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**MEDITERRANEAN ACTION PLAN**

Consultation on costs and benefits of reduction of the degradation of the marine environment from land-based sources of pollution and activities in coastal areas

Athens, 6-8 April 1992

# REPORT OF THE CONSULTATION ON COSTS AND BENEFITS OF REDUCTION OF THE DEGRADATION OF THE MARINE ENVIRONMENT FROM LAND-BASED SOURCES OF POLLUTION AND ACTIVITIES IN COASTAL AREAS

UNEP
Athens, 1992

# TABLE OF CONTENTS

INTRODUCTION

1. The sixteenth session of the Governing council of the United Nations Environment Programme (1991), in decision 16/26 A on "Marine Pollution from land-based sources" (Appendix I), requested the Executive Director *to continue the preparation of elements for draft strategy options and actions to reduce the degradation of the marine environment from land-based activities*. The decision also calls on the Executive Director *to convene a meeting of government-designated experts to formulate a draft strategy, including a targeted and costed programme of action for reduction of the degradation of the marine environment from land-based sources of pollution and activities in coastal areas, and to complete a targeted and costed action programme for the Mediterranean as an input to the strategy, and as an example for the preparation of an international study*.

2. A document (UNEP(OCA)/WG.12/3) outlining the possible strategies and options for programme of action was prepared by the secretariat (Oceans and Coastal Areas Programme Activity Centre - OCA/PAC) for the meeting of government-designated experts, which was planned to be convened by the Executive Director in Nairobi, 9-13 December 1991. The document includes a preliminary estimate of the costs associated with the protection of the Mediterranean Sea against pollution from land-based sources and activities in coastal areas.

3. The draft of the document was reviewed by an Informal Consultation of Technical and Legal Experts (Nairobi, 30 September-3 October 1991), who recommended the preparation of specific detailed case studies on the costs and benefits from the reduction of the degradation of the marine environment, as a supplement to the preliminary estimate of the costs associated with the protection of the Mediterranean Sea.

4. In consultation between OCA/PAC, the Co-ordinating Unit for the Mediterranean Action Plan (MEDU) and the relevant national authorities, and taking into account the ongoing integrated coastal zone management pilot projects carried out in the framework of the Mediterranean Action Plan, the Bay of Izmir and the Island of Rhodes were selected by the secretariat as the sites of the case studies.

5. An ad hoc Consultation on Land-Based Sources of Pollution was organized by MEDU (Athens, 5 - 6 November 1991) to launch the preparation of the case studies. The Consultation agreed (UNEP(OCA)MED WG.32/2) on the terms of reference for the preparation of the case studies, including the outline of the studies and the timetable for their preparation.

6. The preliminary versions of the case studies were presented, as documents UNEP(OCA)WG.14/Inf.8 and WG.14/Inf.9, to a Working Group of the Meeting of Government Designated Experts to Formulate a Draft Strategy for the Reduction of the Degradation of the Marine Environment from Land-Based Sources of Pollution and Activities in Coastal Areas (Nairobi, 9-13 December 1991) (referred to as Meeting of Experts in the ensuing text of this report). The Working Group considered the preliminary studies in the context of costing action programmes for reduction of the degradation of the environment and recommended a general methodology for costing regional programmes and local studies. The recommendations of the Working Group, as approved by the Meeting of Experts (Annex I/Appendix 1 of UNEP(OCA)WG.14/4), are attached as Appendix I to this report.

7. Taking into account the comments and suggestions received from the Meeting of Experts, the two preliminary case studies have been completed and were presented, as documents UNEP(OCA)MED WG.45/2 and WG.45/3, together with methodologies used for their preparation (documents UNEP(OCA)MED WG.45/4 and WG.45/5) to the present Consultation on Costs and Benefits of Reduction of the Degradation of the Marine Environment from Land-Based Sources of Pollution, organized by MEDU (Athens, 6-8 April 1992).

8. The participants in the Consultation, attending in their personal expert capacities, are listed in Annex I to this report. The documentation available to the participants in the Consultation is listed in Annex II.

Agenda item 1: Opening of the meeting

9. The Consultation was opened at 9.30 on 6 April 1992 at the Co-ordinating Unit for the Mediterranean Action Plan (UNEP/MEDU) in Athens, by Mr. Salvino Busuttil, Co-ordinator of the Mediterranean Action Plan, who welcomed the participants on behalf of the Executive Director.

Agenda item 2: Organization of work

10. Mr. Ljubomir Jeftic, Senior Marine Scientist of UNEP/MEDU, was proposed and elected to chair the Consultation. Mr Stjepan Keckes, consultant to UNEP/MEDU, was elected to act as the rapporteur of the Consultation.

11. The agenda of the Consultation was adopted as proposed by the secretariat (Annex III).

12. The Consultation was convened in plenary sessions and in English only, with some drafting between the plenary sessions.

Agenda item 3: Scope and objective

13. Mr. Ljubomir Jeftic recalled the events leading to the Consultations (see paragraphs 1-7) and identified:

- the finalization of the two case studies; and

- the description of a methodology for assessing the costs and benefits of measures for the reduction of degradation of the environment;

as the expected outcome of the Consultation.

14. The format of the document resulting from the preparation of the case studies was discussed, and it was agreed that the two case studies and the methodology should be published as a single volume in the MAP Technical Reports, and the Regional Seas Reports and Studies series. A "preface" and a "background" would have to be added to the volume describing, in a language suitable for policy-makers and managers, the background relevant to the preparation of the document, and its intended use. A draft of such a preface and background was prepared during the meeting, and is attached to this report (Annex IV and V). As suitable title for the publication *Costs and Benefits of Measures for the Reduction of Degradation of the Environment from Land-Based Sources of Pollution and Activities in Coastal Areas* was proposed, with a subtitle *Case Studies and Methodology*.

15. The document would be used as a further input in the estimate of the costs associated with the protection of the Mediterranean Sea (see paragraph 3 of this report), and as a methodological guideline for the preparation of assessment of costs and benefits of measures for the reduction of degradation of the environment in additional case studies which may be prepared.

Agenda item 4: Case Study on Bay of Izmir

16. Mr. Ferenc Juhasz reviewed the document describing the Bay of Izmir case study (UNEP(OCA)/MED WG.45/2) and highlighted the parts of the document where, on the basis of additional material changes have been introduced in the preliminary version of the study considered by the Meeting of Experts (Nairobi, 9-13 December 1991). Additional information relevant to the preparation of the study was presented by Mr. Turgut Balkas. The presented document was discussed under the next agenda item, after the presentation of the document describing the Island of Rhodes case study.

Agenda item 5: Case Study on Island of Rhodes

17. In reviewing the Island of Rhodes case study, Mr. Glafkos Constantinides draw the attention to the parts of the document (UNEP(OCA)/MED WG.45.3) where the preliminary version of the study was expanded on the basis of additional information.

18. When comparing the preliminary versions of the two case studies with the versions submitted to the present Consultation, it was revealed that the basic conclusions of both versions, including the estimated costs and benefits, remained in essence unchanged.

19. Although it was recognized that the studies could be further expanded by inclusion of additional material, and by considering a number of additional management and policy options, the Consultation felt that the experience with the preparation of the case studies showed that studies of this type can be prepared in relatively short time, subject to the:

- availability of information needed for their preparation;
- involvement of experts already familiar with the conditions relevant to the scope of the study; and
- co-operation of local authorities.

It was estimated that the preparation of the studies required about 4 person/months in the case of the Bay of Izmir and 2 person/months in the case of the Island of Rhodes.

20. Some concern was expressed by one of the Consultation's participant about the way the studies considered by the Consultation may be interpreted and used. However, it was felt that the suggested preface (Annex IV) of the publication in which the case studies are planned to be released, clarifies sufficiently the scope, nature and intended use of the case studies.

21. It was agreed that Messrs Balkas and Constantinides will send to Mr L. Jeftic, by the end of April 1992, the final versions of the Bay of Izmir and the Island of Rhodes case studies, taking into account the comments made during the Consultation. In order to avoid duplications, the final versions should not repeat what will appear in the "preface" and in "background" of the publication in which the case studies will be issued (see paragraph 14).

Agenda item 6: Methodology for the use of cost-benefit analysis

22. Messrs Juhasz and Constantinides gave a detailed presentation of the documents referring to the methodological aspects of the two case studies (UNEP(OCA)MED WG.45/4 and WG.45/5).

23. In discussing their presentations and the documents, the Consultation agreed that the two documents should be merged and should be prepared in such a way that the new text could be used as a general guideline for the methodology applicable in the preparation of similar case studies. Furthermore, it was agreed that the new text should:

- reflect the relevant conclusions and recommendations of the Meeting of Experts (Appendix I of this report);

- take into account the experience and practice of the United Nations system in this field (UNEP, the World Bank and UNDP in particular); and

- illustrate the application of the proposed methodology with examples from the two case studies.

24. The new text describing the methodological guidelines, as drafted during the Consultation, is attached as Annex VI. It was agreed that Messrs Balkas and Constantinides will send, by 21 April 1992, their comments on Annex VI to Mr Ferenc Juhasz. He agreed to provide Mr Ljubomir Jeftic, by the end of April 1992, with the final version of the "methodological framework" which, subject to clearance from UNEP's Headquarters, is planned to be issued as part of the publication containing the two case studies (see paragraph 14).

Agenda item 7: Adoption of the report

25. The draft report of the Consultation, including its annexes, was reviewed by the participants of the Consultation and adopted, as it appears in this document.

Agenda item 8: Closure of the Meeting

26. The Consultation was closed by Mr Ljubomir Jeftic at 17:00 on 8 April 1992.

# ANNEX I

# LIST OF PARTICIPANTS

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# ANNEX II

# LIST OF DOCUMENTS

| | |
|---|---|
| UNEP(OCA)/MED WG.45/1 | Provisional Agenda |
| UNEP(OCA)/MED WG.45/2 | Preliminary Study on the Costs and Benefits of Measures for the Reduction of Degradation of the Environment from Land-Based Sources of Pollution and Activities in Coastal Areas of the Bay of Izmir (T. Balkas and F. Juhasz) |
| UNEP(OCA)/MED WG.45/3 | Preliminary Study on the Costs and Benefits of Measures for the Reduction of Degradation of the Environment from Land-Based Sources of Pollution and Activities in Coastal Areas of the Island of Rhodes (G. Constantinides) |
| UNEP(OCA)/MED WG.45/4 | Methodology for the Use of Cost-Benefit Analysis in Environmental Investment Projects - A Review of the Izmir Bay Analysis (F. Juhasz) |
| UNEP(OCA)/MED WG.45/5 | Methodology for the Use of Cost-Benefit Analysis in Environmental Investment Projects - A Review of the Island of Rhodes Analysis (G. Constantinides) |
| UNEP(OCA)/MED WG.45/6 | Report of the Meeting |
| UNEP(OCA)/MED WG.45/Inf.1 | Provisional List of Documents |
| UNEP(OCA)/MED WG.45/Inf.2 | Provisional List of Participants |

# ANNEX III

# AGENDA

1. Opening of the Meeting

2. Organization of work

3. Scope and objective

4. Case Study on Bay of Izmir

5. Case Study on Island of Rhodes

6. Methodology for the use of cost-benefit analysis

7. Adoption of the report

8. Closure of the Meeting

# ANNEX IV

# PREFACE

The costing of programmes designed for the protection of the environment, and the assessment of benefits from such programmes, is a crucial step in the environmentally sound management and sustainable development of the coastal and marine environment.

The present attempts [1], [2] to assess, on a global and on regional levels, the costs and benefits from the reduction of the degradation of the marine environment from land-based sources of pollution and activities in coastal areas revealed that the methodology used by government agencies and international financial and aid institutions for the cost-benefit analysis of environment protection measures vary considerably, and that at present there is no agreement on procedures which may lead to comparable results on a global or regional level.

As a contribution to the improved assessment of the costs and benefits associated with the environment protection measures, the preparation of two case studies was undertaken by UNEP, along the general methodological guidelines recommended by a recent meeting of government experts[3].

Taking into account the ongoing integrated coastal zone management pilot projects carried out in the framework of the UNEP-sponsored Mediterranean Action Plan, the Bay of Izmir (Turkey) and the Island of Rhodes (Greece) were selected as sites of the case studies. They represent two different, yet typical and complementary situations, common throughout the Mediterranean: one a large coastal urban and industrial centre, the other an island with tourism as the main economic activity.

The two case studies were successfully completed in short period and at low cost, thanks to:

- availability of information needed for their preparation;
- involvement of experts already familiar with the conditions relevant to the scope of the studies; and
- co-operation of local authorities.

The main conclusions of both case studies is that the benefits from environment protection measures would, if applied, significantly outweigh the costs of their application in long-term.

This publication contains the two case studies, as well as the general methodological approach used as guideline in their preparation. They are proposed to be used in the preparation of regional and local case studies.

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1 Sessions of the Preparatory Committee of the United Nations Conference on Environment and Development (Nairobi, 6-31 August 1990; Geneva, 18 March-5 April 1991; Geneva, 12 August-4 September 1991; New York, 2 March-2 April 1992).

2 Strategy for the Reduction of the Degradation of the Marine Environment from Land-Based Sources of Pollution and Activities in Coastal Areas (including an annex on Preliminary Estimate of the Costs associated with the Protection of the Mediterranean Sea against Pollution from Land-Based Sources and Activities in Coastal Areas (UNEP(OCA)/WG.14/3).

3 Meeting of Government Designated Experts to Formulate a Draft Strategy for the Reduction of the Degradation of the Marine Environment from Land-Based Sources of Pollution and Activities in Coastal Areas (Nairobi, 9-13 December 1991).

# ANNEX V

# BACKGROUND

The sixteenth session of the Governing council of the United Nations Environment Programme (1991), in decision 16/26 A on "Marine Pollution from land-based sources" (Appendix I), requested the Executive Director *to continue the preparation of elements for draft strategy options and actions to reduce the degradation of the marine environment from land-based activities*. The decision also calls on the Executive Director *to convene a meeting of government-designated experts to formulate a draft strategy, including a targeted and costed programme of action for reduction of the degradation of the marine environment from land-based sources of pollution and activities in coastal areas, and to complete a targeted and costed action programme for the Mediterranean as an input to the strategy, and as an example for the preparation of an international study*.

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The preliminary versions of the case studies were presented, as documents UNEP(OCA)WG.14/Inf.8 and WG.14/Inf.9, to a Working Group of the Meeting of Government Designated Experts to Formulate a Draft Strategy for the Reduction of the Degradation of the Marine Environment from Land-Based Sources of Pollution and Activities in Coastal Areas (Nairobi, 9-13 December 1991). The Working Group considered the preliminary studies in the context of costing action programmes for reduction of the degradation of the environment and recommended a general methodology for costing regional programmes and local studies.

Taking into account the comments and suggestions received from the Meeting of Experts, the two preliminary case studies have been completed and were presented, as documents UNEP(OCA)MED WG.45/2 and WG.45/3, together with methodologies used for their preparation (documents UNEP(OCA)MED WG.45/4 and WG.45/5) to the Consultation on Costs and Benefits of Reduction of the Degradation of the Marine Environment from Land-Based Sources of Pollution, organized by MEDU (Athens, 6-8 April 1992). The Consultation reviewed and revised, as appropriate, these documents and they constitute the three substantive sections of the present publication.

# ANNEX VI

# METHODOLOGICAL FRAMEWORK FOR THE ANALYSIS OF COSTS AND BENEFITS ASSOCIATED WITH ENVIRONMENT PROTECTION MEASURES

**CONTENTS**

## 1. BACKGROUND

Cost-benefit analysis is a powerful and versatile tool which enables economists and planners to construct an information and evaluation framework for the appraisal of *planned* or *on-going* public investments. However, at present there is no universally accepted methodology for cost-benefit analysis for the evalutation of projects for environmental improvements.

At a recent meeting of government experts[1] a generalized methodological framework which could be used in assessment of costs and benefits from the reduction of the degradation of the marine environment from land-based sources and activities in coastal areas was formulated. The methodology proposed by the meeting was later endorsed by the Preparatory Committee for the United Nations Conference on Environment and Development[1], and the two case studies included in the present publication were prepared largely along the lines of this methodology.

The methodology itself is elaborated in this last section of the present publication, and the approaches and tools used in cost-benefit analysis are reviewed in this context. Whenever applicable, references are made to the relevant parts of the case studies.

## 2. INTRODUCTION

Since the results or outputs of environmental projects are seldom traded in markets for goods and services financial costs and revenues underestimate or fail to capture the social /community benefits associated with environmental improvements. On the basis of financial criteria environmental projects may fail to prove viable and fail to secure public funds.

Environment policies are developed in response to public demand and they produce partly private and partly public goods. Public goods have various characteristics which they possess to differing degrees. For example a beautiful landscape can be enjoyed by everybody; it is a pure public good; sewerage services are available only to those who pay for them but they also contribute to public health in general and even those who are not in the sewerage system benefit from them.

The important point about environmental public goods is that they are similar to public goods produced by health and educational expenditures and are difficult to evaluate in economic terms. Economic evaluation is however important because the allocation of public funds is based partly on the benefits these funds can produce; at the same time governments also take into account public demand for environmental goods and services as it is expressed through the political process.

Consequently requests for better evaluation of environmental expenditures are becoming more and more frequent both at the national and at the international level. Such assessments are needed to make choices between environmental and other public projects and also between environmental projects and to define priorities. The rational allocation of limited public funds can be undertaken only with the assistance of cost-benefit or similar techniques. The results of such evaluation techniques are only one of the factors that need to be considered, but certainly the most important one for economic efficiency.

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1 Annex I/Appendix 4 of UNEP(OCA)/WG.14/4.

1 4th Session, New York, 2 March - 2 April 1992.

The necessity for evaluation of environmental effects in public and private projects has been evident for sometime - at least since the 1960's this was a widespread concern - as they produced significant environmental benefits or costs together with main output of the project. To illustrate this point, an irrigation project is a good example. A purely economic evaluation required positive net benefits based on agricultural benefits (output) less cost of production including the cost of a dam and delivery cost of water, calculated over a sufficiently long period; often some other macro-economic benefits, such as job creation, were also taken into account. However such public/private irrigation agriculture projects usually produced significant environmental effects: loss of land and landscape due to the construction of dams, soil erosion and salination were examples of environmental losses; recreational benefits of the dam, and ecosystems created were examples of environmental benefits. These losses and gains were not included in the assessment and this could have led to incorrect results and therefore wrong decisions.

Today it is therefore widely accepted that environmental costs and benefits should be taken into account in both private and public investments and associated expenditures. In the case of private projects Environmental Impact Assessments are required and the shape and the execution of the project are adapted to conform with those requirements. If after these changes the financial analysis, a 'cost-benefit' for private projects, shows that the project is not profitable then it should be abandoned, unless the social consequences, such as unemployment, are very severe.

The situation with public projects is different. In most countries large investment projects proposals need to be submitted for approval with a cost-benefit analysis, which in principle should take environmental costs and benefits into account either by quantifying and valuing them or in less specific forms. If the objective of the project is a marketable commodity, such as water, electricity, wood products then environment appears as a byproduct. In other cases better environment is the major output of the project such as with sewerage systems, land conservation, and protection of wetlands. There are still other cases where government policies aiming at environmental improvements, particularly pollution control, need to be evaluated. Such a policy might require that, for example, all cars should have catalytic converters for pollution control and in this case the government might wish to evaluate to nationwide costs and benefits of the policy over the longer term.

This short discussion indicates that there is a considerable scope for cost-benefit analysis in the environment field. The environmental community is divided on this issue. Environmental economists have been arguing for a wider use of cost-benefit analysis for environmental and natural resource systems suggesting that this would lead to more rational environmental and resource management policies. Others argued that environment is either too difficult or too precious to be expressed in monetary terms., and such an approach would lead to a relative undervaluation of the environment. It has been also argued that cost-benefit evaluation can not be applied in its conventional form in countries where a large section of population live in a subsistence economy.

Recent advances in the valuation techniques of environmental benefits and damages and the capability of cost-benefit analysis to go beyond *financial analysis* and profitability concerns make cost-benefit analysis particularly appropriate for the analysis of environmental projects.

The most general way of expressing cost-benefit analysis that takes into account also the environment is by the following simple equation:

$$NPV = Bd + Be - Cd - Cp - Ce$$

where NPV = net present value
Bd = direct project benefits
Be = external (and/or environmental) benefits
Cd = direct project costs
Cp = environmental protection costs
Ce = external (and/or environmental) costs

The traditional development project evaluation takes into account only the direct project benefits and direct project costs. The expanded approach above includes the external and environmental benefits, including those from environmental protection, and the cost of external and/or environmental damages and of environmental protection measures. There are three steps involved in this process: identification of costs and benefits; their quantification; and their valuation. Each of these steps require careful analysis and some relatively new and untried methodologies and assessments. Extreme care is needed that all effects are identified and that double counting is avoided[2].

All items on the right hand side of the equation are to be discounted in present values. The process of discounting is simply compound interest worked backwards. In general the present value of any future receipt or expenditure is calculated by multiplying it by $1/(1 + d)^t$ where 100d is the percentage rate of discount and t is the number of years ahead. By this process of discounting expenditures and receipts, costs and benefits, which occur at different times throughout the construction and operation of the project are all revalued to make them comparable to present expenditures and receipts. Thus, the rate of discount becomes a crucial element in the evaluation.

## 3. CONTENTS OF COST-BENEFIT ANALYSIS

A full scale cost-benefit analysis consists of integration of the results from a number of simultaneous or consecutive steps and sectorial analyses (Figure 1).

The methodological framework referred to in the Background Section contains six items. They are reviewed in the ensuing paragraphs[3]; expanded with commentaries and explanations; and, whenever applicable, cross referenced with the relevant parts of the case studies presented in this publication.

Items 3.1 and 3.2 in this section describe the physical, social and economic characteristics of the study area, sources of pollution and their physical environmental impacts; item 3.3 refers to the pollution damage occured in the past; item 3.4 analyses the cost and benefits of environmental measures taken in a specified past period; and item 3.5 assesses the cost and benefits of the measures to be taken under the proposed project. The methods of quantification of the cost of the environmental measures and the methods of quantification and valuation of the

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2 Dixon, J.A. and M.M. Hufschmidt: Economic Valuation Techniques for the Environment, East-West Center; John Hopkins University Press, 1986.

3 The original text of these items is indicated in italics.

environmental benefits (reduced environmental damages) are the same for all three cases. These methodologies are described in section 3.5; corresponding cross-references are provided in each of the sub-sections. The question of non-monetary costs and benefits and subsistence economies is discussed in section 3.6. The method of discounting is described and cross-referenced in section 4.

*3.1. A general description of the study area* (see Table IX, Izmir Case Study)

A general description of the study area should provide *basic information on the status of the natural resources of the area, demographic trends, land and sea use practices, economic development indicators, etc.* Specific information is required on:

(a) Delimitation of the study area:

- coastal stretch (horizontal)
- hinterland (vertical)

(b) Status of the natural resources of the area

- coastal lands
- coastal waters
- communications and road network
- forests
- rivers
- wetlands
- coastal air area
- marine resources
- flora and fauna

(c) Trends in the ambient quality of coastal waters, coastal terrestrial environment and air

(d) Demographic trends, land and sea use practices and economic development

- population and labour force
- urbanization and settlements
- industry
- agriculture
- transport (land and sea)
- fisheries
- tourism
- harbour activities
- energy production and use
- mining

3.2. *An analysis of land-based sources of pollution and activities in coastal areas contributing to the degradation of the marine and coastal terrestrial environment*

Three specific items should be considered:

(a) *An inventory of coastal point and non-point sources of pollution and activities*

(b) *An estimate of the type and amount of pollutants reaching the environment from coastal and land-based sources and activities either through direct discharges or indirectly through atmosphere or riverine transpor*t, including:

- assessment of the relative importance of individual sources, activities and pollutants;
- calculation of the present pollution load, and future projections;
- analysis of existing measures for pollution control, and assessment of additional measures which may be needed;

(c) *An estimate of the ecological and human health related impact of the sources and activities*:

- human health
- coastal water quality
- food quality
- air quality
- ecosystem diversity
- natural resource stock depletion

3.3. *An analysis of the actual and potential social and economic costs of pollution from land-based sources and activities in coastal areas, expressed in monetary terms; indirect impacts due to loss, depletion or depreciation of natural resources or their quality, or due to effect on human health*

This analysis seeks to value in monetary terms the overall impacts listed under 3.2 (c) in order to set future pollution reduction objectives for the region. For method of valuation and discounting, see under sub-section 3.5.1. and section 4.

3.4. *An analysis of the costs and associated benefits, expressed in monetary terms, from measures which have been introduced to control pollution from land-based sources or activities in coastal areas*

This analysis is needed to evaluate in monetary terms the performance of policy measures taken in the past. For method of valuation and discounting, see under sub-sections 3.5.1, 3.5.2 and section 4. Such an analysis might not be feasible in all cases.

3.5. *An analysis of costs and benefits of additional measures (legal, administrative, economic, fiscal, technological, institutional) which would have to be introduced in order to protect the marine and coastal areas and ensure their sustainable development and use*

3.5.1. Analysis of costs

(a) Nature of costs:

- costs should be expressed in <u>economic costs</u> not financial or accounting costs; this means financial costs need to be adjusted for distortions such as subsidies, distorted exchange rates, non-market wage costs and other distorting taxes;
- costs as well as benefits should be expressed in <u>constant prices</u> of the base year.

(b) Identification and quantification of costing

- All costs associated with the measures should be identified and quantified; they include:
  - investment or capital cost of equipment, construction and land:
    - sewage treatment plant,
    - sewage collection system including pumping station, etc.,
    - construction of sea outfalls,
    - installation of pollution control equipment for water, air and solid waste disposal,
    - noise control,
    - shore protection installation,
    - stream control,
    - transport equipment, ships, boat, trucks, etc.;
  - operation and maintenance costs:
    - all costs associated with the operation and maintenance of capital equipment; they include:
      - wages and salaries,
      - materials cost,
      - energy costs;
    - other routine operation not necessarily associated with significant capital equipment such as routine collection of waste on harbour shores;
    - administrative cost.

(c) Costing for uncertainty and alternative options:

- Uncertainty:
  - engineering cost estimates of projects usually contain a certain element of uncertainty; in the past this was often as high as 100% (see recent Channel Tunnel estimates);
  - costing should take into account this uncertainty and several estimates should be prepared based on past experiences and included in the analysis;
- Alternative technical solutions:
  - benefits within the same range could be obtained with different technical solutions and costs for the alternative solutions should also be prepared and included in the analysis.

3.5.2. Analysis of Benefits/Reduced Losses

(a) Identification of benefits (see Table 1)

- change in outputs such as food production, tourism, recreation, reduced corrosion;
- changes in health conditions, reduced mortality and morbidity;
- changes in environmental functions: flood control, storm control;
- changes in environmental quality and consequential changes in values;
- maintenance and conservation of natural resources: habitats, biodiversity.

(b) Quantification of benefits:

- outputs: quantity of food, number of tourists or tourist/days, number or recreationist or recreation/days, number of additional years of material saved through reduced corrosion;

- health conditions: reduced number of working days lost, reduction in the number of death;

- reduced quantity of crop lost, reduced number of houses or other property lost;

- the area of land where values increased;

- number of endangered species saved quantity of natural resources conserved area of forest, area of water.

(c) Valuation of benefits:

Benefits should be expressed in economic terms (excluding subsidies, etc.) in constant base year prices. The quantified benefits will be valued differently according to the nature of benefits.

- additional output to be valued in market prices (e.g. market price of fish); market prices might need to be adjusted for distortions such as subsidies or taxes;

- additional tourist days valued in daily expenditures;

- additional recreational benefits valued in travel costs;

- reduced material losses valued in replacement costs;

- health benefits valued in reduced loss of earnings or life earnings in case of death; alternatively in the reduction in health expenditure;

- reduced losses from natural disaster valued in market values;

- increased land values valued in market prices adjusted for monopoly pricing practices;

- endangered species valued by various methods: insurance values, damages awarded by the court, etc.;

The method of discounting is described in section 4.

3.5.3. Coastal zone management framework for cost-benefit analysis

The analysis has to be carried out within a specific coastal management framework which would consist of the following arrangements:

- Legal arrangements are needed to define clearly property rights of natural resources in the coastal zones such as property rights to coastal stretch, coastal water marine resources, inland water rights.

- Administrative arrangements are required for the allocation of management responsibilities of coastal resources and environmental pollution: a special body needs to be created to integrate the activities of the various administrative agencies in coastal areas and in the hinterland as defined for the study area;

- The use of cost-benefit analysis should be required by administrative decree or statute to be carried out for all major coastal projects with significant environmental impacts; it should be also prescribed that all environmental impacts are incorporated in the analysis and that the analysis is carried out according to the guidelines developed in this report;

- Objective of integrated coastal zone management should be sustainable development of coastal resources; for this purpose a whole range of economic and regulatory instruments should be employed to implement environmental policy; the cost-benefit analysis should include the cost of these environmental measures as well as the benefits generated from them;

- Fiscal arrangements needed to finance coastal zone management measures should be based partly on user charges collected from environmental services (sewage and water fees, waste charges) and taxes and fees on coastal activities benefiting largely from the use of coastal resources such as land development taxes, tourist taxes; public/private partnership should also be used to finance infrastructure developments.

3.6. *An evaluation of costs and benefits in non-monetary terms, related to sustainable development and the quality of life of populations, including those largely outside the monetary economy*

It is now recognised that there are certain environmental benefits/losses which cannot be valued in terms that are generally acceptable to all concerned and some of these are discussed under section 4.2 valuation approaches. It should be recognised that those that cannot be treated within the cost-benefit analysis still need to be explicitely taken into account in the decision making in addition to the results of the cost-benefit analysis.

Furthermore, there are certain societies with very restricted or non-existent monetary economy. In these cases, the following considerations should be taken into account:

- In the case of non-monetary economies, small isolated islands for example, coastal management cannot be evaluated in conventional monetary terms;

- In such cases priorities should be given in the evaluation of the projects to the social values of the societies living in these areas; this could take a substantial reassessment of the values used for barter in these economies;

- Environmental protection measures and benefits would have in these areas relatively high values when these are essential for the survival of these societies;

- In some of these cases the global environmental values of these areas would also have to be taken into account and assistance be provided to ensure their sustainable development.

## 4. CONCEPTS, APPROACHES AND TOOLS USED IN COST-BENEFIT ANALYSIS

### 4.1. Characteristics of environmental projects

Environmental projects cover a wide range of investments with varying scope and technological features. They range from relatively small control measures (like designation and protection of parks) to large capital facilities (sewage systems). There are, however, some basic characteristics which are common to most environmental improvement projects; and often contribute to the complexity of the analysis:

- capital intensity,
- long - term social benefits (community benefits),
- positive impacts on regional development,
- "outputs" do not pass through markets (and cannot easily be priced),
- often commercially not viable,
- undertaken by public sector agencies.

### 4.2. Valuation of approaches

Valuation is at the heart of environmental cost-benefit analysis. It is also one of the most difficult steps. The most important principle of valuation central to cost-benefit analysis is that costs should reflect "opportunity costs" as opposed to financial costs and benefits should reflect willingness to pay as opposed to actual cash payments.

Valuation from a social point of view can be grouped in three main categories referring to market or market-related settings in which indications of values may be obtained to give monetary measures to costs and benefits :

- Conventional markets
- Implicit markets
- Artificial markets

*Conventional markets* : Existing markets can provide indicators of social values relevant to cost-benefit analysis. There are four such indicators which can be used effectively : (i) changes in production, (ii) replacement cost, (iii) preventive expenditure and (iv) human capital changes. The choice of indicator depends on the problem under investigation. Sometimes several approaches may be combined: Air pollution from industrial sources may affect agricultural output and/or tourist income (approach i) necessitate earlier replacement of building materials on houses and/or hotels (approach ii) cause additional construction costs to prevent exposure to polluted sites, three - glass windows etc (approach iii) and cause damage to human health entailing money costs, loss of wages and time (approach iv). Many environmental impacts have direct effects on production levels: Pollution can damage fisheries and potable water; Soil erosion reduces the value of crops.

*Implicit markets* : The main concepts behind this approach to valuation is the link between the consumption of market goods with strong environmental characteristics (like *houses* in different residential areas) and people's willingness to pay a premium on houses with such environmental characteristics. Thus changes is environmental quality will be reflected in *house prices* and differences in the price of houses of similar architectural type and size are very likely to offer clues to the value of residential amenity and environmental quality. The same basic idea leads to the use of *travel costs* as indication of people's valuation on recreational areas, parks, coastal environments etc.

*Artificial markets* : It is not always possible to draw inferences from actual behaviour as in the approaches outlined above. Sometimes valuation may have to be measured through further manipulations and hypothetical situations in order to estimate the *willingness to pay* for an environmental improvement or for preventing environmental damage. Alternatively, to estimate *the willingness to accept compensation* for environmental damage or a project with negative effects.

An alternative classification of environmental benefit valuation is presented in Table 1.

4.3. Discounting

It is impossible to make economic sense of any project or programme unless one is able to compare costs with the flow of benefits. The need for comparison is the reason for identifying costs and measuring the benefits. As costs and benefits occur over time it is necessary to bring all costs and benefits with different time-profiles under a common present value. The importance of bringing all costs and benefits on a common basis is particularly crucial in environmental projects which typically have long-term benefits and early capital costs. The process of expressing the stream of benefits arising over time in terms of present values is done through discounting by using an appropriate discount factor.

The choice of the discount factor is controversial because the higher the discount factor the lower is the present value of benefits arising later in time relative to benefit (and costs) arising earlier. For example : an increase in tourist income of $100 million arising in 20 years time is worth $14.8 today at a 10% discount factor but $37.7 at a 5% discount factor. Another controversial issue concerning discounting is that it expresses society's preferences between present consumption relative to conservation of resources for future use. Higher discount factors imply stronger preference for earlier use of resource (development) allowing fewer choices to future generation (non-sustainability).

Generally, the choice of the appropriate discount factor should be established by the national planning agencies in the context of national priorities and environmental concerns. It should be clear however, that the higher the discount factor the lower the Net Present Value which implies that environmentally desirable programmes with long-term benefits may appear financially and even socially unfeasible.

The proper way to approach the issue of discounting in environmental projects is to select the factor in close consultation with national authorities so that it best reflects the investment opportunities and the environmental concerns within the national economy.

To avoid underestimation of long-term benefits cost-benefit analysis should concentrate on adequate valuation of benefits and risk rather than on manipulation of the discount factor.

"Instead of adjusting discount rates we recommend therefore that environmental efforts be concentrated on :

(i) improving valuation techniques, including valuing costs and benefits more carefully;

(ii) integrating environmental considerations into all economic decisions; and

(iii) incorporating a sustainability constraint into the appraisal of environmental programmes."[5]

4.4. Distribution effects

The analysis of distributional effects is an important consideration associated with cost-benefit analysis. It raises important questions about who pays the costs and who incurs the benefits of environmental improvements. There are two aspects which require attention : the first aspect is a matter of *equity* and focuses on the distribution of costs and benefits between the rich and the poor. If the benefits of environmental improvement accrue to property owners or high-income neighbourhoods or prosperous regions, cost-benefit analysis should highlight the fact that the investment will improve the living standards of the rich at the expense of the poor. The second aspect is a matter of *financial strategy* and concerns the issue of how to design a system of beneficiary charges or taxes through which to recover all or part of the cost of projects to ensure replicability and fairness.

4.5. Practical implementation of the cost-benefit approach

(a) Selection of the time frame

- The first and final year of the project/study should be selected:
  - the first year is when expenditures that will produce benefits are undertaken;
  - the final year is either when the capital structure to be replaced or when benefits ceased to be generated (usually not longer than 35 years).

(b) Allocation of costs and benefits

- allocate separately costs over the life of the project to the year when they are undertaken (see Table XIII in UNEP(OCA)/MED WG.45/2 and Table VII in UNEP(OCA)/MED WG.45/3);
- allocate separately potential benefits over the life of the project to the year when they occur;
- add up the total of costs and the total of benefits separately for each of the projects;

[5] David Pearce et al.: Blueprint for a Green Economy, Earthscan Publications Ltd. London, 1990

- discount, by dividing by the discount factor, separately costs and benefits and add up the total for the whole life of the project; the discount factor is the compound rate of interest calculated using a selected rate of interest.

(c) Discount rate

- to be able to discount a discount rate need to be selected;

- discount rate for cost-benefit analysis of public project might be described by the Finance Ministry or by the International Lending Institution providing funds;

- if no such Directive is available select the rate that might be: the opportunity cost of capital (rate at which business can borrow in the capital market or the rate of government borrowing) or the social rate of time preference;

- only one discount rate should be used for cost and benefits;

- the discount rate should not reflect the rate of inflation;

(d) Presentation of the results

- the presentation of the results of the above calculation can be either in terms of:

    - net present values; or
    - benefit-cost ratio.

- net present value is calculated by deducting the total of discounted costs from the total of discounted benefit;

- benefit-cost ratio is calculated by dividing the total of discounted benefit with the total of discounted costs;

- an alternative method of calculation and presentation is the internal rate of return technique which is not presented here; the internal rate of return discounts the stream of the net value of benefits (benefits less cost) to zero over the life of the project;

- to test the sensitivity of the analysis to different discount rates carry out the calculations with different rate with a considerable range.

(e) Evaluation of results and making decisions (see Table 2)

- a clear decision can be taken when there is <u>no constraint</u> on the total cost of the project: undertake the project if:

    - net present value is greater than zero (NPV > 0), or
    - benefit/cost ratio is greater than one (B/C > 1).

- if there is <u>constraint</u> on costs:

    - net present is suitable provided total costs are not exceeded; but not suitable for ranking different projects;

    - benefit costs ratio is suitable for ranking projects and selection provided total costs remain within limit.

- if the projects are mutually exclusive:

  - select largest NPV;
  - B/C not suitable.

4.6. Financing considerations

Even though the focus of cost-benefit analysis is on the welfare of the society as a whole attention should still be directed to the public authority operating environmental improvement investments and the management of financial resources at its disposal. Financial management and the mechanism of converting social benefits into cash income remain significant aspects in cost-benefit analysis. For example, the public authority operating a sewerage system has to remain financially viable in order to continue as an active agent of environmental policy. When the benefits generated by a sewerage system are large enough to make the system socially viable, financial strategies have to be designed to cover the costs undertaken by the authority. Often public authorities are politically unwilling to impose on the beneficiaries full - recovery sewerage charges (or water charges) in which case subsidies are necessary. It is a matter of financial analysis to show how much this transfer payment will amount to, who will receive it, who will ultimately finance it, and how if will affect the finances of the authority. Financial analysis is important when one is tackling the distributional effects of environmental projects and decide on the incentive system for the use of the services by different income groups with different ability to pay. It is of little actual benefit to society to construct a project which is potentially valuable to society when individual households are unable to afford its services. Financial considerations, although different from social considerations, must always be incorporated into the cost-benefit analysis process.

4.7. Application of cost-benefit analysis in developing countries

Although cost-benefit analysis has been widely used in developing countries the concern is often expressed that under certain conditions cost-benefit analysis can lead to misleading results in these countries.

This concern is not new and has been the subject of debate over the last 20 years. It has been restarted and taken on new dimensions when evaluation of infrastructure projects and environmental benefits started to be subjected to cost-benefit assessment.

The major point in the debate is the presupposition that actual prices in developing countries, prices which are used also to value economic and environmental benefits, are much worse reflectors of social costs and benefits than in advanced economies. The reason is that certain economic factors are operating in such a disproportionate manner that they distort the operation of market prices. These are: inflation, currency overvaluation,
wage rates and unemployment, imperfect capital markets, large investment projects, inelastic export demand, protection, and income distribution.

Some of these issues have been touched upon in this paper, such as income distribution. In the Izmir context some of these factors, such as inflation, are also of importance and should be accounted for.

It is not feasible to treat these issue in any detail in this paper but some of the main concerns can be mentioned:

i) inflation is often rapid in developing countries and this could necessitate the control of some sectoral prices by the authorities; it could also mean that relative prices will move differently in the future: these factors need to be taken into account when constant prices are used for valuing costs and benefits;

ii) wage rates should be in theory equal to the marginal product of labor; because of monopoly power of trade unions or employers and immobility of labor there are serious imperfections in the labor market even in the developed economies; in the developing countries to these must be added large scale of under- or unemployment; when wage costs are used for valuation in developing countries adjustments are needed to establish the social cost of employment or other alternative wage costs;

iii) imperfect capital markets in developing countries produce unrealistic interest rates, completely unsatisfactory for establishing discount rates; these imperfections due to government intervention, monopoly power and create a very wide band of interest rates;

iv) large projects with significant environmental costs and benefits are common in developing countries; such large projects can have major macro-economic impacts and can alter overall profitability, wage rates and other economic variables; in the valuation of future costs and benefits these potential changes should be incorporated;

v) inelastic export demand implies that the free market price is not measuring correctly the benefits if the country is the major supplier of the product in question; again for valuation purposes these prices need to be adjusted;

vi) protection, in the form of import quotas, tariffs and export disincentives, is used often for good economic reasons, such as to support industrialisation policy; but they can completely distort the price structure of the economy and its use for valuation is difficult unless adjustments are made;

vii) the income distributional effects of major projects could be drastic in developing countries; this issue has already been treated earlier in this paper and their impacts again need to be taken into account for future costs and benefits.

This brief survey of special factors in cost-benefit analysis in developing countries indicates that they are numerous and their impacts could be important for the results of the evaluation. It also suggests that these impacts are not basically different from other valuation problems already discussed in this paper and that they can be successfully solved. (See also Section 3.6)

### 4.8. Policy actions and investment priorities

Financial analysis cannot take into account the social costs of environmental damage and the social benefits of investments necessary to protect the environmental and natural resources. Without the use of cost-benefit analysis national governments and municipal administrations will have insufficient information and analysis to justify investments in environmental programmes on the basis of long-term social benefits. Unless environmental investment priorities can be properly justified, there will be constant scarcity of funds, fragmented policy actions and degradation of the environment.

4.9. Wider issues complementary to cost-benefit analysis

Cost-benefit analysis need to be supplemented with information generated outside the strict framework of cost-benefit analysis to assist decision makers.

(i) Identification of the main beneficiaries and the main groups paying for the projects

- identify the main groups benefiting from project: fishermen from better water quality, the tourism industry from overall improvement in the environment, the whole population if these is general improvements in health.

- identify the main groups paying for the projects: tax payers in general, local tax payers, user groups.

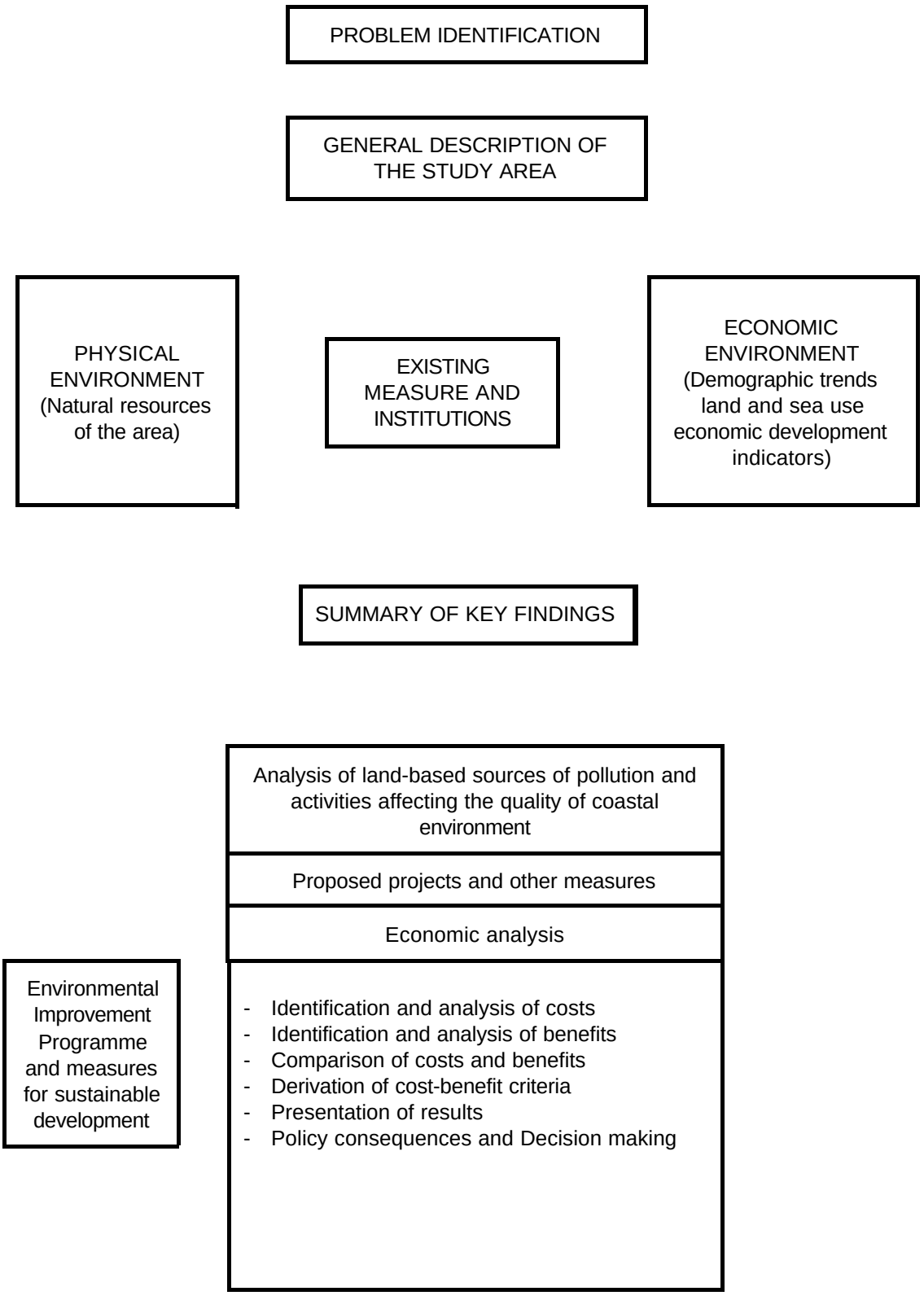
(ii) Projects could be financed in different ways according to benefits, to provide incentives to reduce pollution, to conserve resources, to distribute incomes. Financing therefore might be evaluated according to the purpose of financing or to the capacity of rising funds that is the user (see also 1.6 and section 7)

(iii) Any regional project should also be assessed in the broader national context to the extent that the benefits of the project should not occur somewhere else in the national economy as losses; for example tourist benefits should be drawn away from other areas.

(iv) Requirements for undertaking cost-benefit assessment should be accompanied by appropriate training programmes that would provide also further capabilities on a national wide basis.

## FIGURE 1

## FLOW CHART FOR COST-BENEFIT ANALYSIS



## TABLE 1

## A MATRIX OF BENEFIT TECHNIQUES BY ENVIRONMENTAL SECTOR

| Pollution | Type of effect | Benefit impact | Benefit estimation technique | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Hedonic property | Hedonic wages | Travel cost | Contingent valuation | Dose-response | Other techniques | Comment |
| **AIR POLLUTION** | | | | | | | | | |
| 1. Conventional pollutants (TSP, $SO_2$, $NO_2$) | Respiratory illness | WLD, RAD, medical expenses, suffering | O | L | O | X | X | Health capital model | |
| | Respiratory death | Death | L | X | O | O | X | | Some wage valuation |
| | Aesthetics | Visual, sensory | X | L | O | X | O | | experience |
| | Recreation | Visits especially to forests | O | O | X | X | O | | |
| | Materials | Maintenance/repair | O | O | (?) | (?) | X | | For historic monuments |
| | Vegetation | Crop losses | O | O | O | O | X | | Forest reclamation |
| **WATER POLLUTION** | | | | | | | | | |
| 1. Conventional pollutants (BOD, etc.) | Recreation:fishing, boating, etc. | Visit behaviour | L | O | X | X | O | | |
| | Commercial fisheries | Stock losses | O | O | O | O | X | | |
| | Aesthetics | Turbidity, odor, unsightliness | X | O | L | X | O | | |
| | Ecosystem | Habitat and species loss | O | O | O | X | X | | |
| 2. Trace concentrations | Drinking water | Illness, mortality | O | O | O | (?) | X | | |
| | Fisheries | Stock | O | O | O | O | X | | |
| **TOXIC SUBSTANCES** | | | | | | | | | |
| 1. Air (benzene, PCB, pesticides) | Illness and mortality | WLD, RAD, medical expenses, suffering (?) | X | O | X | X | | | |
| 2. Hazardous chemicals to land | Aesthetics | Unsightliness | X | O | O | X | O | | |
| | Ecosystem | Health, anxiety, ecosystem losses | O | O | O | X | X | | |
| **RADIATION** | Illness, mortality | WLD, RAD, lives lost | (?) | X | O | L | X | | |
| **MARINE POLLUTION** | | | | | | | | | |
| Oil, radioactive substances, sewage | Aesthetics, swimming | Unsightliness, visit behaviour, illness, fish stock losses | (?) | O | X | X | X | | |
| **NOISE** | Nuisance | Annoyance | X | O | O | X | L | | |

X = Used technique
O = Non-usable technique
L = Very limited application exists
(?) = Not developed but possible
WLD = Work loss days
RAD = Restricted activity days

Source: OECD: Environmental Policy Benefits: Monetary Valuation; Paris, 1989.

**TABLE 2**

**COMPARISON OF THE THREE MEASURES OF PRESENT VALUE**

| | Net present value | Internal rate of return | Benefit-cost ratio |
|---|---|---|---|
| **Selection or ranking rule for:** | | | |
| Independent projects: | | | |
| No constraint on costs | Select all projects with NPV > 0; project ranking not required | Select all projects with IRR greater than cut-off rate of return; project ranking not required | Select all projects with B/C > 1; project ranking not required |
| Constraint on costs | Not suitable for ranking projects | Ranking all projects by IRR may give incorrect ranking | Ranking all projects by B/C where Ce is defined as constrained cost will always give correct ranking |
| Mutually exclusive projects (no constraint on costs) | Select alternative with largest NPV | Selection of alternative with highest IRR may give incorrect result | Selection of alternative with highest B/C may give incorrect result |
| **Discount rate** | Appropriate discount rate must be adopted | No discount rate required, but cut-off rate of return must be adopted | Appropriate discount rate must be adopted |

Source: Adapted from Gittinger (1982) from Dixon and Hufshmidt

# APPENDIX I

## REPORT OF WORKING GROUP ON COSTING ACTION PROGRAMMES[1]

1. The working group considered the following documents:

   (i) Preliminary study on the costs and benefits of measures for the reduction of degradation of the environment from land-based sources of pollution and activities in coastal areas of the Bay of Izmir (UNEP(OCA)/WG.14/Inf.8);

   (ii) Preliminary study on the costs and benefits of measures for the reduction of the degradation of the environment from land-based sources of pollution and activities in coastal areas of the island of Rhodes (UNEP(OCA)/WG.14/Inf.9); and

   (iii) Report of the ad hoc consultation on land-based sources of pollution (Athens, 5-6 November 1991) (UNEP(OCA)/WG.14/Inf.10).

2. Consultants described the methodology used for the cost-benefit studies and presented their main findings relating to the Bay of Izmir and the Island of Rhodes. In doing so, they stressed that the studies had been completed quickly and would require further work to fulfil the request of UNEP regarding such case studies (ref: experts' meeting October 1991). The preliminary assessment for the Bay of Izmir suggested that the benefits of action outweighed the costs of control measures by a factor of 3 to 7. Similarly for Rhodes, the annual return on investment was shown to outweigh the costs by a factor of at least three.

3. In the subsequent working group discussion, the following points were made:

   (i) Cost-benefit-analyses of localized remedial action can be highly informative and could lead to appropriate investment decisions, even in the current absence of adequate methods that allow social or quality of life benefits to be quantified;

   (ii) Regional programmes should develop priorities, with identified costs and targets as necessary, to combat the most serious problems. Implementation of priorities identified requires high-level political and financial commitment and participation;

   (iii) Reliable costing of implementation strategies, particularly at the national level, will only be possible when the causes of degradation and the means to control them are clearly identified. Concerning the studies tabled, even with their incomplete analyses, it was apparent that the benefits of protecting the coastal environment far exceed the costs;

   (iv) Further case studies with improved methodologies would be useful if they included an identification of potential sources of income, obtained through economic activity or environmental improvement, resulting from the planned action programme, to finance its costs;

   (v) Methodologies need to be developed to evaluate, in non-monetary terms, costs and benefits related to sustainable development and quality of life indicators (such as

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[1] Annex I/Appendix 4 of the Report of the Meeting of Government designated Experts to Formulate a Draft Strategy for the Reduction of the Degradation of the Marine Environment from Land-Based Sources of Pollution and Activities on Coastal Areas, Nairobi, 9-13 December 1991 (UNEP(OCA)/WG.14/4).

improved infant mortality rates, life expectancy and literacy), that are particularly suitable for developing countries where populations are largely outside the monetary economy; and

(vi) Revolving funds, given the evidence of the two case studies, can play a valuable role. These funds should be structured so that non-monetary issues are taken into account, through mechanisms such as the conversion of non-monetary benefits into monetary terms or through subsidies.

4. The working group did not make a detailed costing of either regional action programmes or of a global programme due to the absence of adequate information and time constraints. The working group did discuss a methodology for costing action programmes.

5. The working group emphasized that costing analyses must be an integral part of every regional action programme and should be updated and reviewed periodically.

6. The working group agreed on the merit of costing projects of a high priority programme of action, regionally agreed upon at a high political level, with the participation of global, regional and national financing institutions carrying out the pre-feasibility studies as well as the involvement of the corporate sector.

7. The working group recommends that the methodology below be used for costing regional programmes and local studies:

(a) A general description of the study area, providing basic information on the status of the natural resources of the area, demographic trends, land and sea use practices, economic development indicators, etc.;

(b) An analysis of land-based sources of pollution and activities in coastal areas contributing to the degradation of the marine and coastal terrestrial environment, including:

- An inventory of coastal point and non-point sources and activities;

- An estimate of the type and amount of pollutants reaching the environment from coastal land-based sources and activities either through direct discharges or indirectly through atmospheric or riverine transport;

- An estimate of the ecological and human health related impact of the sources and activities;

(c) An analysis of the actual and potential social and economic costs of pollution from land-based sources and activities in coastal areas, expressed in monetary terms; indirect impacts due to loss, depletion or depreciation of natural resources or their quality, or due to the effect on human health, should also be accounted for;

(d) An analysis of the costs and associated benefits, expressed in monetary terms, from measures which have been introduced to control pollution from land-based sources or activities in coastal areas;

(e) An analysis of costs and benefits of additional measures (legal, administrative, economic, fiscal, technological, institutional) which would have to be introduced in order to protect the marine and coastal areas and ensure their sustainable development and use; and

(f) An evaluation of costs and benefits in non-monetary terms, related to sustainable development and the quality of life of populations, including those largely outside the monetary economy.

8. The working group recommends that the above costing methodology be included in the report of the Meeting to the Preparatory Committee for UNCED and the post-UNCED meeting [to ensure the implementation of the land-based sources of marine pollution component of Agenda 21].