution management. Mismatch between sectors, socio-cultural constraints, financial resource constraints and institutional constraints are identified as key issues hampering sustainable pollution management in developing countries. Resource valorisation, sectoral synergy and sectoral policy reforms are identified as principles for dealing with the special circumstances in developing countries. Since most examples and illustrations in the study are on Ghana, the second part of this chapter presents general description of the socio-economic background of Ghana and its current development strategies. The section also gives an overview of the pollution problems in Ghana and examines the national environmental policy and assesses pollution management tools used in Ghana. A review of Tema, a port city in Ghana with pollution problems, is presented. The review outlines the general background of Tema, its pollution problems and industrial activities.

- 2 *What are the major tools and approaches that can be used in pollution problem analysis and explanation, and how may these become part of a comprehensive OPiC framework?*

Answers to these questions are presented in Chapter 4 of the study where the Problem-in-Context (PiC) framework, environmental assessment (EIA) tools, functions of the environment, Life Cycle Assessment (LCA), economic assessment (TEV; CBA) and Action-in-Context (AiC) are identified as tools to guide environmental problem analysis and explanation. The tools are reviewed and where possible their application in Ghana is illustrated to generate insights for the development of OPiC framework.

These tools have been chosen for the development of OPiC because of the following reasons:

- PiC's problem analysis is taken as a template for the problem analysis because it encompasses all other tools, is conceptually clear and close to daily life reasoning. It covers the facts and norms that jointly define what a problem is, and the full causal chains between human activities and impacts in terms of policy objectives.
- The functions concept is taken up in the framework because classifications of ecological functions such as 'CPSH+PR' have a good structuring power in complex and multi-sectoral analyses and are cheap to use. Moreover, they provide a systematic basis to establish Total Economic Value.
- Life cycle thinking approach is used to expand the 'activity' element of the problem analysis because it makes explicit that different pollution flows are connected to different stages of the life cycle of products. Moreover, it connects the analysis with the emission and impact models produced by the global LCA community.
- Tools and models from the conceptual structure of EIA may play a useful role in the analysis of effect chains and the derivation of environmental standards for higher-level norms. Moreover, the principles of strategic EIA will help to mainstream the environment in policymaking.
- Economic tools such as total economic value (TEV) assessment or cost-benefit analysis (CBA) should be used with awareness of their sometimes arbitrary character and limitations (e.g. see under evaluation, below), but then may form a powerful tool to communicate the value of the environment with policy makers.
- Action-in-Context is made explicit in the framework because it is able to give truly causal explanations of environmental problems by focusing on the actors behind the problem-generating activities. Moreover, it can be applied in flexible, informal ways and links up quite concretely with options for policy interventions.

The structure that results from the integration of these tools is summarized in Chapter 7 (e.g. Figure 7.1). Key elements are effect chains and norm chains that run parallel to each other but with reversed causality ('impact assessment' versus 'norms derivation') between the polluting activities and the 'final variables' that express policy objectives of health, biodiversity, welfare and culture. The polluting activities are decomposed in a cradle-to-grave manner that may be regionally constrained. Norms in terms of human activities (e.g. emission standards) are called environmental capacities. Discrepancies between effects and norms (facts and values) describe the seriousness of the problem, which may be expressed in monetary terms through the economic tools but may also be left in their own terms, e.g. environmental variables, emission variables, variables of performance of environmental functions or final variables. Specifying this structure for the

problem at hand is called the problem analysis. As a process, problem analysis may start anywhere in the structure and follow any sequence thereafter, but it is important to in the end cover all elements and causal linkages with a level of sophistication that is as balanced as possible. Problem analysis may well include local and traditional knowledge as well as local and traditional values, and may be carried out in any degree of stakeholder or public participation.

Environmental problems stand in a contextual structure that comprises the normative context, the ecological context and the social context. Each of these is connected to its own elements of the problem analysis. The normative context comprises the deeper justifications of why values in terms of the final variables (health, biodiversity, economic development etc.) are set as they are. The ecological context comprises the causes of why the environmental capacity of a certain place is what it is. Finally and most importantly in practice, the social context comprises the reasons why the problem-generating human activities are carried out the way they are. Going into these contexts marks the cross-over from problem analysis to problem explanation. It is often done most effectively in a step by step manner ('progressive contextualisation').

The social explanation of the environmental problem in OPiC is actor-based, with as its central element that for the explanation of an activity A, we first need to identify the decision-making social entity of the activity (*i.e.* the actor), then take stock of the options the actor may implement (A, B, C etc.) and the considerations the actor uses to make its decision (their 'motivations'). Starting this process from the directly problem-causing activity, we may identify actors causally behind these 'primary' ones by finding out what actors have an influence on either the options or the motivations of the primary actors. Simple examples of such influences are giving information on new options for pollution prevention, or the establishment of a levy on polluting activities. The 'secondary' actors responsible for such actions in turn have their own options and motivations, which are then influenced by tertiary actors, and so on. The causal structure thus identified around the polluting activity is called the actors field. Out of this field, selected actors may be further analyzed on how their options and motivations are connected to underlying societal structure and culture. This analysis adds the elements of the actors' knowledge, capitals, economic costs and benefits and the cultural interpretations thereof, self-image, micro-structure and macro-structure. Relevant for the design of solutions to the environmental problems, the actors field identifies potential target groups for policy interventions and the deeper analysis per actor identifies potential policy content (the 'policy instruments').

3 *What are the major tools and approaches that can be used to discover and realise opportunities, and how may these become part of a comprehensive OPiC framework?*

Answers to this question are presented in Chapter 5 of the study. The problem-analytical and explanatory tools from the preceding chapter but also normative concepts such as sustainable product development, cleaner production and industrial ecology, as well as creativity-enhancing approaches are identified as tools and approaches that could be used to discover and realise opportunities to solve environmental problems.

The problem analysis of the preceding chapter generates physical policy options which include options interrupting causal chains in the environment, options to reduce environmental burdens, options that integrate environmental restoration and management, and end-of-pipe solutions. The LCA-type of structure given to the 'activity' element in the problem analysis translates to policy options of waste management, extended producer responsibility, and environmental product improvement. From the problem explanation arise insights in potential target groups and options for policy content that include (1) options directed at the actors' capacities such as research for technological innovation, credit schemes and prestige enhancement, restrictive regulation and so on, (2) options directed at the actors' motivations such as financial internalization, social internalisation, environmental information and education and many others.

Based on normative concepts explored in the chapter, it is found that the re-valuation of local raw materials and the upgrading of indigenous and existing processing technologies can provide new opportunities for the field of product development in developing countries. Pollution prevention strategies based on local industrial skills and capacities may enable industries and society to achieve improved production efficiency. The application of industrial ecological concepts in developing countries could take different forms and depths depending on the scope of the region, the nature of industrial activities in the region, and the desirable objectives to be achieved. Resource and material flow analyses could be used in a qualitative manner to establish trends that would provide a sound background for sustainable environmental management.

Traditional and local knowledge offer good opportunities to improve environmental management in developing countries. One example is to help establish the current use and cultural meanings of lands and resources by people that may be adversely affected. Traditional ecological knowledge may also play a vital role in the environmental assessment by providing different perspectives on the ecosystem and human-environment interrelations. Traditional ecological knowledge could also be used in the public review phase of environmental impact assessment

to contribute to understanding the cumulative effects of activities. Participatory local appraisal, focus groups and advisory committees can be used to tap traditional ecological knowledge for environmental management.

For developing countries especially, the enhancement of self-efficacy of actors has the potential to cause positive change. With improved self-confidence, actors can more successfully engage in a creative search for opportunities and support these opportunities in debates and media. Allied to this point, action learning should be used to guide creative identification of opportunities. Learning through early field trials of possible solutions is part of this strategy for learning in and by environmental and industrial organisations. The creative identification of opportunities will also be enhanced if organisations and individuals would pay more attention to the power of serendipity and dreams.

- 4 *How may a solution to an environmental problem be designed that integrates the options identified through problem-based and opportunity-based approaches to jointly serve comprehensive objectives such as sustainability and efficiency?*

Chapter 6 starts out with a round-up of the types of options identified in the preceding chapter and then moves on to discuss how these may be brought towards implementation by way of market-based tools, regulatory tools, environmental communication and education and conflict resolution tools. With respect to market-based tools, charges and taxes may be recommendable for water pollution, tradable permits for air pollution, deposit-refund system for solid waste management and eco-labels to promote the use of sustainable products. Regulatory tools and environmental education and communication tools should be used in combination with other tools. However, the effectiveness of tools will depend on the pollution problem in question and the legal, judicial and social context. The effectiveness of conflict resolution, for instance, will depend on the conflict at hand as well as the history of the relationship among the parties in the conflict, particularly their willingness to come together to find a long-lasting solution to the conflict. Often, a balanced and synergistic mixture of market-based, regulatory and communicative tools is most effective in the development of solutions to pollution problems.

Furthermore, Chapter 6 discusses the principles and applications of co-management, stakeholder participation and adaptive management as overall characteristics of pollution management strategies. Co-management involves government and local actors (e.g. industries) that negotiate over the sharing of visions and regulatory inputs. Participation entails the inputs of the wider circle of all stakeholders in the design, implementation and follow-up of pollution management plans. Adaptive management focuses on the time dimension, and especially on the flexible responses to monitored changes. These principles may serve to guide

the coherent integration of options and tools for solutions of pollution problems. The principles may be combined to form the notion of participatory and adaptive co-management, but this combination has its limitations, too.

The final sections of Chapter 6 focus on the methods of design, evaluation, implementation and monitoring of pollution management plans. Contrary to common approaches, the evaluation in OPiC implies a two-tiered process. Designed solutions first have to pass an equity filter that checks produced designs on the avoidance of harm to basic needs of the poor, to future generations and to biodiversity. Once passed this filter, designed solutions may enter a traditional efficiency test such as cost-benefit analysis, since the equity filter has already taken care of interests that are poorly expressed in CBA. The adaptability test, finally, involves elements such as the preservation of open options for the future and institutional learning.

Overviewing all preceding material, Chapter 7 summarizes the OPiC framework. It starts out with the conditions that need to be fulfilled for effective use of OPiC and then focuses on the key elements of OPiC such as problem analysis and problem explanation, the options for solutions arising from these and from additional industrial concepts and creativity, the features of a conducive context of discovery and the principles of design and evaluation of pollution management strategies. Finally, the chapter discusses the range of applicability of the framework. Due to its generic character, OPiC can be used not only for pollution abatement but also in many mixed problem situations that also include issues of poverty abatement, natural resources, pollution prevention etc. on various scales. Although designed as an instrument for the design of action, OPiC may also be used as a framework for the analysis of planning processes. And although designed primarily for use in developing countries, OPiC may well be of use in industrialized countries as well. At the same time, however, OPiC is not something to be applied rigidly as if it were a mathematical formula with only one way of doing it. People have to adapt the framework to address the issue under consideration.