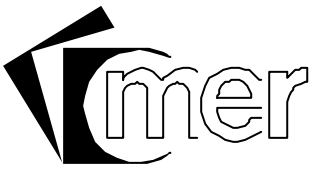
New experiences on EIA in The Netherlands

Process, Methodology, Case Studies



Commission for Environmental Impact Assessment
The Netherlands
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Main steps in the Dutch SEA and EIA process[1]]

screening phase	*Screening of plan or project on EIA obligation with the application of criteria and thresholds* – *EIA required; possibility to apply for exemption*	*$ No EIA required* *$ Exemption granted*
	–	
scoping phase	*exemption not requested or refused: proponent prepares notification of intent* – *notification of intent is published by competent authority* – *public consultation and scoping advice by independent Commission for EIA and environmental agencies* – *competent authority issues plan or project specific guidelines for EIA content[1]]*	
	–	
documentation phase	*proponent prepares EIA report[1]]*	
	– =	
reviewing phase	*competent authority decides on acceptability of EIA report* – *public consultation and quality review by independent Commission for EIA and environmental government agencies*	
	–	
documentation phase	*proponent prepares supplementary information if required by competent authority*	
	–	
decision and monitoring phase	*competent authority takes decision in a written statement taking into account the EIA* – *mandatory monitoring and post decision evaluation by competent authority* – *competent authority considers the potential consequences of results of the evaluation for the decision taken*	

1 SEA of national and regional plans and programmes follows the same procedure as EIA for projects. In the flow chart the term EIA is used for both strategic and project EIA.

2 Legal requirements include the description of alternatives, including the one that would be best from an environmental viewpoint. Social impacts directly stemming from environmental effects are typically included; other social impacts and economic impacts are no legally required part of an EIA.

3 Also called: Environmental Impact Statement

PREFACE

In the Environmental Impact Assessment (EIA) procedure in the Netherlands the Commission for EIA has a special role as independent advisor to the pertinent competent authorities. In addition, this Commission also supports the Directorate General for International Co-operation of the ministry of Foreign Affairs in matters related to EIA for activities in developing countries. In this position, this Commission has gathered considerable experience in the execution and management of EIA and Strategic EIA (SEA). The experiences are presented at conferences and workshops in the Netherlands and abroad.

As there is wide interest in the Dutch experience, the Commission prepares papers in English for presentation to EIA-practitioners abroad. In order to increase their accessibility selections of these papers are published bi-annually in special volumes. This particular volume is the third of its kind in this series. It comprises seven papers that are grouped into three different categories: papers dealing with the process, papers that concern methodology and case studies. Six papers pertain to EIA and SEA in the national system whereas one paper focuses on an integration problem encountered in EIA for development co-operation.

The papers on the process and the case studies demonstrate that EIA and SEA continue to have appreciable added value to the decision-making process. In fact, this is in line with the traditional objective of EIA and SEA to give environmental concerns a structural place in the assessment of initiatives. Additionally, a new trend can be observed in that in a number of initiatives the existing environmental quality of the affected area and the environmental goals for that area play a part in the design of the initiatives. This development indicates a shift in the position of the environment from a following role to a co-determining role thereby increasing the chance that the result contributes to an environmentally more sustainable situation.

The Commission hopes that this new volume will inform EIA and SEA practitioners about new developments in the Netherlands and that it will contribute to the international exchange of experiences.

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Marja van Eck

In recent years experience has been gained in the Netherlands with strategic environmental impact assessment for sectoral plans and programmes, covering topics such as waste processing, electricity generation and drinking water management. But strategic EIA can also play an important role in spatial planning.
The fourth national policy document on spatial planning, the 'VINEX', covering the years 1990–2005, was prepared in the early nineties without the use of strategic EIA. An EIA at this highest strategic level could have had significant advantages if it focused on specific decisions contained in the plan. This turned out to be the case when an EIA was carried out for revising parts of the VINEX, extending its coverage to the period 2005–2010.
This article discusses the use and advantages of EIA in strategic spatial planing, and provides criteria for selecting decision-making processes for an effective use of EIA. The advantages are illustrated by the case study mentioned above: the EIA for revising the VINEX.

2 The environment: from add-on to guiding principle

Rob Verheem, Michiel Odijk and Jules Scholten

One of the reasons for the introduction of EIA in the Netherlands in the eighties was the observation that many environmental impacts caused by private and public developments could have been avoided. EIA was introduced with the intention to give environmental goals and implications a structural place in the development of and decision making on initiatives. The importance of this fact was underlined by the growing awareness during the nineties of the need for sustainable economic development.
Common sense dictates that EIA cannot bring this about from one day to the next. During the initial period following its introduction in the Netherlands, EIA was used mainly to compare the environmental impacts of alternatives which for the most part had been drawn up on economic and technical grounds. This article describes the Commission's recent experiences in a number of sectors indicating that environmental considerations really do influence the development of alternatives in the way intended by EIA – guiding development, rather than simply being added on at the end. A necessary condition for achieving this is to set clear environmental goals at the beginning of the EIA process, thus creating a tool to assess the contribution made by the new development to a sustainable development. Experiences are discussed, on the basis of which some guidelines for the formulation of workable goals are proposed.

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3 MCA: making subjectivity explicit

Rob Bonte (IWACO), Ron Janssen (Free University of Amsterdam), Rob Mooren (Arcadis Heidemij Advies), Jacques de Smidt (Commission for EIA), Jack van den Burg (Province of Noord-Holland)[1].

Writing an environmental impact statement involves making choices. Subjectivity is unavoidable, but as long as any subjective judgements are made explicit this need not be a problem. Multi criteria analysis (MCA) is an excellent tool for doing just that, provided it is used in appropriate cases and correctly – for instance, MCA must not saddle the reader with a 'black box feeling'. The Commission for Environmental Impact Assessment formed a working group to help draw up clear aims for the development and use of MCA in environmental impact assessment. This article contains the personal views of the five members of this working group. When can MCA be useful? And what is the important difference between scientific and political weightings?

4 All five authors were members of the Commission's working group which drew up a report on the use of MCA in EIA.

most favourable to the environment: (AMFE). Although complicated by the absence of SEA, project EIA still proved to be a strong tool for guiding the development of the initiative in a more sustainable direction. This article describes some key elements of the EIA.

7 The Use of SEA and EIA in decision-making on drinking water management and production in the Netherlands

Rob Verheem

Environmental impact assessment for decision-making on drinking water management and production, at both strategic and project level, has been mandatory in the Netherlands since 1987. Environmental assessments have been carried out for strategic decision-making at the national level (in particular, for decisions on *sources* and *methods* of drinking water production), for the *siting* of drinking water production in specific regions and to determine the *amounts* to be abstracted at specific sites. This paper discusses the approaches to EIA, the methodologies used and the effects on decision-making in three case studies at different administrative levels: the SEA for the National Plan on Drinking and Industrial Water; the EIA for the selection of a site for a deep infiltration project in a sensitive coastal dune area to the west of the city of Amsterdam and the EIA to determine the environmentally best way to produce drinking water from two wells on an ecologically valuable island off the north coast of the Netherlands.

1 EIA FOR STRATEGIC SPATIAL PLANNING POLICY

Marja van Eck

1. Introduction

In recent years experience has been gained in the Netherlands with strategic environmental impact assessment for sectoral plans and programmes, covering topics such as waste processing, electricity generation and drinking water management. But strategic EIA can also play an important role in spatial planning.

The fourth national policy document on spatial planning, the 'VINEX', covering the years 1990–2005, was prepared in the early nineties without the use of strategic EIA. An EIA at this highest strategic level could have had significant advantages if it focused on specific decisions contained in the plan. This turned out to be the case when an EIA was carried out for revising parts of the VINEX, extending its coverage to the period 2005–2010.

This article discusses the use and advantages of EIA in strategic spatial planning, and provides criteria for selecting decision-making processes for an effective use of EIA. The advantages are illustrated by the case study mentioned above: the EIA for revising the VINEX.

2. Desirability of EIA for strategic decisions

The motives for carrying out a strategic EIA are in principle the same as for an EIA for a project decision:

- incorporating environmental issues into decisions which can have negative environmental impacts;
- drawing up an alternative with the best prospects for the environment;
- independent quality control;
- public participation.[1]]

Undertaking an environmental impact assessment demonstrates a willingness to take environmental aspects into account. If the nature of the decision is controversial, an EIA can create a broader platform of support and provide a more objective basis through the extensive opportunities for public participation and an independent review.

EIA at the strategic level is also relevant because strategic policy documents often contain important decisions affecting the environment. These documents set the framework within which future choices are assessed by stating qualities and values and formulating objectives for conservation and development. In this way they provide direction for future policy or an integrated vision for a specific geographical area.

5 Alternatives, public participation and independent quality checks are obligatory for strategic EIA in the Netherlands.

Strategic EIAs, therefore, contain greater opportunities for considering the *sustainability* of combinations of initiatives than project EIAs. They can provide insight into the *cumulative impacts* of activities and check these against national environmental objectives.

Strategic EIAs offer additional advantages over project EIAs:

a) EIA at the strategic level allows alternatives to be compared which are no longer at issue in project EIAs.
b) Strategic EIA rounds off discussions that do not then need to be re-examined at a later date. This can save a lot of time.
c) By carefully examining environmental information during a strategic EIA, EIAs at project level are made simpler. For example, use might be made of information in the strategic EIA that is valid for all projects. In addition, the scope of alternatives at the project level can be restricted because many alternatives would have been examined and rejected at the strategic level.
d) Strategic EIA can be used to examine environmental aspects of policy, including policy that does not directly result in projects for which EIA is mandatory.

There are therefore many arguments supporting EIA for strategic decisions.

3. Opportunities for EIA for strategic policy documents

Nevertheless, there are doubts whether it is possible to carry out an EIA relating to decisions at a relatively high level of abstraction or for plans of a general nature. Is EIA suitable for every strategic decision? The following three questions can be used to determine whether an EIA can be a useful tool when making and justifying strategic decisions:

1 Does the strategic policy document contain real decisions and do these decisions have possible (negative) environmental impacts?
2 Are there possible alternatives that are limited or foreclosed by decisions in the strategic policy document?
3 Is it possible to illustrate the environmental impacts of the alternatives in any way?

In strategic spatial planning documents, this profile is met primarily by indicative decisions concerning the desired distribution of land uses. The environmental impacts of these types of decisions are relatively simple to illustrate, expressed in terms such as their impacts on nature and the landscape and the effects on car use, for example.[1]] An analysis of the decisions contained in the VINEX on the basis of the two other criteria reveals that EIA could have been particularly useful for decisions determining future patterns of new urban development (see Table 1). EIA seems to be less effective in relation to the other decisions.

6 At least, this is the case in the Dutch situation where, for example, national transport models have been developed that allow new developments to be calculated and where national maps of existing natural and landscape values are available.

Table 1: Decisions in the VINEX for which EIA would have been useful

Category of decision in the VINEX	Are important impacts expected?	Are alternatives limited, in the VINEX?
1 General spatial planning policy	**Yes, decisions on the desired population distribution throughout the country**	**Yes, choices concerning policy for population distribution**
2 Decisions concerning the location of large new residential and commercial developments	**Yes**	**Yes**
3 Strategies for rural development[1]]	No, the rural development strategies are indicative only; definite decisions are taken by lower tiers of government	No, such decisions are made in other strategic plans
4 Infrastructure projects (new roads and railways)	**Yes, in so far as these concern decisions on projects for which a project EIA is mandatory**	No, such choices are made in other strategic plans and at the project level
5 Designation of areas with special environmental problems for which an action plan must be drawn up	Possibly	No, this takes place in area-based plans
6 Designation of urban nodes	No	**Yes**
7 Special projects	**Yes**	No, this takes place at the project level

4. Case study: Strategic EIA for the revision of the VINEX

During the revision of the VINEX, an EIA was carried out on the direction of future new development in two urban areas denied further room to expand by existing policies. In the EIA the proponent, the National Spatial Planning Agency, demonstrated how to make good use of alternatives and environmental impacts at the strategic level. The EIA was limited to an examination of the main issues and no time was wasted on endless details. It focuses on the ministerís decision indicating the negotiable areas for further urban expansion, those areas which are excluded from consideration and the main thrust of spatial planning policy. Decisions concerning the elaboration of policy are left to the regional authorities and were not included in the EIA.

7 The VINEX indicates development paths for different rural areas, such as ›emphasis on nature development‹, ›emphasis on extensive agriculture‹, etc.

In order to avoid unnecessary detail, the alternatives were indicated in the EIA as search areas five times larger than the actual area needed for the residential and commercial developments. This was to prevent lapsing into overdetailed examinations of development plans and environmental impacts; after all, it was not known at that stage precisely where the houses and business premises were to be built.[1]] Emphasis was placed on the most vulnerable zones and qualities within the search area which could, in principle, be affected. Environmental impacts were indicated in terms of greater or smaller risks of harmful impacts occurring.

The alternatives were compared in the EIA and assessed against the principles of national spatial planning and environmental policies regarding:

- valuable natural, cultural and landscape elements;
- sustainability issues (basic conditions, raw materials, use of land, mobility);
- the quality of the physical environment.

These aspects were translated into measurable assessment criteria. The framework for assessment covers only the main issues, making most scores [1]] easy to derive and to check.

In addition to environmental aspects, the assessment framework contains other topics that play a role in decision-making, such as economics and cost.[1]] This resulted in a broad and relatively well balanced overall picture of the pros and cons of the alternatives, while the EIS is brief and to the point (50 pages).

Results

The EIA for the revision of the VINEX generated the following results:

- A lively discussion between national government, the provinces, the urban regions and other parties involved provided a good basis for decision-making. This became clear when answers could be found in the EIS to all the questions raised during a public participation meeting.
- The Commission played an important role as objective commentator. Various representations were critical of government decisions and used the EIS to back up their criticisms. The Commission examined these remarks in more depth when reviewing the EIS and indicated which criticisms were well founded and which were not.
- There was a reduction in the scope and complexity of subsequent EIAs. Of the five search areas for industrial development, four were rejected. Two search areas for residential development were designated for the short term, two for the long term and one was rejected. It is now possible to concentrate in more detail on the remaining search areas in a subsequent EIA.
- A step has been taken towards making the national policy principles more explicit to these types of decisions and (implicitly) towards clarifying priorities. By working with this assessment framework when comparing alternatives and making choices, it became clear which policy principles were the deciding factor at the national level.
- The working method and assessment framework established for the revision of the VINEX can act as models for future projects. They are well suited to weighing up interests when making other spatial planning decisions at the national level or strategic planning decisions at the provincial level, such as regional plans.

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8 This also served to prevent land speculation.

9 Except a few based on traffic models and economic calculations.

10 In accordance with the requirements of the EIA regulations the environmental aspects were clearly separately identifiable.

Given that many of the positive expectations for strategic EIA have been realized in practice in this spatial planning case study, there is every reason to believe that this experiment can be repeated for future strategic spatial plans.

2 THE ENVIRONMENT: FROM ADD-ON TO GUIDING PRINCIPLE

Rob Verheem, Michiel Odijk and Jules Scholten

5. Introduction

One of the reasons for the introduction of EIA in the Netherlands in the eighties was the observation that many environmental impacts caused by private and public developments could have been avoided. Apparently, the old Dutch saying ›Take stock before you start‹ was not being adhered to often enough. EIA was introduced with the intention to give environmental goals and implications a structural place in the design and assessment of initiatives.

The importance of this fact was underlined by the growing realization during the nineties of the need for sustainable economic development. If the desire to achieve ›strong sustainability‹ is taken seriously **C** development whereby not only the physical, economic and social capital but also the natural capital of the world are conserved **C** it is vital that environmental values and goals are placed at the heart of plans and projects.

Common sense dictates that EIA cannot bring this about from one day to the next. During the initial period following its introduction in the Netherlands, EIA was used mainly to compare the environmental impacts of alternatives which were drawn up for the most part on economic and technical grounds. Although this was a big step forward at the time, it was clear that the ›true face‹ of EIA had yet to be seen: a decision-making process whereby, as a matter of course, the existing environmental quality of a specific area and the environmental goals for that area play a part in the design of plans and projects.

This paper describes the Commission's recent experiences in a number of sectors indicating that environmental considerations really do influence the development of alternatives in the way intended by EIA **C** guiding development, rather than simply being added on at the end. A necessary condition for achieving this is to set clear environmental goals at the beginning of the EIA process, goals that make it possible to assess the contribution made by the new development to achieving a sustainable situation. A number of experiences are discussed and this forms the basis for establishing a number of guidelines for formulating workable goals.

6. Infrastructure: first establish environmental criteria

In its advisory scoping guidelines for the EIA of the Dutch part of the high speed train link from Amsterdam to Frankfurt (Germany), the Commission endorsed a recent development in the planning of new roads and railways. This involves establishing clear criteria for designing alternatives, including environmental criteria, before the alternatives are drawn up. The Commission has taken this initiative a stage further in its advice and tried to set out a structured procedure for developing alternatives within a complex planning environment.

1 The first step in this procedure is to derive criteria for the selection and ranking of alternatives from current government infrastructure and environment policy and regulations.
2 These criteria are then supplemented with criteria derived from the stated goals of the project. Transport and technical criteria are derived from transport and traffic objectives; environmental and ecological criteria are derived from environmental goals.
3 In order to formulate environmental goals and the criteria derived from them, information is collected on the existing environmental quality in the plan area, the potential of the area, the expected and desired future quality and an initial impression of the expected environmental impacts.
4 Alternatives are developed on the basis of environmental, ecological, transport and technical criteria and then compared.

Related methods are now being designed to give environmental aspects a more leading role in the choice of alternatives to be investigated. An example of this is the use of so-called ›vulnerability maps‹ (see box 1), which are designed for use in the third step described above.

Box 1: Vulnerability maps

This method (which makes use of a Geographical Information System) illustrates the (environmental) vulnerability of a plan area. It covers aspects such as sensitivity to noise, disruption to the landscape, barrier effects and environmental protection zones. By illustrating and integrating these effects (which can also provide an indication of any accumulation of impacts), a map can be created that can be used, for example, to identify a number of likely routes. In this way, the environmental qualities of the area partly determine the potentially suitable routes, which fits into the process described above. After an initial assessment based on the vulnerability maps, the environmental impacts of a smaller number of selected routes can then be assessed in a more conventional way.

7. Land development: environmental constraints and potentials as basic principles

›Land development‹ (*landinrichting*) involves the restructuring and development of rural areas in order to create a more coherent and integrated pattern of the various land uses and functions such as agriculture, residential uses, transport, environmental quality and recreation. These projects involve the use of EIA. One of the most important goals of land development projects in recent years has been the creation of the National Ecological Network, a network of nature areas in the Netherlands which will allow animals and plants to migrate or disperse from one area to another. Such a network will create habitats of sufficient size to maintain and increase biodiversity. This means that the environmental quality and potentials of the plan area have to play an important role in the development of alternatives in the EIS.

From this perspective it is logical that EISs for land development projects begin with descriptions of the existing situation and the ‹autonomous‹ development (i.e. the environmental quality to be expected in case no restructuring would take place). These are then used to identify constraints and potentials with respect to the stated goals. These constraints and potentials form, in turn, the basis for the development of alternatives. An example of this is the approach taken in the EIS for the Westzaan land development project (see box 2).

Box 2: EIS for the Westzaan land development project

The Westzaan land development project covers an area to the north of Amsterdam where the natural quality is gradual declining, affecting both the meadow bird population and the aquatic and marshland communities. This is stated in the EIS as being one of the main problems facing the area. Three goals have been drawn up for nature: 1) the sustainable conservation, restoration and development of all communities, with an emphasis on marsh and grassland; 2) the creation of good ecological connections within the area and with the surrounding areas; and 3) reducing the cost of nature and landscape management. The problems and goals have led to the development of two alternatives: a ›marshland‹ alternative and a ›meadow bird‹ alternative, the important difference between the two being the area of reed in the hydrosere and the area of grassland.

8. Dike improvement works: environment by design

Prompted in part by a number of near misses in recent years when the main distributaries of the Rhine threatened to cause serious flooding, a large number of river dikes are currently being systematically strengthened. Raising, widening and rerouting dikes can have important consequences for the landscape and the plant and animal communities living on or near the dikes. Most dike improvement works, therefore, are subject to EIA.

During the last few years a procedure has been set in motion for developing dike improvement plans that takes as its starting point the existing landscape, natural and historical values (LNH values). Part of this procedure is the development of a ›vision‹ for selecting possible solutions on the basis of safety, existing values and the desired future development of the area. This means that the LNH values are taken into account early on in the process, and alternatives are worked up for sites where the various interests (safety, LNH values and land uses) conflict. An example of this is the improvement work to the Rhine dike between Wageningen and Rhenen (see box 3).

Box 3: Improvements to the Rhine dike

The western end of this dike runs through an area of important historical and natural value. A system of forts and canals dating from the early 18th century (the ›Hollandse Waterlinie‹, a strip of land which could be flooded as a line of defence) lies on both sides of this stretch of dike. These provide homes to exceptional plant and animal communities, including rare amphibian and reptile species. The existence of these historical and natural features guided the development of alternative options for the improvement works to this stretch of dike. Options involving widening the dike would damage these valuable features, so in the end a unique type of construction was chosen consisting of sheet piling throughout the entire length of the body of the dike. This solution **C** which does not alter the external appearance of the dike **C** is more expensive than the other alternatives but does most justice to the environmental interests on the spot.

9. Condition: formulate clear environmental goals

The stated (environmental) goals can only properly guide the development and comparison of alternatives if they are stated clearly enough. This does not always happen in Dutch practice. What a developer really wants is very often not clear from the chapter in the EIS on the goals of the initiative. Some authors of EISs consider the chapter on goals to be a place to describe the historical development of the initiative, or turn it into a PR story. If this chapter is well written it can have two functions:

- it can define the alternatives to be considered in the EIS (definition function); and
- it can provide a framework for comparing the alternatives examined in the EIS (comparison function).

If specific environmental goals are set for a project it is even more important to formulate clear and consistent goals.

Some EISs are found wanting in the formulation of goals. Examples are:

- not all the goals are mentioned;
- formulated goals are not workable;
- formulated goals are not worked out to comparable levels of detail;
- the relation between higher level (abstract) and lower level (concrete) goals is not clear;
- the relations between the goals **C** or the priorities afforded them **C** are not indicated.[1]]

A few examples from practical experience are given in box 4.

Box 4: Examples of inadequate formulation of goals

1) *Goals not workable, relation to national goals not given*

An EIS for a composting installation for the treatment of organic household waste indicated a problem with the treatment of this waste. The EIS states four goals for the proposal, including ›low costs to the public‹. Put this way, no workable criterion can be derived from the goal; what is cheap for some can be expensive for others. Even if there were no income differences, people would place different values on the costs of processing this waste. A clear indication of what level of costs is acceptable is required to allow alternatives to be defined and ranked.

2) *No priorities given in (sub)goals*

The EIA for an airport set goals both for achieving the status of ›main port‹ and for improving environmental quality, or preventing a further decline, compared with the existing situation. Fourteen subgoals were set for implementing the environmental goal, but nowhere did the EIS state how these subgoals related to each other or whether they were all equally important or not. For example, if nine subgoals were achieved and five not, would the main goal be achieved?

3) *Some goals are workable, others not*

The notification of intent for a new industrial estate contained both economic goals and goals for the preservation of historical and cultural features, nature conservation and the quality of the physical environment **C** but the economic goals were much more specific and workable. The Commission has stated that if the goals are considered equal, the ›LNH values‹ will have to be made more specific, and asked the competent authority to indicate which criteria will be used to assess the alternatives.

Another source of uncertainty in the formulation of alternatives is the incorrect use of various terms such as ›goals‹, ›conditions‹ and ›principles‹. A ›goal‹ should stem from the private interest of the developer, while a ›condition‹ arises from external prescriptive regulations (almost always set by government). In practice, these terms tend to be used interchangeably.[1]] The term ›principles‹ is also used in rather different ways: either to indicate that something is still uncertain (›it‹s only a principle, after all‹) or, conversely, to indicate that no further discussion is possible at all (›this is the principle and that‹s that‹).

However, there are good examples from current practice of workable, consistent and coherent goals (see box 5).

11 This last shortcoming is particularly important when there are dual goals, for example: goals for the physical environment and for mobility in road projects, and goals for the development of the ›main port‹ status of Schiphol while also improving environmental quality, which in principle conflict with one another.

12 Besides, one might even doubt whether in the case of government projects the distinction between goals and conditions is of any value at all. Government authorities are, after all, in principle supposed to accept all conditions laid down at the same or higher levels of government as if they were its own and not consider them as constraints on achieving their own interests.

Box 5: Examples of well formulated goals

1) *Example of a clear assessment of whether goals are achieved or not*

The EIS on future transport and traffic patterns in the corridor between two large Dutch cities (Amsterdam and Utrecht) made use of quality of life objectives set at the national level. These objectives contain specific criteria **C** for example, 'the total area within the 50dB(A) contour may not increase' or 'the number of fatal casualties must be reduced by at least 50%' **C** allowing clear conclusions to be drawn from the alternatives. The EIS was able to clearly demonstrate that the objectives for CO_2 emissions and noise nuisance were met only in the alternative most favourable to the environment.

2) *Example of clear and workable goals*

The EIS for a large new refinery states that the alternatives must satisfy the external assessment framework imposed by environmental and other government policy. This assessment framework is then translated into specific criteria; for example, that the sulphur recovery installations must achieve 99,7% efficiency. Such criteria enable alternatives to be clearly defined.

To summarize, it can be stated that well formulated goals can play an important role in designing, defining and ranking the alternatives to be described in the EIS, as long as a few general guidelines are followed. These guidelines are listed in box 6. The Commission will apply these guidelines when reviewing EISs.

Box 6: General guidelines for formulating goals in an EIS

- Describe all the goals of the proposal.
- Ensure that there is a logical and consistent relationship between higher level and lower level (derived from higher level) goals.
- Indicate what are the main goals and what are the subgoals; priorities must be clear.
- Indicate any conflicts between goals and how these will be dealt with. This is particularly important when there are dual goals.
- Make goals sufficiently workable so that alternatives can be designed and compared.
- Indicate how 'hard' the goals are. Do they demarcate options or only provide general guidance?

10. Conclusion

It is important that all those involved in EIA contribute to the further adoption of a more leading role for environmental considerations in the design of alternatives. Of course, this will not automatically lead to better impact statements or more environmentally-friendly decisions. These depend, above all, on the relative importance attached to environmental interests by developers and competent authorities. But the trend already underway provides the best opportunities for achieving stated environmental goals.

If these environmental goals are derived from national or regional environmental policy plans (such as the National Environmental Policy Plan in the Netherlands) that draw inspiration from the desire to achieve sustainable development, the stated environmental goals can also be used to assess how far the proposed activities or their alternatives are capable of contributing to sustainable development. A point to bear in mind here is that the formulated environmental goals must be sufficiently clear and workable.

3 MCA: MAKING SUBJECTIVITY EXPLICIT

Rob Bonte (IWACO), Ron Janssen (Free University of Amsterdam), Rob Mooren (Arcadis Heidemij Advies), Jacques de Smidt (Commission for EIA), Jack van den Burg (Province of Noord-Holland)[1].

11. Introduction

Subjectivity is unavoidable, but as long as any subjective judgements are made explicit this need not be a problem. Multi criteria analysis (MCA) is an excellent tool for doing just that, provided it is used in appropriate cases and correctly **C** for instance, MCA must not saddle the reader with a ›black box feeling:. The Commission for Environmental Impact Assessment formed a working group to help draw up clear aims for the development and use of MCA in environmental impact assessment. This article contains the personal view of the five members of this working group. When can MCA be useful? And what is the important difference between methodological and political weights?

12. What is MCA

Every EIS must compare alternatives by presenting their impacts in an overview. This overview is a handy way to summarize the information in an EIS and present it to decision-makers and interested parties. An overview of not yet processed impacts must never be left out. And if the issues involved are not too complex, this will often be enough.

In most cases, though, there will be a need to further structure and aggregate the information in order to bring out the differences between alternatives more clearly. Any method that does this is a method of comparison. There are many methods to choose from, including tables, graphic presentations, cost**B**benefit analysis and, the subject of this article, Multi criteria analysis.

The identifying feature of Multi criteria analysis (MCA) is *allocating weights to assessment criteria in order to rank alternatives*. An MCA, therefore, always involves calculation, either simple or complex. This allocation of weights and subsequent calculation is the subject of much criticism: manipulation, technocracy and pseudo accuracy are said to lurk in the wings. In reply, proponents of MCA, and we count ourselves among them, emphasize the thematic approach, the reproducibility and, yes, the clarity of the method. This article examines how to gain these benefits.

13. When not to use MCA

When can MCA be useful? MCA is appropriate for a limited number of categories of activities for which EIA is mandatory. When preparing an EIS, consideration should be given at an early stage to which method of comparison will generate most added value. This will sometimes be MCA, but often not. The advice provided by the Commission and the competent authority:s scoping guidelines can be helpful when deciding on the choice of method of comparison **C** both in

13 All five authors were members of the Commission:s working group which drew up a report on the use of MCA in EIA.

recommending MCA and advising *against* its use. We mention below a number of cases for which we think MCA would *not* be appropriate:

- When there are just two or three alternatives, a step involving a complicated calculation will usually be superfluous. An explanatory note to the impact summary drawing attention to the most marked differences is often sufficient.
- An MCA is unnecessary when the alternatives are considerably different. There is no sense in using MCA to show that ›waste incineration‹ performs poorly in terms of air pollution and ›land filling‹ performs badly in terms of the good use of space. That is clearly obvious.
- If there are not many different types of impacts (and so few relevant criteria) MCA can add little new information of significance. Take, for example, a nature development project that only generates impacts on nature and the landscape. In such cases a clear explanation of summarised unprocessed information on the impacts is much more helpful than an MCA.
- If the alternatives have been assessed and selected by an ›advisory working group‹ in an open planning process, as in many dike engineering projects, MCA is again unlikely to be of much use. Reasoning ›backwards‹ and explaining the results obtained by this type of selection process **C** in itself very worthwhile **C** would add little more of value.

14. When to use MCA

There are also cases in which MCA can be of significant help. As a general rule, MCA will be of most value when at least one or more of the following conditions are present:

- A choice has to be made from a *large number of alternatives*. (For example, the location for a sand extraction concession of 100 hectares in an area of 150,000 hectares.)
- *Many partial solutions* may be combined to form alternatives *and* the impacts can be expressed in units which can be added together. (For example, when alternatives for the allocation of building land for residential and business development in the regional plan consist of combinations of many smaller sites; all these sites can first be compared against each other using MCA.)
- A *large number of criteria* must or can be used. This is often the case when many ecological data are available. If a particular activity causes many different (negative and positive) impacts it is usually extremely difficult to compare the different alternatives accurately with each other without the aid of a tool (MCA).

In general, MCA is useful primarily in site-selection and route-selection EIAs. In this, the application of a simple form of MCA is usually the most effective (see Box 1). Descriptive methods are to be preferred in most other EIAs, e.g. for the design of projects, which often contain only few and clearly distinct alternatives. MCA will, for example, usually not be of significant value in EIAs for projects such as the design and use of manure processing plants or recreation parks.

Box 1: Weighted summation

Multi criteria analysis is the collective name for a large group of widely differing Multi criteria methods. The MCA method of ›weighted summation‹ is a good candidate for application in environmental impact assessment. This method can be easily explained, is simple to use and easy to calculate. There is therefore less chance that the reader of the EIS will view the method as a ›black box‹.

The principle of weighted summation is simple:

1. Standardize the scores per criterion.
2. Attribute the weights.

3. Multiply the weights by the standardized scores.
4. Add up the resulting scores to obtain total scores for each option.
5. Determine the ranking of the total scores.

The difficulty with weighted summation does not lie in the calculation but in choosing a good standardization method (the way in which the scores are converted to a common denominator) and attribution of the weights. A disadvantage of the method is that it is less suitable for processing qualitative data. In practice, this disadvantage is not very significant because the pluses and minuses used for qualitative assessments are often not really qualitative at all, but are derived from underlying classes of quantitative data. With a well chosen method of standardization this underlying quantitative scale can be used in the weighted summation of these scores.

15. How to select the criteria

Once the decision has been taken to use MCA, the next question is how to select the criteria. The alternatives have to be checked on their agreement with government policy. Policy objectives, though, are mostly formulated in such abstract terms that it is almost impossible to measure the degree to which concrete projects meet them. They need to be ›translated‹. The objective ›to reduce noise nuisance‹, for example, can be translated as ›reduction of the number of people affected by noise nuisance‹. The links between criteria and objectives may not always be as obvious as this, but are ultimately the only justification for the formulation of criteria.

Choosing the right criteria is a key stage in the process, but there are many pitfalls. When considering the ecological consequences of a project, for example, the criteria must be good indicators of the quality of the ecosystem. It is a bonus if the criteria used also appeal strongly to the reader. A good but also ›cuddly‹ indicator of the quality of the Wadden Sea is the health of the seal population, which also happens to be at the top of the food chain.

Quantifiable criteria are favoured by most impact assessors. However, leaving aside the costs of measuring these criteria, quantitative methods of comparison are by no means always best for describing impacts. Moreover, because relevance and quantifiability do not necessarily go hand in hand qualitative criteria have to be used in many impact summaries, mostly expressed as pluses and minuses **C** the significance of which must, of course, be clearly indicated (see box 2 for an example).

Box 2: Pluses and Minuses - an example

When describing the visual impacts of a road on the landscape the qualitative judgement of experts is often better than quantitative measurements. If the expert expresses his judgements with pluses and minuses, these symbols must be clearly explained. Describing ›---‹ as a very large and ›--‹ as a large negative effect is not enough. In the case of a new road, for example, the following legend might be used:

0	the road is not visible
-	the road is visible in places but fits in with the existing railway line and canal
--	the road is visible in many places and does not fit in with the existing railway line and canal
---	the road is visible in many places, does not fit in with the existing railway line and canal and will result in the loss of valuable elements in the landscape

This avoids forcing the visual impact of the road into the straightjacket of a quantitative index, while still making it clear to everyone how this impact has been assessed. It allows others to argue for a different interpretation to that of the expert.

Grouping criteria into ›themes‹ helps the reader to gain a better overview of impacts. These criteria must relate to a common element, for example a group including all the impacts on water quality or a group of all impacts on mobility.

A balanced distribution of criteria between each theme is also important. Describing the impacts on the vegetation using ten indicator species but using just two criteria to describe the impacts on human health may give the impression that plants are more important than people.

16. Weights and perspectives

The central characteristic of MCA, the attribution of weights, is much criticised for inviting subjectivity. This subjectivity is inherent to all methods that include making choices. Criticism is justified when such choices are not made explicit. In MCA this subjective step in the procedure is always explicitly made.

It is important for decision makers to know who did the weighting and from which background this is done. The weights can be attributed by experts on the basis of general accepted knowledge or by politicians on the basis of policy priorities. The importance of criteria within one theme, for example the importance of different species of animal within the theme ›ecology‹, is determined on the basis of reasoned argument by an expert, backed up by scientific knowledge. The scientist allocates ›expert‹ weights. Deciding the relative importance of the different themes (ecology, recreation and accessibility, for example) is a task for political decision-makers on the basis of political priorities. In this case we speak of ›political weights‹. In principle different sets of weights should always be used; in other words, account should be taken of different *perspectives*.

Working with different perspectives is an important element of MCA. They show that there is not always just one truth, but many. The points of view each of us chooses (the weighting of themes) are the ones that suit us best. These may be ecocentric, anthropocentric or economic perspectives. A pitfall is that the number of perspectives can become too large, nullifying any additional value beyond the comparison of themes. In most cases, two or three perspectives will be sufficient to clarify the different possible points of view.

If more than one perspective is to be employed it is logical that the competent authority guides the selection of perspectives before the EIS is compiled. The perspectives, after all, put different priorities on the various interests and are therefore political in nature.

Political weighting easily ignites debate. The use of perspectives in MCA can clarify these discussions. There is usually less discussion about the underlying scientific and technical weights because most people have the idea that this is purely a question of fact. However, MCA also brings out the subjective elements in scientific decisions. Although these are different from purely political judgements, an expert who balances the loss of one badger den (ecology) against the retention of one hectare of fen meadow (ecology again) is doing nothing less than a politician who balances one road death (road safety) against the loss of one hectare of industrial land (economy).

A vital element for every good MCA is the sensitivity analysis. The reliability of the results can be checked by making small changes in the allocated weights and scores to see if this results in a different ranking of alternatives. This can remove any doubts about the significance of the results. Caution is advisable when presenting a detailed sensitivity analysis because this might turn out to be quite a pile of paper, full of tables and statistics. This is better left out of the EIS. A good solution is to present the results and refer to a separate report, obtainable on request, containing all the background data.

17. Avoid the Black Box

How does the reader react to the use of MCA? Without careful use mistrust can easily grow. ›They just put some figures in, jiggle them about, and after a lot of abracadabra something else comes out; and of course it turns out to be just the answer they were looking for in the first place. But how or why? You tell me.‹ In short, a *black box feeling*. This can be avoided by clearly explaining the method and adequately presenting the results (see Box 3 for an overview of recommendations).

This presentation of the results deserves special attention; there should be ›something for everyone‹. The method must be explained at different levels of comprehension, and a thorough substantiation of the method (where possible with references to the relevant literature) should be provided in an annex to the EIS. The main report must contain a sound and comprehensible explanation of the method and a discussion of the results and the sensitivity analysis. Every step should be made explicit and no steps missed out ›for the sake of clarity‹. Finally, the summary (and any presentations at public information meetings and hearings) should not contain a detailed explanation of the method. It is sufficient to mention the fact that weights have been allocated to the results in accordance with the scope and severity of impacts. Further explanation usually raises more questions than answers.
The results can be presented in the EIS in a number of different ways. Although there is often the suggestion that graphics can do wonders (›one picture is worth a thousand words‹) a simple table containing rankings or pluses and minuses are often the most successful. Pie charts, histograms and other figures mostly contribute little to the eventual goal of MCA, the *mutual* comparison of alternatives (or variations).

An essential part of the presentation of the outcome of an MCA is the description of the results obtained. A brief explanation of the rankings, indicating the impacts and weights that were of most significance in determining the rankings, will often serve to dispel any ›black box feeling‹. Presentation of both the rankings and the (standardized) scores can help provide a good overview when there are various aspects and many alternatives to be considered.

Finally, the disadvantage of every form of comparison that makes use of standardized instead of actual scores is that the direct link with reality is lost. For example, there is no obvious relationship between a standardized score of 0.35 and the 8500 people suffering noise nuisance it represents, which is not helpful. That is why **C** and we repeat **C** a summary of (unprocessed) impacts represented by actual scores must not be left out. This summary remains an indispensable starting point for (and part of) every well conducted MCA.

Box 3: Recommendations for the use of MCA

- Always include a summary of unprocessed impacts in the EIS.
- Choose a method of comparison that suits the project, and present a reasoned argument for using it. In certain cases this may be MCA.
- If possible, indicate as early as the scoping phase whether an MCA would be useful.
- If an MCA is to be carried out, ‹weighted summation: is a good MCA method which can be explained clearly to interested parties.
- Make a clear distinction between scientific/technical and political weights and make this clear in the EIS.
- Always undertake a sensitivity analysis and include the results of this test in the EIS.
- Ensure that the reader does not get a ›black box feeling:; explain what you are doing and pay full attention to the presentation.

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4 TOWARDS INTEGRATION OF ASSESSMENTS

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18. Introduction

Donor agencies appraise development projects on a multitude of aspects covering poverty, gender, culture, the social and institutional fabric and the environment. Moreover, appraisal covers institutional, financial and economic feasibility and manageability for the donor agency. Until now, appraisers have largely used an›aspect by aspect‹ approach to the various specialistic topics and usually invite specialists to advise on these aspects. The product of this approach is a number of sectoral reports, often prepared at different moments ***in time, with conclusions and recommendations that must be interpreted and combined by the appraisers into a consistent project proposal of acceptable quality on all aspects.

Sectoral reports unavoidably ignore cross-connections between aspects. An›aspect by aspect‹ approach thus carries the risk of misjudging impacts, which may compromise the quality of the project proposal and its appraisal. Moreover, one of the specialistic studies (environmental impact assessment, EIA) differs from other studies as EIA considers alternative solutions to the envisaged problem. Usually, other specialistic studies do not consider alternatives, nor do financial, economic and institutional assessments. As the impacts of the alternatives proposed in the environmental impact statement (EIS) are not addressed or worked out in other studies, appraisers lack information enabling them to conclusively compare these alternatives. Appraisers and decision-makers may thus foreclose valuable alternatives or display a reluctance to accept EIA for project preparation.

Imperfections of the project appraisal process may be remedied in various ways. A first important improvement may be realised by synchronizing the execution of the various sectoral studies and ensuring communication between the various experts. This requires active planning and management of the appraisal process. This process may further be improved by integrating the sectoral studies. Two levels of integration may be distinguished. At a lower level of integration, sectoral studies may be asked to address a common set of project alternatives. Applying this level of integration would facilitate comparison of the alternatives on all aspects covered by the sectoral studies. Cross-sectoral aspects, however, would not yet be addressed at this level of integration. Cross-sectoral aspects can only be addressed at a high level of integration at which one single assessment covers all relevant aspects of the appraisal.

From the onset of its advisory activities and in line with World Bank and OECD guidelines for EIA the Netherlands Commission for EIA[1]], in advising the Directorate-General for International Cooperation, has included sociocultural and institutional aspects in its Terms of Reference for EIAs. Integrated impact assessment, however, is a complex affair for which a proven comprehensive conceptual framework is not yet available. This paper presents some preliminary reflections on the development of such a conceptual framework and reports on the results of initial experiences with integrated studies. This is done on the basis of the assumption that the best

14 The Commission for Environmental Impact Assessment advises competent authorities in the Netherlands on the Terms of Reference (or scoping guidelines) for and reviews of EISs. The Commission has advised the Directorate-General for International Cooperation (DGIS) of the Ministry of Foreign Affairs on EIA since 1993.

results for informed decision-making can be attained through integration of the various sectoral studies, and that procedural tuning of the various studies must be considered as a first step towards integration.

19. The theoretical basis for the framework

The theoretical basis of the conceptual framework for integrated impact assessment is the system-analytical model used by Dalal Clayton (1992) to define sustainability. In this model the world is seen as a system comprising three subsystems that support human existence: an economic subsystem, a social subsystem and a natural or biophysical subsystem. It cannot (yet) be determined whether a subsystem (or the overall system) functions sustainably. There can be no indisputable measure or determination of sustainability. Therefore, the use of qualifiers such as ›more sustainable‹ and ›less sustainable‹ is preferred to ›sustainable‹ and ›unsustainable‹. Wise interventions can be made in the functioning of each subsystem that will result in increased sustainability (increased system stability). Decreasing the sustainability of the functioning of a system implies long-term inviability.

An acceptable level of sustainability of the overall system can be reached by increasing the sustainability of each of the three subsystems. The first subsystem, the social subsystem, is human society. Cultural characteristics, knowledge, norms and values and their expression in laws, regulations, informal standards of social behaviour and institutional bodies facilitate the functioning of the social subsystem. The economic subsystem is the system of production, delivery and consumption of goods and services. The economic system reflects the way in which human society uses the resource base according to the traditions, laws, etc. that characterize the social subsystem. The social and the economic subsystems together can be seen as the ›demand side‹ of goods and services. The final subsystem, the natural system, comprises the biotic and abiotic renewable and non-renewable resource base and can be seen as the ›supply‹ side.

20. The framework

20.1 Goals and method

The goal of integrated impact assessment is to improve the reliability of information covering the three susbsystems upon which decision-making on development projects is based. The method under development aspires to describe **C** from the perspective of an identified problem or a proposed project **C** the relations between the human communities concerned, their economic organization and their actual resource base. It qualifies, quantifies and, as far as possible, values the effects of proposed and alternative interventions on the three subsystems and their intersystem relations. It attempts to identify beneficial interventions and to fully expose unavoidable trade-offs. The conceptual framework does not propose or develop new analytical tools; it merely combines and possibly slightly adapts existing assessment methods and analytical instruments.

20.2 Steps

In nine steps, the framework attempts to produce the bulk of the information necessary for project appraisal. In step 1 a general description is made of the problem to facilitate step 2, defining the limits of the of the physical and sociocultural and economic systems within which the impacts of possible intervention may be felt. Step 3 involves describing the local and international context, identifying the interests of stakeholder groups, and also qualifying and quantifying the existing situation and describing trends in the natural, sociocultural and the economic systems in so far they influence, or are influenced by, the problem. Based on the analyses in step 3, a detailed problem definition is developed in step 4. This definition specifies the underlying causes of the problem. Project objectives logically ensue from this problem definition.

Having identified the fundamental problem, knowing the existing situation and the trends, and having assessed the interests of stakeholders, realistic alternatives for interventions are formulated in step 5. In step 6 predictions are made of the impacts of the alternatives on the three subsystems and the cross-system relations. In step 7 stakeholder groups attach values (weights) to the impacts of the various alternatives (including the no action alternative). Then, in step 8, the various alternatives are compared with each other and with the expected development if no intervention is made (the autonomous development). If there are several alternatives, Multi criteria analysis is proposed as a tool here, applying the various weights given by the stakeholder groups. In step 9 assumptions and uncertainties are listed and their importance for decision-making assessed. Indicators for evaluation are given and a monitoring programme is proposed.

For the integrated assessments tools such as context analysis, the function evaluation method, current participatory analysis techniques and current techniques for economic evaluation are proposed in addition to Multi criteria analysis (see Appendix 1). In fact, the steps described above will be easily recognized by assessment specialists, as are the proposed analytical tools.

21. Work and experience to date

Recently, a start has been made with developing and testing preliminary drafts of the framework for the integrated assessment of impacts. It is thought that the development of this framework will be continuous and iterative. Work programmed or carried out so far relates to:

a. introducing elements of integrated impact assessment into the formulation of the Terms of Reference for EIAs of some projects in the water sector;
b. formulation of an analytical framework for the appraisal of integrated water management projects (policy level);
c. evaluation of 3 cases of integrated studies from the ›process management perspective‹.

Box 1: Terms of Reference

a: Introducing elements of integrated analysis into Terms of Reference for EIAs

Terms of Reference (ToRs) were formulated for EIAs of a number of projects in the water sector in which elements of integrated assessment of impacts were included (see box 1 for an example). The inclusion of these elements, however, was not yet based on a clear-cut conceptual framework for integrated assessment. Such a framework is not yet available.

A team comprising a health expert, a cultural anthropologist, a hydrogeologist and a civil engineer formulated the ToR for the Environmental Impact Statement on water supply, sanitation and water disposal projects at various locations in the semi-arid environment of Shabwah Governorate in Yemen. The ToR not only required the physical and environmental impacts of possible project alternatives to be addressed, but also the immediate implications of proposals for project design and impact assessment, especially on social issues (e.g. hygiene, education, gender) and institutional/financial issues (water management by user groups, wastewater treatment and re-use, water pricing policy, recurrent cost recovery).

Multidisciplinary teams were formed to formulate these ToRs and a joint visit to the project site was organized. Consensus on the basis for the integration of aspects grew during the process of intense interdisciplinary interaction between the experts, especially during the site visits. When formulating these ToRs no serious problems were experienced in reaching a common basis for the integration of impact assessments. Maintaining agreement on a common basis for analysis appeared to be much more problematic during the preparation of the assessment studies themselves. An evaluation of the process of preparing these studies was commissioned (see under »c« below) in order to obtain insight in the possible pitfalls and constraints arising from the production of integrated assessments studies.

b: Formulation of an analytical framework for the appraisal of integrated water management projects

An early case in which a multidisciplinary working group of the Commission developed ideas for a conceptual framework for integrated analysis was advice given on an analytical framework for appraisal of integrated water projects. The water sector is particularly appropriate for this purpose as links between the presence and functions of water and the biophysical, social and the economic systems are obvious, and water is of foremost importance for all systems. Moreover, throughout the world water is becoming a scarce resource and a great proportion of development projects concern water. The relevance of an analytical framework for integrated water management was stressed in 1993 by the World Bank (Policy Paper on Water Resources Management). In its advice the working group proposed application of the function evaluation method (de Groot, 1993) in the water sector as the tool to identify relations between water and the three systems (natural, social and economic). The framework includes assessment of water resources, identification of users groups, assessment of formal and informal water management institutions and capacity development in water resources management. Participatory techniques are proposed to value the social, ecological and economic functions of water. Principles for integrated water resources management strategies, masterplans for water resources development and projects in the water sector are given in the framework. Policy instruments for demand and supply side

The function evaluation method identifies functions of the natural system from an anthropocentric point of view and categorizes them in carrier functions, production functions, information functions and regulation functions. The method identifies the users groups and attributes economic value, social value and ecological value to the functions. Values are represented in a matrix directly showing the links between the social, economic and natural system.

management are addressed as well. In the process of formulation of the advice, the function evaluation method proved to be an acceptable, though not complete, basis for integrated analysis to all disciplines represented in the working group.

c: Process management: the interdisciplinary aspect

Evaluation of three cases in which multidisciplinary teams carried out an integrated analysis confirmed the hypothesis that diversity of visions is, indeed, the main hurdle to be crossed. Difficulties in stepping outside ones own professional and ethical vision easily leads to conflicts, which seem to pop up particularly in the reporting phase of a study[1]. The implication of this finding is that the challenge of assessment is not only in defining and refining its conceptual framework; equally important is the challenge of its application, especially for achieving successful and lasting interdisciplinary collaboration. Integration requires sectoral experts to forsake their professional reflexes, to open their minds and acquire the skill of looking at society, nature and economy from other perspectives. Integrated analysis is inherently participatory.

Opinions expressed by local groups may well conflict with the visions of the team carrying out the analysis. Opinions may also be unconventional, unscientific or seem irrational, as they may be based on religious or cultural beliefs and behaviour. Nevertheless, these visions and opinions must not be neglected and must be observed in the study on an equal basis with any others. This, again, demands an open mind. Consequently, a major point to consider when applying integrated analysis is the management of the interdisciplinary process in order to keep the team together. Some practical tips may be drawn from the above experiences:

- In applying integrated assessment, an efficient approach is to provoke interdisciplinary conflicts, which may be inevitable anyway, during the first phase of the assessment process, prior to actual impact assessment but after having gained some insight into the problem. Provoking discussion, settling disputes and defining a common basis for the study is the first task, which might be commissioned to an independent convenor/ facilitator. Without a common basis there seems little use in undertaking the study.
- Maintaining a high frequency of interdisciplinary interaction seems to be beneficial for the process.
- Selection of the proper experts and disciplines is of paramount importance.
- Severe time constraints have a negative effect on the interdisciplinary process.
- To ensure that all disciplines are given proportional and fair influence on the outcome of the study it is advisable to:
  - undertake the study in a setting that has no relation to one of the participating disciplines;

The following cases were analysed:

- Andra Pradesh Participatory Tribal Development project (India) in which a combined Gender/Poverty Assessment was carried out. *(W. Wentholt (1995), "Report of the Support Mission of the Gender and Poverty Assessment Study of the Andra Pradesh Participatory Tribal Development Project". (Royal Netherlands Embassy, New Delhi, India.))*
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15 This "weakness" is at the same time a strength. Diversity o[illegible]he problem will be taken into account. This is what interdisciplinary work is all about.

- **$** commission the editing of the study report to an independent professional secretary/editor.

22. Conclusions

A practicable method to improve appraisal may include two steps. A first (procedural) step is the coordination of sectoral studies in time. This opens the possibility of contact between sectoral experts during their study. The effect may be that the experts become aware of differences in approach and may try to adapt their contribution. These interexpert contacts may engineered. The manager of the appraisal process plays a crucial role in this first step.

The second step towards improved appraisal is integration of sectoral studies. Two levels of integration may be distinguished. At the lower level of integration all sectoral studies consider and work out a common set of project alternatives. At the higher level of integration no sectoral studies are carried out; an interdisciplinary team of experts produces one single assessment covering all relevant appraisal aspects. Higher level integrated assessment will probably have to focus mainly on working routines which allow for adequate management of the multidisciplinary process. The function evaluation method may be an acceptable basis for analysing all disciplines and may thus play an instrumental role in process management. Work has to be done to complement this method by, for example, incorporating cultural aspects. The water sector is an excellent sector to focus on in the process of methodology development.

Appendix 1

Assessments considered for integration and tools available:

- **!** Environmental Impact Assessment
- **!** Health Impact Assessment
- **!** Social Impact Assessment
- **!** Poverty Assessment
- **!** Gender Assessment

Analytical tools available:

- **!** Problem in context analysis (De Groot, W. 1992)
- **!** Function evaluation (De Groot, R. 1993)
- **!** Participatory appraisal techniques (Bojanic et al. 1995)
  (Rapid Rural Appraisal, Parcipatory Rural Appraisal)
- **!** Economic valuation methods (Dixon and others)
  - **$** using market values
  - **$** using surrogate or estimated values
  - **$** contingent valuation methods
  - **$** macroeconomic models

Decision support:

- **!** Objective Oriented Project Planning (Gemeinschaft fur Technische Zusammenarbeit [GTZ, Germany], United Nations Environmental Programme [UNDP])
- **!** Multi criteria analysis (Janssen, R. 1992)

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5 THE ROLE OF EIA IN LAND RECLAMATION OF A WETLAND AREA FOR URBAN EXPANSION OF AMSTERDAM

Jules Scholten

23. Amsterdam: the need for urban expansion

The city of Amsterdam, the capital of the Netherlands, has a considerable housing shortage. Its population is increasing and households are becoming smaller. The city also has to contend with a shortage of suitable areas for urban expansion. Most of the sites within the municipal boundary have been built up already; the remaining areas are either designated as nature areas and/or areas of cultural or his torical interest, or cannot be used for urban development because the noise from Amsterdam Airport exceeds permitted limits.

The planning target is to house people who work in the city in areas within easy commuting distance, preferably by public transport or bicycle. The only land still available for urban expansion within the municipal boundary is the area to the east of the historic city centre (Figures 1 and 2). The problem is that this area is a shallow freshwater lake that has been registered by the government as an international wetland under the Ramsar Convention, while the shoreline is that of the former ›Zuider Zee‹ and therefore of historical interest. Its status as an international wetland means that the local and migrating bird populations that rest, feed and breed here make up more than one per cent of the world population of these species.

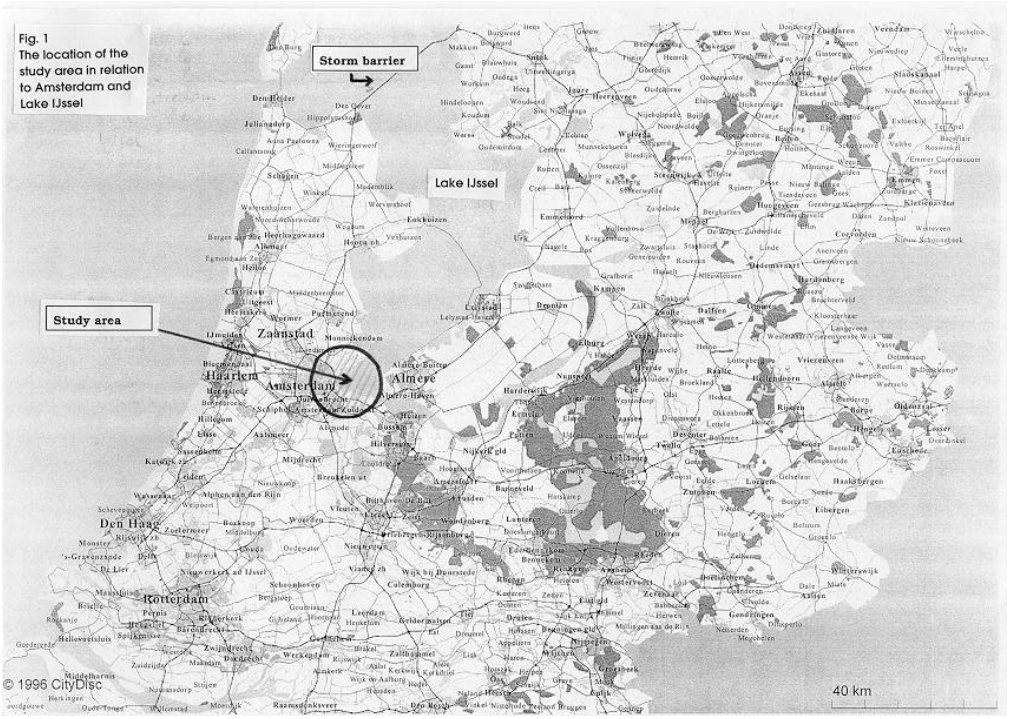


Fig. 1
The location of the study area in relation to Amsterdam and Lake IJssel

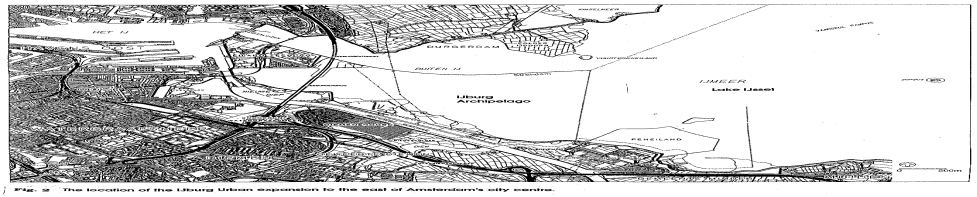


Fig. 3 The location of the Uitburg Urban expansion to the east of Amsterdam's city centre.

24. The problem

There is a clear conflict of interest between, on the one hand, the need for urban expansion and ensuring attractive living conditions on the waterfront with recreational facilities, and on the other hand the considerable value of the area as a wetland of recognized international status.

25. Planning the urban expansion with EIA

Since 1990, the planning and decision-making for this new urban development has been accompanied by an environmental impact assessment (EIA), the aim being to harmonize the urban development with nature conservation and minimize negative environmental impacts. The planning decisions concern not only the design and layout of the new development, they also cover the form of land reclamation and the remediation and isolation of heavily polluted areas along the shore of the mainland (›Diemerzeedijk‹; see Figure 4).

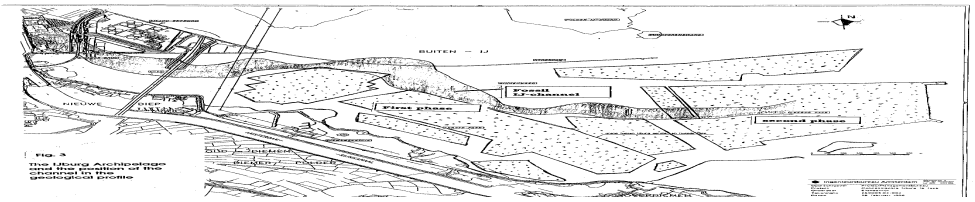
26. Urban planning requirements

The planned urban expansion will require the reclamation of 660 hectares of land, divided between two sites covering 330 hectares each, to accommodate a total of 18,000 homes. On average, 65 houses will be built per hectare. Thirty per cent will be in the social sector (low-rent homes and apartments), the remainder will consist of owner-occupied housing and more expensive rented accommodation. The plan also calls for a high share of public transport and slow private transport, the aim being to encourage more than 40 per cent of the inhabitants of the new housing area to use these forms of transport.

27. Current situation

The wetland area forms part of the IJssel lake, which used to be an inland sea, the Zuider Zee. In 1932 this inland sea was closed off from the North Sea by the construction of a storm barrier. The Zuider Zee was gradually transformed into a shallow freshwater lake (Figure 1). The water level in the lake is managed to keep it high in summer and low in winter. This is necessary to allow excess water to be drained from the surrounding polders into the lake during winter, and to allow water into the polders during summer to make good the shortfall. The shallow depth of this freshwater lake allows feeding birds to reach the bottom. The IJSSELMEER is eutrophic and so

the biodiversity is limited but biomass production is huge. These conditions are ideal for a relatively small number of species of migrating and local waterbirds.



28. Spatial planning and EIA

From the outset of the spatial planning and EIA process it was clear that urban development in the wetland area would have a negative environmental impact. The role of the EIA has been to develop an alternative that combines an easily accessible, attractive living environment with water-related recreational facilities with conditions that limit any degradation of the aquatic ecosystem and create valuable new habitat as far as possible.

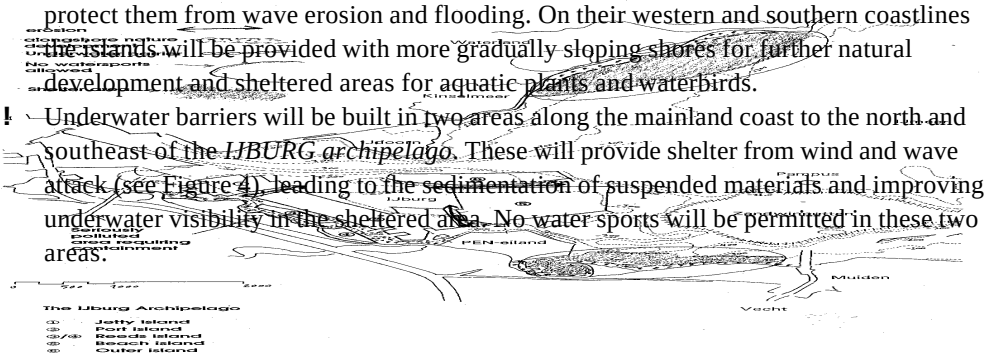
This led to the adoption of an urban design, called *IJBURG archipelago*, consisting of six islands separated by narrow water channels (Figures 3 and 4). The original plan to reclaim the land for these islands by impoldering was dropped in favour of filling in the island areas with sand to a level one metre above the average water level. More sand is needed to raise the surface above the mean water level than in the impoldering option, but infilling has the advantage that it provides a safer living environment for the residents. Neither does it influence the geohydrology as it does not require an artificial draining and pumping system to maintain the ground water at the lower polder level. The polder model has the additional disadvantage that the required forced drainage system would create a ground water flow from the heavily polluted area on the mainland (›Diemerzeedijk‹) towards the polders, clearly undesirable if the materials used to seal off this area were ever to leak.

The EIA brought to light another surprising feature. Geological investigations revealed that the substrate of most of the study area consists of alternate layers of sand and clay. This otherwise regular geological profile is interrupted by an ancient channel of the river IJ, which cuts through most of these layers of sand and clay. This fossil river bed is filled with sedimentary deposits that have a low bearing capacity, making the land above this old channel poorly suited to land reclamation and construction. In the design of the *IJBURG archipelago* the islands are positioned to avoid this subsurface channel (Figure 3). Taking this geological feature into account will save millions of cubic metres of sand that would otherwise be needed to raise the bearing capacity of the channel deposits.

The islands are positioned so that a channel is left between the islands and the mainland, thus preserving the shoreline with its historic sea dike. The EIA was instrumental in speeding up the containment of the seriously polluted ›Diemerzeedijk‹ area on the mainland, which between 1950 and 1970 has been used to dump a variety of wastes and for incinerating hazardous waste. If not dealt with adequately, this polluted site would have posed an unacceptable risk to the nearby residents and the adjacent wetland area (see Figure 4).

The following features have been incorporated into the design to compensate for the loss of aquatic ecosystem habitat to land reclamation.

- The configuration of the archipelago with islands separated from each other by narrow channels will set a relatively rapid circulation of water in motion. As the water will not stay long in any one place there is little risk of excessive algal growth.
- The flow of water in the channels between the various islands will be sufficiently rapid to prevent these channels silting up (see Figure 4). Erosion and the presence of a hard substrate in these channels will be favourable to the development of freshwater clams, the main source of food for most waterbirds in the wetland.
- The islands will have rock embankments on their eastern and northeastern coastlines to protect them from wave erosion and flooding. On their western and southern coastlines the islands will be provided with more gradually sloping shores for further natural development and sheltered areas for aquatic plants and waterbirds.
- Underwater barriers will be built in two areas along the mainland coast to the north and southeast of the *IJBURG archipelago*. These will provide shelter from wind and wave attack (see Figure 4), leading to the sedimentation of suspended materials and improving underwater visibility in the sheltered area. No water sports will be permitted in these two areas.



29. Conclusion

The reclamation of land in the wetland area to the east of Amsterdam will result in the loss of a considerable area of internationally recognized shallow freshwater ecosystem. In exchange for this loss, an attractive living environment will be created for approximately 45,000 people in close proximity to the city.
The decision-making on the planning and design of the urban development and the method of land reclamation was supported by an EIA. This combination brought about an acceptable design which takes the considerable environmental concerns into account. The physical loss of wetland area will be compensated to some extent in the archipelago model by the improved surface water circulation and increased length of shoreline, including variable land-water transitional zones (beach, marsh and rock). In addition, two coastal areas to the north and southeast of the *IJBURG archipelago* will be sheltered from wind and wave action by the construction of underwater barriers parallel to the shoreline. All these measures will provide conditions for higher biodiversity in the freshwater ecosystem compared with the current situation. The EIA also helped all the parties concerned in the decision-making to reach an agreement that no further urban development will be allowed in the wetland.

The land reclamation will take advantage of the geological characteristics of the area to minimize the quantity of sand needed for the creation of the islands and all engineering structures. The development has brought forward a solution to control the serious soil and ground water pollution in the area along the ›Diemerzeedijk‹ that is both financially and environmentally acceptable.
The decision by the municipality of Amsterdam and the provincial government of North Holland to approve the development plan was made on September 4th, 1996. In March 1997 the city of Amsterdam put the decision on *IJBURG archipelago* to the test by holding a referendum, which again raised opposing interests. The National Society for the Preservation of Nature (*Natuurmonumenten*) and other environmental interest groups put their full weight and financial support behind the opponents to the plan. In spite of this strong opposition the plan was given the green light by a narrow margin.

6. INTEGRATING ENVIRONMENTAL OBJECTIVES IN THE PLANNING OF NATURAL GAS EXPLORATION DRILLINGS IN SENSITIVE AREAS IN THE NETHERLANDS: THE NORTH SEA COASTAL ZONE AND THE WADDEN SEA

Stefan Morel[1]]

30. Abstract

The Dutch Government has decided that, in the public interest, there is a need to prospect for and extract natural gas reserves in the North Sea coastal zone and the adjacent Wadden Sea. As highly important nature values are at stake, environmental assessments at both the strategic and the project level would have contributed to a balanced decision-making process. However, the assessment was restricted to the project level; the disadvantage of this was that discussions on strategic topics were not resolved at the strategic level and complicated decision-making at the project level.

The government has determined that exploration for natural gas (and later its exploitation) must satisfy the most stringent environmental conditions. The main purpose of EIA, therefore, was to identify the 'alternative most favourable to the environment' (AMFE). Although complicated by the absence of SEA, project EIA still proved to be a strong tool for guiding the development of the initiative in a more sustainable direction. Key elements were:

- EIA stimulated a *proactive approach* C the vulnerability of the area determined the project formulation;
- the obligation to *develop and compare alternatives* in the EIS enabled the selection of the AMFE, which was essential in this process;
- the *involvement of the public and the independent Commission for EIA* in reviewing the EIS led to the formulation of additional mitigation measures in the AMFE;
- the need to *identify gaps in knowledge* in the EIA process resulted in a recommendation by the Commission to further study the natural values in the area;
- the competent decision-making authority had to *substantiate in the decision the significance assigned to the environmental information*. This showed clearly that the decision did not fully comply with the elements of the AMFE identified in the EIS, which was one of the reasons the decision was challenged successfully in a court case; and
- in the EIA process it became clear that *protection criteria for sensitive areas* such as the North Sea coastal zone had not been specified in sufficient detail to allow clear conditions to be placed on the proposed activities. As a result of the EIA a start has been made in drawing up these further specifications.

31. Introduction to the project

Geological formations underlying the Netherlands contain large quantities of natural gas, which supplies an important part of Dutch energy requirements. Current Dutch stocks of natural gas stand at approximately 2000 billion m^3, and about 70 per cent of these reserves are contained in

16 Paper for the International Seminar on Coastal Area Management, March 1998.

the Groningen gas field in the northern part of the country, bordering the Wadden Sea. The remaining reserves of natural gas are distributed over a number of smaller fields, including prospects under the North Sea coastal zone and the Wadden Sea.

The Dutch Government has decided that, in the public interest, there is a need to prospect for and extract the ›Wadden gas‹ despite the presence of unique nature values in the Wadden Sea and the North Sea coastal zone. There are two reasons for exploiting the gas reserves in this area. The first is the current ›small field policy‹, the aim of which is to continue to prospect for new gas fields and bring them into production to ensure the continuing exploitation of the Groningen field for as long as possible. (One motive for pursuing this policy is the unique ability of the Groningen field to match short duration peak level demands.) The second reason is to do with economic and export interests. If the potential gas reserves under the Wadden Sea and bordering area is not exploited, it will not be possible to fully meet the demand from the home and export markets in the long term, with a detrimental effect on government revenue: loss of revenue, more expensive natural gas imports and lost job opportunities in the natural gas production business. The proponent, the Nederlandse Aardolie Maatschappij (NAM) has plans for 6 exploration drillings in both the North Sea coastal zone and the Wadden Sea. An EIA has been carried out on these planned drillings, but should significant natural gas reserves be found exploitation will follow. Exploration drillings take about 3 to 5 months; exploitation of the field may last for more than 20 years.

32. The policy framework: protection principles

The North Sea coastal zone and the Wadden Sea are recognized as nature reserves of high environmental value of national and international significance. This is expressed in the rural character of the landscape and the unique hydrography and geomorphology of the area with its tidal sandflats and moving channels. The value of the entire area is recognized in a number of policy documents. The National Structure Plan for the Rural Areas (Structuurschema Groene Ruimte, SGR) designates both areas as ›core areas‹ within the National Ecological Network. Moreover, the Wadden Sea is a wetland designated under the Ramsar Convention, it falls under the protection of the European Union (EU) directive concerning the protection of bird populations (79/409/EC, 2 April 1979) and is proposed for designation under the EU directive concerning the protection of habitats, flora and fauna (92/43/EC, 21 May 1992). The special status of the Wadden Sea is expressed in the National Spatial Planning Key Decision on the Wadden Sea (Planologische Kernbeslissing (PKB) Waddenzee). The policy for both areas aims at sustainable protection and development. Under this policy, *protection principles* have to be applied in decision-making processes on new activities in these areas. The framework of protection principles requires that the following four steps be followed:

- Projects are not permitted if *essential values and characteristics* of the area would be harmed, unless,
- there is a *considerable need* in the public interest for carrying out the activity. This embraces two elements: demonstrating the *social importance* of the activity and the necessity of locating the activity in the area (the so called *translocation principle*: the project could not be done anywhere else).

- If implementation of an activity is deemed acceptable, the best practicable means to *prevent* and to *mitigate* negative impacts should be adopted, which means implementing the alternative most favourable to the environment.
- Temporary and permanent impacts remaining after prevention and mitigation should be *compensated*.

The *best available information* must be used in coming to decisions, taking into account the *accumulation of impacts* in the area.

33. SEA or EIA?

The above-mentioned framework of protection principles embraces a strategic and a project level, both of which could be subject to environmental assessment.

1) *The strategic level*
   The decision on the acceptability of an activity must be the outcome of a process of balancing the essential values of an area against the social need for carrying out the activity, taking into account the possibility of locating the activity elsewhere. In the case of the exploration drillings, this can be summed up by the question *Is exploratory drilling in the North Sea coastal zone permissible under the terms of government policy for this area?* Answering this question is complicated by the fact that exploration might be followed by exploitation. Despite adoption of all possible preventive and mitigatory measures, exploitation of natural gas may give rise to soil subsidence. This would result in a loss of tidal sandflats which are of primary importance in the ecosystem. In other words, the significance of the potential loss of these sandflats due to gas extraction should be discussed in terms of its impacts on the essential values of the ecosystem and, therefore, should be carried out at the strategic level of decision-making.
2) *The project level*
   This encompasses decisions on the implementation and design of an activity, i.e. *where, when and how the exploration drillings can be carried out in a way most favourable to the environment, including prevention, mitigation and compensation*. More detailed arrangements for the gas exploration project had to be drawn up with the help of a project EIA. The key questions were:

   - Site selection: where should drillings be located?
   - Period selection: in which season will the drillings have least impact?
   - Method selection: which techniques are most environmentally friendly?

The Environmental Assessment Decree in the Netherlands requires an environmental assessment at the project level (EIA) for test drillings in both areas because of their sensitivity. Environmental assessment at the strategic level is not required as the decision at this level is addressed in the National Spatial Planning Key Decision on the Wadden Sea (PKB Waddenzee). Strategic Environmental Assessment (SEA) for a PKB is only required in cases where a decision is made on the specific *location* of an activity mentioned in the EIA Decree. The Government decided that execution of an SEA for the Key Planning Decision was not needed as this decision did not specify the locations for the drillings. The PKB accepts only the principle of carrying out drillings and the conditions applying to this, but these conditions were not the outcome of thorough

research. Although the strategic decision took account of some issues such as nature values and soil subsidence, important questions remained unanswered:

- What are the essential values in the area?
- At what point do these essential values become seriously affected? For instance, do reversible impacts harm values considered to be essential, or does this depend on the kind of impact?
- At what point does the damage to essential values caused by creeping subsidence become unacceptable?

Answers to questions like these could have contributed to a framework of environmental criteria to be met by individual activities in the area. Regardless of the fact that SEA was not legally required, the decision-making structure shows that a balanced decision would have been served best if environmental assessment had been carried out both at the strategic level, weighing present nature values against the need to extract gas in the area, and at the project level, for fine tuning of the site selection and project design.

As the more strategic questions were not addressed by SEA, stakeholders such as nature conservation organizations continued to raise such strategic issues during the formulation of the project and the project EIA. This could be expected since public participation had not taken place at the strategic level and the Wadden Sea is, after all, a symbol of nature conservation in the Netherlands. Without thorough research and public participation, important decisions on the future of this area can hardly be deemed acceptable given its political and social importance in the country.

34. Results of the project EIA

The starting point for the project EIA was the permission, subject to conditions, given in the National Spatial Planning Key Decision for the Wadden Sea to undertake test drillings followed by the exploitation of natural gas. To protect the natural values of the area the Government demanded that the exploration (and later also the exploitation) meets the most stringent environmental conditions. The main purpose of the EIA, therefore, was to identify the alternative most favourable to the environment (AMFE), representing a combination of the most environmentally-friendly locations, timing and technology. The key question was not ›Can drillings be allowed?‹ (the strategic question) but ›How can drillings be executed in the most environmentally-friendly (or environmentally least harmful) way?‹ Although complicated by the absence of an SEA, project EIA still proved to be a strong tool for guiding the development of the initiative in a more sustainable direction. Key elements were:

- EIA stimulated a *proactive approach*: the vulnerability of the area determined the project design, whereas environmental impacts often do not guide project design (with or without EIA) but follow from a predetermined project design. This proactive approach was achieved by involving an expert group, independent of the project developer, which selected the least vulnerable sites in the area. Moreover, an expert workshop was organized during which the site selection and other important elements of the project design were discussed.
- The obligation to *develop and compare alternatives* in the EIS enabled the selection of the AMFE, which was essential in this process.

- The *involvement of the public and the independent Commission for EIA* in reviewing the EIS **C** one of the legal requirements to ensure an adequate quality of environmental information in decision-making in the Netherlands **C** showed that the AMFE that had been developed did not make use of all the opportunities available, such as measures to further reduce noise hindrance. Supplementary information was asked for, and the Commission stressed in its review of the EIS that some additional measures be included in the AMFE. These included measures related to noise hindrance, monitoring, gas flaring and transport of materials and workers.
- One outcome of the obligation to *identify gaps in knowledge* in the EIA process was a recommendation by the Commission to further study the natural values in the area in order to improve on or extend the weight given to environmental interests in future decision-making processes. In this way the EIA also promoted the development of ecological knowledge more generally.
- The competent decision-making authority in its decision had to *substantiate the significance assigned to environmental information*. This showed clearly that the decision did not fully comply with the elements of the AMFE identified in the EIS. Moreover, the decision was not adequately recorded, one omission being how gaps in knowledge were taken into account in the decision. These were grounds for a successful legal challenge to the EIS.
- Finally, it became clear during the EIA process that *protection criteria for sensitive areas* such as the North Sea coastal zone and the Wadden Sea were not specified in sufficient detail to allow clear conditions to be placed on the proposed activities. For example, the definition of the criterion ›essential values may not be harmed‹ must be further clarified. This was a shortcoming resulting directly from the absence of a more strategic impact assessment as discussed above. Work has now started on rectifying this, following the judgement of the court president which was based on the information arising from the EIA.

35. Conclusions

Step-by-step decision-making linked to environmental assessment

Decision-making on projects often starts with strategic decisions (setting policies and criteria for projects) and ends with more specific project decisions on the implementation, mitigation and compensation of (environmental) impacts. Each step should be supported by the provision of (environmental) information as a starting point for a well motivated decision. The use of EIA can ensure that both the procedure of decision-making and the reasoning behind decisions are of the required quality. Important elements in this respect are early scoping, publication of an - environmental impact statement (EIS), reviewing, involvement of the public and an independent expert committee, and a written explanation of how the results of the EIA process were taken into account in the final decision.

Controversial projects will always give rise to public debate, and broad public support will only be gained if procedures comply with certain quality standards. If they do not, support may be lost. In the case discussed here, the result of insufficient environmental information at the strategic level was that strategic decisions were challenged at the project level. One of the reasons that the decision to allow test drillings in the North Sea coastal zone was suspended by the courts twice was that the EIS did not deal adequately with strategic issues. The discussion continues. The competent authority is currently drafting a document discussing more strategic issues such as the need for the activity, the definition of essential natural values and the question of when serious damage to these values occurs. A further verdict by the court is expected in April 1998.

Integration of interests

Complex projects with many (conflicting) interests demand a more integrated decision-making process. As shown in the case discussed here, the decision concerns not only natural values but also big economic interests linked to the benefits of gas production, job opportunities and recreation, and it will influence (the environmental impacts of) other activities in the area. It is therefore necessary to integrate information from all sectors in decision-making at different levels. This may be achieved by either integrating all information in the EIS or, should separate sectoral procedures be followed, by linking the outcome of these procedures in the final decision. In the case of natural gas extraction, the economic interests could have been integrated with strategic environmental issues at the strategic level during the preparation of the National Spatial Planning Key Decision for the Wadden Sea. The links between the environmental impacts of the drillings and other activities (recreation, fisheries), possibly resulting in cumulative impacts, could then have been made at the project level.

7 THE USE OF SEA AND EIA IN DECISION-MAKING ON DRINKING WATER MANAGEMENT AND PRODUCTION IN THE NETHERLANDS

Rob Verheem[1]]

36. Introduction

Environmental impact assessment for decision-making on drinking water management and production, at both strategic and project level, has been mandatory in the Netherlands since 1987. Environmental assessments have been carried out for strategic decision-making at the national level (in particular, for decisions on *sources* and *methods* of drinking water production), for the *siting* of drinking water production in specific regions and to determine the *amounts* to be abstracted at specific sites. This paper discusses the approaches to EIA, the methodologies used and the effects on decision-making in three case studies at different administrative levels:

- the SEA for the National Plan on Drinking and Industrial Water;
- the EIA for the selection of a site for a deep infiltration project in a sensitive coastal dune area to the west of the city of Amsterdam;
- the EIA to determine the most environmentally friendly way to produce drinking water from two wells on an ecologically valuable island off the north coast of the Netherlands.

37. SEA for the National Plan on Drinking and Industrial Water

Issues

The two main goals of this SEA were to determine the ecological impacts of alternative national water production policies (see below under 2.1) and to compare environmental and other aspects of alternative methods of water production (see below under 2.2).

37.1 Alternative policy options

As a first step in the assessment, five alternatives for future national water production policy were developed. Two broad categories may be distinguished:

A using existing production methods:
- increasing total drinking water production;
- reducing total drinking water production;
- reducing the industrial use of water;

B altering production methods:
- increasing the existing use of ground water (shallow and deep ground water, infiltrated river water), decreasing abstraction from surface water;
- reducing current use of ground water, increasing the use of surface water.

Assessment approach

The environmental effects of the alternatives were assessed in three steps:

1 The development of national hydrological models (for both ground water and surface water) and an appropriate geographic information system. Using these models and prognoses of the future water production capacities needed in each of the alternative policy options, the impacts of alternatives on surface water and ground water in the Netherlands were then determined.
2 The development of a model to determine existing natural values of moist and wet ecosystems in the Netherlands (the DEMNAT model). The main features of this model are the identification of homogenous ecosystems (›ecotope groups‹) and the estimation of the existing natural value of these ecosystems per square kilometre, based on:
   - the presence of ecotope groups
   - the national and international rarity of these groups.
3 Determination of changes in existing natural values expected as a result of the influence of the various policy alternatives on the state of surface water and ground water.

Results

The approach described above produced the following results:

- there is a *direct relation* between the level of drinking water production and ecological impacts;
- ending all *ground water* abstraction would lead to a 12% increase in the natural value of moist and wet ecosystems (compared with 1988);
- ending all *drinking water* production would lead to a 10% increase in natural value;
- ending all *industrial use* of water would lead to a 2% increase in natural value;
- ending abstractions from shallow ground water would be most effective in raising natural values, followed by deep ground water, infiltrated river water and industrial use.

37.2 Alternative production methods

The SEA made a *comparison of production methods*:

- use of ground water: shallow ground water, deeper ground water and infiltrated river water
- use of surface water: direct abstraction, via a natural reservoir and via an artificial reservoir
- use of artificial infiltration: surface infiltration and deep infiltration.

Assessment approach

The following approach was taken:

1 The following environmental aspects were compared:
   - nature effects
   - landscape effects
   - effects on the abiotic environment: use of resources, waste production, energy.

   In addition to environmental aspects, public health, use of space and technical/economical aspects (such as availability, flexibility, vulnerability and costs of methods) were assessed.
2 Several *subcriteria* were defined for each aspect.
3 A *mix* of quantitative and qualitative information provided the basis for scoring each of the subcriteria.
4 Scores for subcriteria were translated into *one score* using a mix of methods (normalization).
5 Sensitivity analyses were carried out.
6 For each aspect, methods were classified from ›best‹ to ›worst‹ on the basis of a multicriteria analysis, with weights reflecting different perspectives: health, abiotic environment, nature, landscape and economy.

Results

The main conclusions from each of the perspectives were broadly the same:

- best score:
  deep ground water, infiltrated river water and deep infiltration;
- medium score:
  surface infiltration and natural reservoir surface water;
- worst score:
  direct extraction from surface water, shallow ground water and artificial reservoir surface water.

SEA Quality review

The Commission reviewed the SEA and considered the quality to be good. In particular, the development of the DEMNAT model was judged favourably. However, the lead authority was advised to adopt caution when applying the results of the assessment at the regional level. The production techniques that score best in the SEA could perform differently in the regions due to specific hydrological situations in each case (water abstraction does not affect nature in all regions) and/or developments in related sectors within a region, such as agriculture. For example, it would not be very effective to end the abstraction of ground water for drinking water production in a specific region if this meant that the same water would later be used and discharged to surface water by farmers (to improve soil structure to allow the use of farm machinery, for example). The Commission advised the selection of a framework of measures from the EIA aimed at the conservation or development of nature (related to water production).

Effect on decision-making

According to the competent authority, the SEA did influence the decision-making process. The results of the SEA were taken into account when formulating national policy for future public water infrastructure in the Netherlands. Furthermore, the methods developed as part of the SEA both stimulated and structured project EIAs in the water sector, which facilitated interpretation of the National Plan when preparing plans at the regional level.

38. EIA for the location of drinking water production capacity

Issues

Government policy in the Netherlands is to move away from the use of shallow ground water and surface infiltration to the use of deep infiltration of surface water. This was also one of the outcomes of the SEA described above. The present use of shallow ground water is especially harmful in sensitive nature areas, such as the coastal dune area where it leads to desiccation. An EIA was carried out to identify the best site for deep infiltration in the Overveen Coastal Dune Area (west of the city of Amsterdam).

Alternative sites

Alternative sites to be examined further in the EIA were found by screening all potential areas on the basis of geomorphological and planning constraints, in particular existing landforms and land uses such as houses, campsites, etc. Forty potential sites remained.

Assessment approach

The best areas for drinking water production were identified using a multicriteria analysis (MCA). In this MCA the 40 potential areas were scored on 7 aspects:

- ecology
- visual impacts/landscape
- technology/hydrology
- recreation
- agriculture
- effects on living-area
- financial costs

Parameters were defined for each of these aspects. As an example, the following parameters used for ecology and landscape are listed below:

- *ecology*:
  - the site=s potential for the development of ecologically valuable ecosystems, both aquatic and terrestrial (moist dune valleys) ecosystems;
  - the possibility of using existing infrastructure;
  - the need for levelling, both on and outside the site (e.g. for pipelines);
  - existing valuable vegetation on the site;
  - existing valuable fauna on the site;
  - existing degree of disturbance on the site (e.g. recreation, eutrophication).
- *landscape:*
  - possibilities for camouflaging any necessary buildings on the site (e.g. relief, vegetation);
  - visual effects of removing trees and shrubs;
  - possibilities for integrating necessary buildings into the landscape.

As no quantitative information was available for most of the parameters, it was decided to score all parameters on the basis of expert judgement. A three point scale was used: a site is scored as being >relatively positive= (score 1.0), >neutral= (score 0.5) or >relatively negative= (score 0) for each parameter. On the basis of these scores, the sites were ranked from >best= to >worse= with the use of MCA. In calculating final rankings, weights were given to scores to reflect different priorities. Three sets of weights were used to reflect technical priorities (the quantity and quality of the water), environmental priorities (environmental protection) and a mix of concerns (a compromise between technical and environmental priorities).

Results

From the EIA it could be concluded that from all perspectives:

- the sites outside the dune area score best;
- within the dune area, one specific site scores best;
- the site originally preferred by the water company scores poorly.

The sensitivity analyses that were carried out showed the above conclusions to be sound.

EIA quality review

In its review, the Dutch EIA Commission concluded that the assessment was of good quality. The EIA provided all information necessary for further decision-making. However, the Commission also concluded that it was not clear how the information in the EIA had played a role in the preparation of the license application submitted to the competent authority for which the EIA had been carried out. This application proposed choosing the site originally intended by the water company, despite the fact that this site scored poorly in the EIA.

Effect on decision-making

In its final decision, the competent authority decided not to select any sites outside the coastal dune area. The main reasons for this were the absence of available water infrastructure and the inevitable problems associated with property rights. The site in the dune area originally preferred by the water company was eventually chosen in combination with the site that scored best on environmental aspects in the EIA.

39. EIA for the amount of drinking water production

Issues

Currently 150,000 m^3 of water is abstracted each year from the deep ground water under the dunes in the middle of the island of Schiermonnikoog, which lies off the north coast of the Netherlands. In future (2015) the demand for drinking water is expected to increase to 230,000 m^3 per year. The existing rate of abstraction already causes damage to valuable moist and wet dune ecosystems, which is why the possibility of extracting water from a well outside the dune area was investigated. This well is situated close to the southern shore where there are no dunes. The EIA was carried out to determine whether ground water abstraction at the new site is more environmentally friendly than at the old site. A second question was whether it would be better to abstract all the water needed in future from the well outside the dune area (which entails certain risks to the quality of the water) or use a mix of water from the old and the new well.

Alternative production quantities

The following alternatives were assessed in the EIA:

A maximum abstraction of 125,000 m^3 per year outside the dune area and a maximum of 75,000 m^3 inside the dune area, with a constant proportion being provided from each well;

B the same amounts, but the amount abstracted inside the dune area is kept constant while the amount abstracted outside the dune area is varied to match peaks in demand during summer;

C the same amounts as A, but flexibility is sought in the amount abstracted inside the dune area while the amount outside the dune area is kept constant;

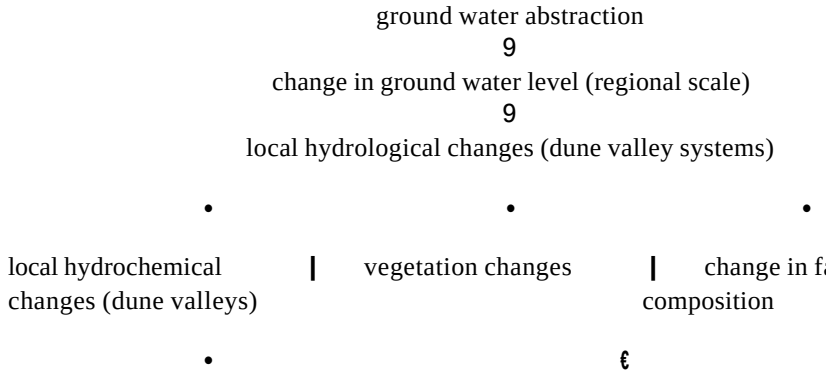
D all the water needed is abstracted outside the dune area; the well inside the dune area is closed.

Assessment approach

The alternatives were assessed on the following parameters:

- **$** ecological value of dune valleys
- **$** surface water quantity
- **$** chemical quality of surface water
- **$** impacts on birds
- **$** impacts on aquatic vegetation
- **$** landscape/cultural history
- **$** public health/safety
- **$** risk of accidents
- **$** purification
- **$** construction/maintenance

The main elements in the assessment were the impacts of alternatives on ground water levels, surface water levels, the quality of surface water and ground water (hydrochemical effects) and impacts on vegetation and (avi)fauna. The following relation was assumed:



A ground water model was used in the EIA to make quantitative determinations of the changes in ground water levels at a regional scale. These calculations, in combination with known hydrological characteristics of the area, were then used to make qualitative assessments of local impacts (hydrological and hydrochemical). Subsequently, impacts on vegetation and fauna were determined qualitatively using an approach developed at the University of Groningen. Field observations were used to relate hydrological and hydrochemical changes to the presence of indicator species and groups of species. A qualitative assessment was chosen because insufficient ecological and hydrological knowledge was available for a quantitative assessment. Impacts on birds were also determined qualitatively, based on expected vegetation changes and existing knowledge of the preference of birds for certain types of vegetation structure. All other criteria mentioned were discussed qualitatively on the basis of expert judgement. The impacts were finally presented in the EIA on a 7 point scale.

Results

The EIA showed that alternative D (all water abstraction outside the dune area) yielded the most beneficial environmental outcome. In this alternative, ground water is abstracted directly before flowing into the Wadden Sea, and so plays no further role in the ecology of the dune system. However, in this alternative the surrounding area should be irrigated to prevent it drying out, especially in summer. The EIA also showed that of the three alternatives involving a combination of water abstraction inside and outside the dune area, alternative C scored best on environmental aspects.

EIA quality review

In its review the Commission found the EIS to be of good quality. Although the assessment of ecological effects could have been more specific, the EIS contains all the necessary information to allow the competent authority to take the environmental issues fully into account when making a decision.

Effect on decision-making

On the basis of the EIA, the competent authority decided to grant a license for water abstraction as described in alternative C, on the condition that within 5 to 10 years all water abstraction will take place outside the dunes (alternative D).

40. Conclusion

The cases studies show that a methodology and tools are available to carry out effective and influential environmental assessments of drinking water facilities at all levels of decision-making. In the cases described this led either to a final decision in line with the best option for the environment or to a decision in which the environmental impacts were balanced against the technical and financial issues.

Some facts on the Commission for EIA in The Netherlands

The Commission for EIA is a private foundation, with a budget of its own subsidised by government, acting as an independent expert committee in all EIA processes taking place in The Netherlands. The Commission advises competent authorities in two stages of the assessment process: during scoping on the required content of the environmental studies and during reviewing on the quality of the information compiled. In this, the Commission takes public comments into account. In addition the Commission also advises the Minister for Development Co-operation of the Ministry of Foreign Affairs on EIA matters concerning activities in developing countries with which The Netherlands has a formal co-operation relationship. Advisory reports are published by the Commission itself. So far the Commission has issued more than 800 advises on a diverse range of plans and projects at both strategic and project level.

The functioning of the Commission is founded on two principles: expertise and independence. It is the combination of these two which allows the Commission to observe and review environmental information unbiasedly. In order to achieve these ends, the Commission has been granted formal status in the national legal framework; it has a presidium consisting of a chairman and several deputy-chairmen, and a secretariat which includes at the moment about 31 staff members of which 17 technical secretaries and 14 supporting staff.

The Commission has about 200 members and about 200 advisors who are experts in all environmental fields ranging from air, soil and water pollution to ecology, hydrology, geology, archaeology, radiation, noise nuisance and visual landscape impacts. The Commission also includes expertise on the technical and physical planning aspects of the activities which are the subject of EIA. In addition, the Commission can call upon experts with disciplines in the fields of environmental law, social psychology, environmental economics, land reclamation and consolidation, transportation, waste disposal, energy generation and consumption, environmental health et cetera. In short, the Commission is able to field any expertise required in any EIA. When specific expertise is not readily available among the members and the advisors, new advisors can be called upon. The experts are paid for their services professional fees which are calculated on the actual time spent on the consultation.

The Commission does not convene plenary sessions, but acts through small working groups for each individual EIA or SEA. The legal framework stipulates that the Commission has the privilege to compose its own working groups of experts, since it is recognized that this privilege is a prerequisite for her independence. Once a working group is formed, its composition is communicated to the competent authority who is allowed to question the composition in case of good reason to doubt the impartiality of one or more experts relative to the activity or the decision for which the EIA is executed. If there appears to be a solid case for objection, the Commission usually takes action and replaces the challenged expert. The same working group of the EIA advises on the guidelines for the EIA in the scoping phase as well as reviews the EIA.

Each working group is chaired by the chairman or by one of the deputy-chairmen. The chairman of a working group must see to it that the experts focus their attention on the essential environmental issues of the project concerned. A technical secretary is assigned to each working group. This person is responsible for the management aspects as well as the development and preparation of drafts of the advices. The chairman and the technical secretary observe the deadlines and see to it that the advice is submitted within the legal time-frame.