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Water-related projects

Producing detailed guidelines for appraisals: and OECD experience

Henk A Becker, Josef W M van Doorn and Frans A van Vught

In the 70s, the OECD set up an interdisciplinary team to develop and test guidelines for the appraisal of multipurpose water projects (dams, flood control, irrigation, etc). Two prerequistes were identified: the customer must have sufficient knowledge to define the terms of reference, and the study leader must be conversant with the other disciplines involved.

The team produced guidelines for the kinds of report to be prepared at each of five stages in appraising and evaluating such projects. These guidelines were then tested by local teams in seven countries, and final revisions were incorporated into an OECD book published in 1985.

Keywords: project appraisal; water; conservation

Henk Becker is Professor in Sociology, Research Group of Planning and Policymaking in the Faculty of Social Science, State University of Utrecht, Postbus 80.168, 3508 TC Utrecht, Netherlands.

Joseph W F van Doorn is co-ordinator of the Department of Leisure Sciences at the Catholic University of Tilburg, The Netherlands.

Frans van Vught is Extraordinary Professor in Futures Studies at the University at Leiden and co-ordinator of a research centre in higher education and public administration at Twente University of Technology, the Netherlands.

Together they have participated as temporary advisors in an OECD-project that resulted in the publication of H A Becker *et al, Management of Water Projects, Decision-making and Investment Appraisal*, Paris 1985. This article gives their private opinions.

PROJECT evaluation is a lively field of scientific activity.[1] A large number of reports has been published already, and there is a host of methodological guidelines available.[2] Background studies in this young type of applied research are scarce, however. *Ex post* evaluation of *ex ante* assessment is still in its infancy.[3] *Ex post* evaluation of methodologies is even more rudimentary yet.

This article is an attempt to contribute to the reflection upon methodology in project evaluation. It deals with a R&D project in developing and testing methodologies for impact assessment in water management. This project was carried out by an interdisciplinary team brought together by the Organization for Economic Co-operation and Development (OECD) in Paris, France. The authors have participated in this team.

The article contains a project biography, describing the enterprise period by period.[4] Next the activities involved are analyzed with regard to their goal-attainment and their adequacy. Finally the perspectives of this kind of R&D-project are discussed.

Warming up

The beginnings of this R&D project date back to 1970 when the OECD observed that the Southern European countries were about to embark upon many irrigation projects without adequate concern for the return they would yield, and without attempting to define what markets there might be for the production the projects would make possible.

These recognitions prompted the holding of a conference in Athens in 1971, which in turn resulted in the setting up of teams of experts that developed and tested a 'Guide for the Economic Evaluation of Irrigation Projects'.

From the outset it was understood, however, that this one-dimensional approach could only be a first stage. That Guide dealt only with the problems connected with irrigation projects and their economic appraisal, whereas other important dimensions of the project, such as the social and, above all, the environmental aspects, were almost completely neglected. It became clear that their role was just as important as purely economic factors for the success of the projects, and for regional development in general.[5]

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The next step was the formation of a team of experts to develop and test guidelines for 'multipurpose hydraulic projects'. From the beginning, it was an interdisciplinary enterprise. Two members came from the agricultural sciences, one from economics, one from the environmental sciences, and three from sociology (with a firm background in planning and policy sciences).[6]

The OECD also set up a Steering Committee, consisting of representatives of the member countries participating in the R&D project, observers from the World Bank and other international organizations, and chaired by a banker working as a Chief Technical Adviser at the European Investment Bank. The Technical Co-operation Service and the Agricultural and Environmental Directorate of OECD provided secretarial and other auxiliary services.

Several countries brought together national teams of experts that played a major role in testing the guidelines.

An important component of the warming up period was the bringing about of interdisciplinary co-operation in the international team of experts. The agricultural scientists, the economist and the environmentalist started from the assumption that they would understand each other without difficulties. The sociologists were in a different position. Their contribution was considered to be difficult to understand.

To bridge this gap as much as possible, the first author offered to talk to the whole team on what was to be expected from the sociologists. This offer was accepted. The exposé dealt with the subject matter of sociology, the approaches used by sociologists, and the criteria they apply when they have to decide whether a statement is scientifically valid or not.

In particular, the issue of criteria for demarcation between acceptable and unacceptable statements cleared the atmosphere to quite an extent. This initial discussion on disciplinary procedures provided the team with enough common understanding to tackle difficulties in interdisciplinary co-operation during the rest of the project.

Terminological problems returned quite frequently. The team developed its own little ritual to deal with inconveniences like these.

If, for instance, the chairman of the Steering Committee addressed the first author in a quasi-formal way, starting with 'Professor Becker, I am just a simple banker, but . . . ', the latter understood that he had to define his terms in a more appropriate way. This digression from the normally very informal way of mutual communication used to create just enough hilarity to bridge the gap in jargon.

Gaps in disciplinary approaches, and in demarcations between 'acceptable' and 'unacceptable' statements, were handled in similar ways. Experiences like these are quite common in interdisciplinary research projects.[7]

Exploration and preliminary design

Originally, the main output was planned to be a guide for the *ex ante* appraisal of only multipurpose hydraulic projects. The first drafts were based on the idea that each decision to go ahead with a project is essentially unique: before the decision, a team of experts prepares an evaluation report. Their report merely presents a choice between a few project alternatives. At the time of decision, a decision-maker chooses one of these alternatives (on the basis of some utility function). After the decision, the chosen alternative is implemented more or less according to the plans previously perpared in the study phase.[8]

From the outset, the agricultural scientist, the environmentalist, and the economist could understand each others' concepts and terms. The sociologists were in a different position

Contacts with the experts forming the Steering Committee, field visits, and discussions within the team of consultants, showed that these views were somewhat simplistic and naive. This sort of decision-making process occurs only in the case of very small projects.

With large multipurpose hydraulic projects, the final shape of the physical project is the result of a long process, involving a number of decisions at various stages of the project. At the same time, these decisions are not taken by one decision-maker.

Rather, they emerge as the result of negotiations conducted between the various group interests (eg local, regional, national) involved in the project.

Thus our project evolved from a one-stage towards a multi-stage approach, from a one-actor towards a multi-actor perspective, and fron an approach summarising many political processes towards one taking political negotiations at all stages into consideration.

These various drafts and guidelines ended up as a book. The description of the objectives finally chosen for the book mirror the broad approach mentioned above. In the book (published by OECD), this is formulated as follows:

> 'Two major problems arise whenever expertise in a particular field is needed for a definite purpose, such as preparing a multipurpose hydraulic project:
>
> i) The customer (in the present case, the promotor of the project, or the leader of the team of experts), although not himself a specialist of the discipline, must have a knowledge of it sufficient to be able to specify the terms of reference of the desired study, as well as to appraise the quality of the result.
> ii) The expert in charge of the study must not be confined within his own discipline. It is essential that he be able to communicate with his colleagues of other disciplines, and therefore, that he has at least a good command of their vocabulary. Above all, it is necessary that he be able to have a good picture of how the study, of which he is in charge, inserts into the whole set of studies, which, at each step of the design process, are necessary to bring answers to three basic questions: (a) what is the project, (b) what will be its main effects, and (c) how can it be financed and, therefore, how much does it cost?'

The purpose of our project was to produce a book that will provide potential and actual promoters, as well as the experts of various disciplines, with the information which is needed to solve these two problems, at least for what concerns economics, social science, and enivronmental sciences.

Integrated action plan

Quite early in the project the team decided to develop an integrated action plan for project design, that could serve

as a model for all kinds of water management designs. In this, the design, evaluation and building process of a multi-purpose hydraulic project is divided into nine major steps. These run from the 'initial idea of the project' to the 'summative evaluation'. Table 1 gives an overview of the integrated action plan.

Table 1 An integrated action plan for project design

Step 1: Preliminary screening of project ideas

Economic actions to be taken:

1. Make quick calculations of net benefits of the 'most obvious' alternative, using market prices;
2. Attempt to detect any adverse distribution of benefits and costs;
3. Identify major sources of increased risk and their possible consequences;
4. Recommend continuation or termination of studies.

Financial actions to be taken:

1. Preliminary investigation of financial needs and sources, in approximate figures;
2. Identify major obstacles to the financing of the project;
3. Recommend continuation or termination of studies.

Environmental actions to be taken:

1. Determine likelihood of major negative environmental effects;
2. Identify geographical scope of likely impacts;
3. Estimate possibility of mitigating negative effects;
4. Identify beneficial effects;
5. Recommend continuation or termination of studies.

Social actions to be taken:

1. Identify general social issues which may be important for the project and try to relate these issues to the project idea;
2. Sample public opinion on project idea (snapshot survey);
3. Set up a list of general social issues and analyse these issues on scope and time span;
4. Write report on these issues and recommend continuation or termination of studies.

Step 2: Selection of institutions

Economic actions:

1. Determine the special economic skills needed on the team;
2. Establish a first contact with co-operating agencies regarding data and personnel.

Financial actions:

1. Nominate team financial and accounting expert(s);
2. Establish contacts with potential sources of finance;
3. Establish initial political contacts regarding funding.

Environmental actions:

1. Nominate environmental expert(s) for team;
2. Establish first contacts with co-operating agencies regarding data base.

Social actions:

1. Select institutional arrangements most appropriate for overall planning task;
2. Initiate and differentiate public participation process.

Step 3: Preliminary identification, design, evaluation and screening of project alternatives.

Economic actions:

1. Establish a data base and forecasting models:
   a) National and regional data and projections;
   b) Review of prior studies and available models.
2. Identify economics-related project design components: pricing, taxes, rules, repayment procedures, constraints on technology, etc;
3. Estimate if necessary of shadow prices as needed for project inputs and outputs;
4. Assist design engineering team in designing the 'benchmark variant' project design (which maximises economic net benefits subject to minimal environmental and social constraints);
5. Carry out direct benefit-cost screening (using present value of direct net benefits only) of project alternatives;
6. Carry out a preliminary distributional analysis of benefits and costs based on preliminary financial plan;
7. Carry out a preliminary risk screening in co-operation with the engineering-hydrology team;
8. Eliminate 'dominated' project alternatives, i.e. those which are worse than others in all (economic, environmental, social) dimensions.
9. Conduct a rough analysis of the profitability from the client's point of view.

Financial actions:

1. Identify upper bounds on available financing;
2. Establish a preliminary financial plan for the 'benchmark variant;
3. Eliminate or modify financially unfeasible alternatives.

Environmental actions:

1. Set up criteria for initial screening;
2. Establish a data base:
   a) List existing sources and find gaps;
   b) Establish baseline conditions from available data and/or initial monitoring;
   c) Design continuing monitoring systems and their time grid;
   d) Identify likely irreversibilities.

Social actions:

1. Work out inventory of the social topics to be covered in the social monitoring process;
2. Collect and make inventory of existing data-resources;
3. Identify and formulate the important social objectives;
4. Compile an initial list of evaluation variables;
5. Make an initial identification of population segments;
6. Meet with the public and political leaders concerning 3, 4 and 5; at the same time trying to get some complementary information on point 1 of this step;
7. Formulate initial forecasts on a number of identified evaluation variables;
8. Suggest ideas on additional and more detailed sociological studies;
9. Formulate screening-criteria for an initial evaluation of the project alternatives.

Step 4: Progressive elimination of project alternatives through intermediate level studies

Economic actions:

1. Carry out needed field studies and surveys;
2. Calculate indirect benefits and costs.
3. Calculate distribution of benefits and costs using the detailed financial plans;
4. Make recommendations regarding elimination of alternatives with unfavourable net benefit and distributional characteristics.

Financial actions:

Draw up the detailed financial plans for remaining alter-

Table 1 – *continued*

natives, including the financial requirements for project-related activities.

Environmental actions:

Start initial environmental evaluations, including:

a. Intensification of monitoring;
b. Consideration of the role of formal computer models in further analyses;
c. Apply extended checklist of environmental factors;
d. Analysis of the possibility of eutrophication and its prevention;
e. Consider visual and other aesthetic features;
f. Further public participation on environmental issues.

Social actions:

1. Start social monitoring process; bring in as many of the social topics (mentioned under step 3, point 1) as possible. Give also attention to the monitoring of the project-related participation activities;
2. Carry out additional and detailed sociological investigations (step 3, point 8); write reports;
3. Extract new evaluation variables for the screening of project alternatives from both the social monitoring process and the additional investigations;
4. Construct scenarios to integrate the various social aspects and to work towards the final set of project alternatives.

Step 5: Selection of final set of alternatives for presentation to the decision-makers

Economic actions:

1. Determine the short term business cycle, trade balance, and inflationary implications of the timing of project construction;
2. Design of legislation required for the economic and financial implementation of these alternatives.

Financial actions:

1. Obtain conditional statements of commitment from financing sources for each alternative;
2. Complete final financial plans;
3. Draw up proposed price schedule for project outputs for early public promulgation;
4. Further elaboration of funding which may be required in project-related activities.

Environmental actions:

1. Complete full environmental impact analyses and elaboration of the environmental account, including utilisation of water quantity and quality simulation models;
2. Make a prediction and analysis of problems to be encountered during construction.

Social actions:

1. Work out a full social impact analysis, using the 'social assessment structure';
2. Return to alternative scenarios (step 4, point 5) to formulate detailed forecasts; use all information available (from consultation, existing sources, the social monitoring process and from additional investigations);
3. Consult with the public (public meetings, summaries of scenarios analysing public comments, comprehensive survey);
4. Use additional forecasting techniques to formulate detailed forecasts (cross-impact analysis, model building);
5. Present forecasts on the social impacts of the project alternatives to decision-makers and the public.

Step 6: Final design and evaluation

Economic actions:

Completion of final economic evaluation from national and regional points of view.

Financial actions:

1. Make contractual arrangements for project financing, including subventions and loans;
2. Promulgate proposed price schedules for project outputs, plus details of other cost repayment arrangements;
3. Complete contracts with client groups.

Environmental actions:

Completion of environmental impact statement.

Social actions:

1. Set up the chosen project alternative into programmes of a plan;
2. Prepare detailed procedural reports on the topics covered by the studies undertaken, working closely with all impacted groups.

Step 7: Programming and execution of the project and actual implementation and construction

Financial actions:

1. Set the timing of funds' availability;
2. Establish detailed systems for expenditure control, and construction, contract negotiations.

Environmental actions:

Detailed monitoring of construction impacts and execution of needed mitigating steps.

Step 8: Operation, promotion and evaluation of the project

Economic actions:

1. Establish a properly trained, responsible operating and maintenance team in co-operation with the engineering team;
2. Carry out a benefit/cost evaluation of possible changes in operating rules arising from changes in demand.

Financial actions:

1. Collect project revenues;
2. Carry out debt repayment and sinking-fund management;
3. Promote project services.

Environmental actions:

Continued monitoring and feedback.

Step 9: ***Ex post*** **analyses and feedback.**

Economic actions:

1. Assist in designing appropriate *ex post* studies;
2. Compare direct and indirect benefit and cost between projections and realisations.

Financial actions:

1. Redesign of price schedules if justified;
2. Detailed analyses of profitability from the client's viewpoint.

Environmental actions:

Completion of analyses of long-term monitoring data.

Social actions:

1. Execute formative social evaluation studies and feed information back to construction and operation stages;
2. Execute summative social evaluation studies as a final judgement of the project.

Clearly, the structure and content of the appraisal reports vary according to each of the steps defined in the integrated action plan. Five types of report will be sketched now, corresponding to specific steps in the action plan. Examples are given in the Reports (see the following pages).

Report 1. Preliminary evaluation report

Introduction

Mention:

a) The limits (usually administrative limits) of the area considered for the project (should be larger than the final project area). Join a map of the region;
b) Underline water problems in this area (Is there any problem of irrigation? of food control? of drainage etc.)

Tables to be given in annex: population, income and income distribution in the area. Main cities. Importance of agriculture, industry and services in the regional CNP. Estimates of the corresponding items in 20 years ahead.

Possible solution

Describe briefly the kind of waterworks that could be imagined . Summarise them all in a table giving:

- The identification of waterworks (dam of X, drainage system of the plan of Y, etc);
- The capacity of the waterwork (million of M^3 of the reservoirs, area drained, etc);
- A rough estimate of the nominal costs with a range for the estimation (estimates should be justified in the text).

Expected advantages

Discuss the possible purposes of the waterworks. Summarise the results of this discussion in a table showing:

- The nature of benefits (irrigation, drainage, domestic water, etc);
- The corresponding physical quantity (expected value and range) in appropriate units (number of irrigated ha, number of M^3 supplied for domestic purposes, etc);
- The corresponding values at nominal prices (expected values and ranges).

Give, on this basis, a rough estimate of the IRR or of the benefit/cost ratio.

Links with regional and national plans

Discuss the insertion of the project within regional or national plans, if any. Discuss its influence on the balance of payments (if any). Mention briefly its possible influence on income distribution.

Possible environmental problems

1. Review national laws and regulations regarding environmental standards, restraints on environmental quality changes, and required analyses and reports;
2. Review the concept of regional environmental balance and consider its relevance to the region involved in current water development. Review the list of potentially relevant environmental factors;
3. Make a quick diagnosis of likely *negative* major environmental impacts;
4. Evaluate the possibility of taking steps of modifying project designs to lessen these negative impacts;
5. Make a quick diagnosis of likely *beneficial* environmental impacts;
6. Using existing maps, environmental inventories of plant and animal life, wind data, etc, make a preliminary estimate of the geographic extent of these impacts;
7. Recommendations regarding further consideration of project ideas.

Possible social problems

The following questions must be answered, as far as possible:

a) *General*

1. Do national regulations exist regarding the social aspects of the evaluation of multipupose hydraulic projects?
2. Are these general social issues which may be important for the poverty identified? Examples: rural poverty, unemployed, migrations, health problems, etc;
3. Are these general social issues related to the project idea?
4. Are scope and time spans of these issues taken into consideration?

b) *Participation*

1. Is the public opinion heard? By which instrument? (eg snapshot survey),
2. Is a list of general social issues set up? Are new issues brought up by the public taken into account?
3. What kind of differentiations regarding participation are or could be used?
4. Which kind of participation techniques are or could be used?

c) *Institutional possibilities*

Discuss the institutional arrangements that could be made in order to realise the project. Especially, from a social point of view, try to answer the following questions:

1. How is the project team put together? Are there institutionalised relationships between the various levels of government, the private sector, the public and the project team? How are the team-members recruited? Is there an advisory team formed (experts? political representatives?);
2. Is there a specific organisation structure developed?
3. What kind of data are used for the selection of the institutional arrangements?

d) *Financial problems*

1. Discuss the order of magnitude of expenses of any kind in relation to the project;
2. Set up a tentative list of agencies which are interested *a priori* in the project (Ministries, local communities, etc). Evaluate the possible amount of their participation (this part of the report may be confidential). Try to build formal links between the technical teams of the project and the possible funding agencies.

Conclusion

Recommend and define further studies. Define the framework of these studies, and the composition of the team to be set up for pursuing the work of planning and evaluation. Evaluate the corresponding budget.

Report 2. Examination of variants report

Introduction

Delimination of the area involved and sketch of main water problems in the region (as for report type 1).

Technical description of variants

a) Description of the 'central variant' (usually, that which gives the highest economic benefit). Type and location of waterworks and their main purposes (give map);
b) Description and identification of variants, according to the same criteria.

Economic analysis

a) *Sources of data and estimations*. Assessment of their values – their range of variation. Justification of shadow prices, if any. Brief description of models used, if any. Discussion of any methodological choice;
b) *Presentation of results*. For each variant, fill in Tables 10, 11, 12 and 15. Optionally, fill in Tables 13 and 14 whenever possible.[11] Comment on these results;
c) *Additional information*. Consequences of the 'central variant' for income distribution. Corrections, if any, brought about to this situation by other variants. Degree of risk associated with each variant. Sensitivity analysis for each variant or, eventually, simulation analysis;
d) *Plans for further studies*. Indicate gaps in the available information: Suggest studies for filling them (with indication of cost and resources needed).

Environmental analysis

1. Discuss the criteria used for the initial design and evaluation of project alternatives, including the critical values of any parameters that may be specified by law or practice;
2. Summarise the initial data base, including data gathered by sampling procedures (eg water quality). Indicate all available sources;
3. For each variant as well as for the situation 'without project' present initial projections of the criteria selected in point 1 above, and covering both the construction period and the operating life of the project. Many projections will be qualitative in nature at this point, and will be designed using a table format;
4. Discuss the economic and ecological feasibility of steps to mitigate nagative impacts that have been predicted;
5. Design and initiate monitoring systems that will be needed for more detailed evaluations, eg flow and quality gauging stations and networks, migration and cropping pattern trends, etc;
6. Consider the benefit of formal computer modelling and state the resources (in terms of manpower and data) necessary to continue the studies.

Analysis of social problem

For each variant, check briefly the following points:

1. Is a list of topics drawn up to direct monitoring activities? Is there a relationship with the general social issues mentioned in step 1?
2. What kind of project objectives are identified? What kind of evaluation variables are formulated?
3. What kind of population segments are identified?
4. How was the participation organised?

In addition provide examples of questions used for identification of objectives, variables and population segments. Discuss methods of data collection used if any.

Conclude by discussing:

1. Are additional detailed sociological studies suggested?
2. Are specific screening criteria formulated?

Financial considerations

- Evaluate the total amount of money available from various sources;
- Set up a financial plan for the 'reference variant';
- Check that other variants could be financed in the same framework, or that additional funds could be eventually raised;
- If some variants are significantly less costly than others, indicate the way adjustments should be done. (Requesting funds which will not be used is just as troublesome as being short of money!);
- Check that no firm (including the project manager) can be financially hurt by the existence of the project, under each variant. Otherwise, prepare *ad hoc* plans for compensation.

Conclusion

Summarise by a table showing:

- The list of variants;
- The main advantages;
- The main drawbacks;

Make clear the choices open to the decision-maker.

Report 3. Selection of variants report

Introduction

History of the project: how did it reach this stage? What amount of work has been already spent? (give the references of the corresponding studies). What are the main interests involved in the project?

Technical description of variants

Describe the main waterworks. Provide a map of the region showing their location, and the areas involved.

Economic analysis

The plan made for report type 2 applies here, except that the notion of 'central variant' is probably no longer relevant, since the number of variants is reduced to 4 at the maximum. Each variant should therefore be treated here as the 'central variant' in report type 2.

Of course, the content of the report will be quite different from that of the report type 2, since data and models will be more accurate, and the number of variants is reduced.

Environmental analysis

Basically, this part of the report will be similar to that of report type 2, except that quantitative, instead of qualitative projections will be obtained in most cases.

In addition, a description of the computer models (if any) used during the study would be necessary.

Social studies

1. Describe the social monitoring process which should have been started at this stage. In this social monitor-

ing process both the general issues studies in the first step and more specific topics delimited in the previous studies should be included. Depending on the scope and time-span of the project, the social monitoring process could be more or less elaborated. Is special attention given to the monitoring of project-related participation activities?

2. Describe more detailed sociological investigations done since preceding steps. Are new evaluation variables extracted from these investigations?
3. To integrate the various social aspects, the evaluation variables, topics, etc, a specific technique may be used: the *scenario technique*. This technique has various advantages in working towards the final set of project alternatives. The report should summarise briefly the main results of this exercise (detailed descriptions of the sociological studies can be put in annex).

Finally, it must be stressed that public participation tables must be taken care of at this stage. Therefore, the report should indicate to what extent the evaluation team will be able to:

1. Assist in planning public participation in keeping with national practice to determine reactions to surviving project's alternatives.
2. Re-evaluate the list of criteria being used in the assessment, extending or contracting it as indicated by public concerns and initial analyses.

Financial considerations

A full financial plan is needed for each remaining variant (eventually, it is the same for all variants with the same cost). Refer to the *Guide to the Economic Evaluation of Irrigation Projects* for an example of table to be filled in this respect.

Discuss the financial consequences of each variant on each economic unit involved in the project. These economic units comprise:

- The agency in charge of the project;
- Any user of water resources;
- Public or private agencies in charge of any equipment (such as road, harbour) linked with this project;
- Household (especially, collective households, such as hospitals, school).

(This discussion involves at least some rough knowledge of the pricing system of the projects' outputs. Since the pricing system is probably not yet defined, make use of likely assumptions).

Discuss possible consequences of inflation.

Conclusion

Summary of each remaining variant, according to the following table:

	Variant 1	Variant 2	Variant 3
Identification (name)			
Total nominal cost			
Total discounted cost			
Duration of construction period			
TIR or benefit/cost ratio			
Total discounted benefit			
Breakdown of benefits by purposes, in %			
purpose No 1			
purpose No 2			
.....			
purpose No n			
Main environmental drawbacks			
Main environmental advantages			
Main social drawbacks			
Main social advantages			
Main risk taken with the variant			

For each variant, indicate the reasons for which it could be retained and those, on the contrary, for which it could be rejected. Indicate the recommendation of the technical team, based upon its own preference, with respect to the variant which should be finally retained.

Report 4. Final *ex ante* report

Introduction

Short history of the project. Summary of variants examined and rejected. Reasons for their rejection. Presentation of the variant retained. Main characteristics of the waterworks. Indication of the purposes served by the project. (Give reference of previous studies).

Economic and financial analysis

a) *General presentation*

Summary of previous economic studies. Reference to any model or data bank used for the project. Short methodologcial summary (detailed methodological discussion should be put in annex).

b) *Main results*

Presentation of Tables 10 to 15.[12] Justification of each figure, including especially shadow prices (if any).

Discussion of the events which could in the future necessitate modifications in the plans as they are presented here.

c) *Pricing policy*

Discuss the intended pricing system.

Examine possible consequences of this tariff for the financial equilibrium of customers as well as for the general income distribution among the beneficiaries of the project.

d) *Distributional effects*

As far as possible, fill up Tables 27–32.[13] Discuss and justify.

e) *Risk analysis*

Sensitivity analysis. Description of any decision rule decided upon.

Social analysis

1. *Social assessment structure*

The impacts of the project can be evaluated by the social assessment structure (SAS). This instrument is often used for most detailed forms of social evaluation. The social assessment structure can be used as a sort of check-list of possible social impacts of multipurpose hydraulic projects.

2. *Public participation*

How are consultations with the public organised (public meetings, summaries of scenarios presented to the various groups, etc).

3. *Conclusion*

State any suggestions in preparing detailed procedural

workbooks on the topics covered by the studies undertaken, eg resettlement, together with the impacted groups of people, so as to guarantee the optimal course of public participation.

Environmental analysis

This chapter corresponds to the 'environmental impact statement' as called for existing regulations in most countries.

In the absence of such regulations, filling in Table 57[14] for the retained variant, and justifying each figure by reference to the *ad hoc* study will provide a good starting point for the framework of this chapter.

Any model or data bank used must be outlined, and the reference of at least one more complete report should be given.

In addition, a detailed statement of every measure taken in view of future monitoring will be needed. Describe carefully these measures. Eventually, if operating hand books or regulations have been drafted by the project, give them in the annex.

Financial analysis

Describe financial arrangements taken with each fund supplier. Complete a table of future receipts and payments, as in report type 3.

Conclusion

Summarise again the reasons for which the project should be undertaken.

Report 5. ***Ex post*** **evaluation report**

Introduction

Historical sketch of the project, explaining how it reached its present state.

Present state of project.

Its planned future (according to the feasibility report).

The problems which are encountered now, and which justify the publication of this report.

Description of new alternatives

As for report type 2 'technical description of variants'.

Economic analysis

Present and discuss Tables 10 to 15[15], slightly modified in order to show the differences between what was expected in the feasibility study, and what is observed now.

Indicate the main reasons for these discrepancies (revision in price or quantity forecast, new technology available, etc).

As far as possible, interpret these results in the light of econometric models which should have been built during the preceding steps. Do not forget to take account of inflation.

Discuss the value of the new forecast (revised value of the IRR, etc).

Evaluate the possible alternatives for improving the situation – this presentation of new alternatives should be done according to the plan of report type 2.

Social evaluation

1. Execute formative social evaluation studies and feed back information to improve the quality of the *ex ante* evaluation methodology. For example, by comparing the forecasts of the social assessment structure with the real outcome, one can judge the usefulness of the forecasting techniques that were used.
2. Discuss the new actions to be undertaken in the light of these findings. Disucss new monitoring systems to be set up and, more generally, the means of alleviating the consequences of the errors which have been made previously.

Environmental evaluation

Recall the criteria which were decided upon in the feasibility report. Compare actual values with forecasted values (put in light 'forecasted' and 'actual' values). Report investigations made for discovering the sources of possible discrepancies, especially undesirable ones.

Examine the actions proposed, and make use of the experience gained in previous studies to assess their chances of alleviation or the elimination of the difficulties encountered (if any).

Financial evaluation

Compare the *ex ante* financial plan with values observed *ex post*. Discuss the reasons for the discrepancies. Propose solutions for improving the situation.

A financial plan, presented under the form of a table showing 'expected' and 'actual' receipts and expenses would be helpful.

Pricing considerations

Often, the cause of bad financial results is in an inadequate pricing policy. Compare estimates of demand with actual sales. Discuss the possibility of changing the pricing policy in order to meet effective demand (this should be discussed in close connection with financial analysis). Indicate the methodology which was used to re-estimate the demand parameters.

Conclusion

Summarise the main errors made during previous steps of the project's design and execution. Not, of course, to put the blame on anybody responsible for these errors, but in order that they could not be reproduced elsewhere.

Present the new courses of actions that can be envisaged. Summarise their advantages and drawbacks (as in report type 3).

Recommend the choice of one of these solutions.

'The preliminary evaluation report' (Report 1) applies to completely new projects, for which only a minimum of studies have been done, and a minimum of data are gathered.

'The examination of variants report' (Report 2) applies when the decision to undertake the project has been taken, but no technical choice has been made. The problem is precisely that of making the choice in the best possible way.

The report on 'The selection of variants' (number 3) has fundamentally the same purpose as the preceding report, but applies when the studies go much further in depth and elaboration.

'The final ex ante report' (Report 4) applies to the 'feasibility study'. It describes the choices which have been made, and their expected consequences. It will be the basis of comparison for further post-decision (*ex post*) studies. The *ex post* report (number 5) is similar in many ways. It describes the choices which have been made, and their expected consequences. It will be the basis of comparison for further *ex post* studies. This report has two purposes: first to examine all possible discrepancies between forecasts and observed trends, and analyse their sources and consequences. Second, to prepare proposals for any decision to change the plan previously adopted, in order to adapt it to new circumstances.

In the period of exploration and preliminary design, members of the international team of experts visited member countries of OECD in which multipurpose hydraulic projects were in preparation, under way, or recently finished. They gathered information on these projects, focusing their attention on experiences related to methodology. In the countries involved, local teams of experts started to get under way.

The international team of experts had several meetings lasting a few days, either in Paris or in a country that had an appropriate project. Meetings with the Steering Committee were held, in combination with visits to pilot projects.

At a meeting in Portugal the third author (Van Vught) gave a presentation on the introduction and management of large-scale innovative projects, especially with regard to political and administrative aspects. It was becoming obvious from our project that information on this subject was much in need.

Testing and finalizing

The guidelines that resulted from all this have now been tested in seven countries, and reports on the testing have been published. The testing was done by national teams in co-operation with visiting members of the international team. Portugal, Finland, Ireland, The Netherlands, Italy, Turkey and the United States participated. We shall now sketch out the cases of the first four.

Portugal

Portugal provided a rather extensive final *ex ante* report (type 4), which was mainly economic in character. The report discussed the water arrangements in the lower Mondega valley, a part of a Portuguese water course of about 6,670 square kilometers.

The objectives of the Mondega Hydraulic Scheme were: energy production, flood control, irrigation and water supply to industries and households. The project also made it possible to improve various environmental conditions, and to provide recreational facilities for both local people and tourists. The project appeared to be an important incentive to improve the channels of transport and communication, so that the two social and economic poles of Portugal (the north and south) are more interconnected.

The report especially addresses the difficulties in the estimation of certain parameters required for economic analysis . It is also pointed out that some of the basic data required by the approach proposed by the OECD experts are not easy to collect – especially when traditional administrative structures and procedures are not suitable for the proposed analyses.

An evaluation of the social aspects of the Portugese project was also undertaken, especially on the agricultural sector. An approach developed by the present authors was used (the 'social assessment structure').[10] The report estimates the influence of the project on various social matters that affect different types of farming households as well as the farming community as a whole. The report also attempts to place the project within the general planning options of the region.

Finland

Finland contributed an economic, social and environmental *ex ante* appraisal of the Vuotos reservoir project, whose main purposes were energy production and flood protection.

In the Finnish part of Lapland, an artificial lake of more than twenty square kilometers was planned. A dam was going to catch the water of the Vuotos river. The water could flow to an existing power plant downstream (whose generating capacity could be enlarged without great costs).

The economic anlaysis showed a favourable benefit/cost ratio. But it proved difficult to quantify in financial terms the losses that the project would cause to the local ecology, like woodland and wild life.

In the social analysis, it turned out that only about 50 people would have to leave their homes: the reservoir was going into a sparsely populated area. (The distance to the nearest village was about one hundred kilometers.)

The social analysis also made clear that there was strong opposition, both locally and nationally, to the project on environmental grounds.

The environmental project appraisal made clear that a large area of woodland would vanish. The sandy soil of the valley, and the layer of peat covering it, raised another danger: they contained small quantities of mercury. It would be difficult to extract this mercury, and therefore there was a certain danger of poisoning the water of the reservoir. A number of ancient reindeer tracks would also be cut by the new lake.

In the end, the whole reservoir project was cancelled, mainly for reasons of environmental protection. The relevant document was produced in the light of several detailed studies.

Ireland

The Irish team presented a preliminary appraisal report on the Corrib/Mask Drainage and Flood Prevention Project, drawing on the limited available information. The Corrib/Mask area is in north west Ireland (County Mayo), and covers approximately a region of 338 square miles. Part of the area suffers from waterlogging and/or flooding.

An ultimate aim of the project was to increase the income of landowners whose lands suffer from one or both of these problems. Some secondary objectives were the creation of

A sensitivity analysis was helpful. It showed that, even if many of the initial assumptions turned out to be optimistic, the project could still yield a positive return

employment, and the relief of flooding of roads and built-up areas.

The economic analysis focused on a cost-benefit analysis of the various means of increasing the income of these farmers. The alternative means were:

- increasing production on the farmers' dry land;
- re-structuring the holdings into viable units; and
- provision of off-farm employment to supplement agricultural incomes (where these fall below a certain level).

The planning horizon of the project was taken as 50 years from the completion of the arterial drainage schema.

The agricultural benefit (a likely increase in agricultural production) was estimated with help from an analysis of the soils in the area. The benefit/cost ratio turned out to be 1.9 : 1 (the IRR (internal rate of return) was 7.4%).

A sensitivity analysis, which explored the effects of changing some of the assumptions, showed that the project would still yield a positive return on investment even if many of the assumptions turned out to have been quite optimistic.

The environmental part of the preliminary report consisted of an extensive review of possible environmental effects and the relevant protective measures. The regional environmental balance reviewed six areas: fisheries, scenery, vegetation, wildlife, water quality, and items of archeological and cultural interest. Its conclusions were that the effect of the drainage scheme on wildlife was at least controversial, but it was generally agreed that there will be little if any significant permanent injury to fishing, the scenery, or areas of scientific interest. From this, it has been decided that the effect on wildlife will be closely monitored; new areas could be developed for displaced wildlife.

With regard to social impacts of the project it is important to realize that drainage schemes rarely lead to any large-scale disruption or resettlement of people. All the same, general social issues such as unemployment, low farm incomes, or training of people in industrial skills, were taken into account as secondary objectives of project.

A striking feature of the Irish project was that those minor but primarily social objectives were treated mainly as economic or ecological issues. So, for example, the creation of job opportunities was first viewed as an economic affair. But seen from the sociologist's point of view, the reducing of unemployment is a social concern. The same holds true for the training facilities that were set up for construction workers, the informing of interest groups about the drainage plans, and the rise in productivity – a rise that enables people to change their way of life (which in the long run might lead to a redistribution of income).

Last, it is no wonder that, in an area rich in different species, pressure groups have been formed. Environmentalists have attempted to improve their knowledge of the full range of wildlfe in the vicinity, and of the measures needed for its protection. The sociologist's concern is more with the handling of pressure groups, the different ways of negotiating, and the political context of those groups in the decision making process.

The Netherlands

The Netherlands provided information on the Eastern Schelde Estuary. In 1953 the south-western part of the country was hit by a major disaster: an unusually high flood damaged a number of dikes, and the countryside was innundated. More than 1,800 persons were killed and 110,000 residents had to be evacuated.

To safeguard The Netherlands against similar disasters in the future, the Delta-works were started. They consist of a system of high dikes, sluices and similar constructions, to keep the sea out and to create water reservoirs behind the dikes.

The last major part of the project to be undertaken was the Eastern Schelde Estuary. First a closed type of dam was planned. For ecological reasons, a boulder dam, and then a dam with sliding gates, were taken into consideration. A nation-wide political debate led to the adoption of the third alternative.

In several phases of preparation and building of the estuary project, *ex ante* appraisals have been applied. One example is an ecological analysis of the vegetation, wild life and landscape that could emerge, if the water in the reservoir behind the dam were kept at different levels (very low, medium, and very high). The documents produced by the national authorities are type four (final *ex ante*) documents.

Ex post evaluation of the Eastern Schelde Estuary showed that the costs ultimately exceeded those provided for in the budget, by a long way.

Three revisions

The information gathered during this period of testing led to many alterations in the draft version of the guidelines. Three alterations will be discussed in this article, because they are of general importance.

The first major revisions were to take care of the political process involved in such water projects at the national, regional and local levels, with special emphasis on public participation in the decision-making. The guidelines had to show how the political situation could be analysed, and how the processes involved could be guided. The guidelines also had to show the extent to which intervention was feasible, and where autonomous processes are involved.

Ex post evaluation of multipurpose water projects in particular, and of projects of planned change in general, have shown that much difficulty can be avoided if the information-flows between all parties are given enough attention. *Ex post* evaluation has made clear also that major changes in the plans (for instance, a decision to make the

Three major revisions concerned the handling of political processes (especially public participation), the need to accept budgeting uncertainties, and how to undertake small-scale appraisals

dam much higher) demands a new round of public participation. The final guidelines stress the importance of feed-back to the participants in public debates. In particular, decisions that run counter to the consensus of the public debate have to be explained to the individuals and groups involved.

The second major revisions concerned financial aspects, which demand elaboration. It proved necessary to argue that it is quite normal for budgets to exceed the original financial boundaries. *Ex ante* evaluation of large projects (like artificial lakes) can only give a rough estimate of the costs involved, and rates of inflation can only be guesses for periods of ten years and longer. In private business, errors in the estimating of large investments of about 300% are sometimes considered inevitable.

This implies that, in multipurpose water projects, the emphasis ought to be put on monitoring the development of costs while the project is under construction and the follow-up is under way – and on guarding the appropriateness of the expenses. A rigied adherence to original budgetary estimations does not make sense.

Thirdly, it became clear that the guidelines suggested large and expensive research activities to go along with the projects. In a number of countries, the national teams stressed the importance of small-scale research activities, tailored to smaller multipurpose water projects and to the smaller scientific task forces and research budgets available to them. Within limits, these requests could be met in the final guidelines.

The conclusion also had to be drawn that smaller-scale project appraisal had to be treated in a separate publication with methodological guidelines.

Conclusions

Has this project been able to meet its objectives, as outlined earlier?

The customer had to be provided with enough knowledge to enable him to specify the terms of reference of the desired study, as well as to appraise the quality of the results. If we take the seven countries' experiences with the draft guidelines, the project has been able to meet this objective to quite an extent. For instance, the guidelines have been translated into Finnish and they are being applied in current multipurpose water projects there.

The second objective was related to the ability of team members (especially leaders) to communicate with colleagues from other disciplines. In this respect, the project has been quite successful. The ultimate publication has been successfully tested often enough by people from different scientific disciplines. But of course interdisciplinary co-operation requires more than conceptual clarity. The scientists involved have to become used to each other. Close co-operation over a longer time is the best preparation for mutual understanding.

In the project discussed here, an approach was followed, that is often known as 'program evaluation'. *Ex ante* evaluation and *ex post* evaluations are not treated as separate scientific enterprises, but rather the intervention as a whole (the 'program') is taken into consideration. Each step in the program is given an appropriate basis by applied research projects.

The initial step gets a preliminary *ex ante* appraisal, resulting in a type-one report. The final step is a research project resulting in a final *ex post* evaluation (a type-five report). In large projects, covering more than ten years for instance, each year an *ex post* and an *ex ante* evaluation may be necessary.

Of course, a program evaluation of this kind is feasible only if the research activities required can be carried out quickly and within a reasonable research budget.

The interdisciplinary cooperation in this project has led to positive results. During the seven country testing period, the members of the international team went to the participating countries representing all the disciplines involved. As a rule, they were sufficiently at home in these disciplines to tackle all questions that arose. Sometimes they had to give a preliminary answer, and a fuller reply had to be sent by letter later on.

The positive results are partly to be explained by personal factors: the members of the international team were able and willing to co-operate. On the other hand, the approach itself contributed considerably to the results. The team spent much time and energy on understanding terminology and ways of thinking in all the disciplines involved. It developed rituals for dealing with difficult situations.

The testing of the methodology in the seven countries was indeed important. These case studies have contributed substantially to the practicality of the suggestions contained in the book that resulted.

Notes and references

1. In this article the terms 'project evaluation', *'ex ante* evaluation' and 'impact assessment' are used as synonyms, indicating systematic studies of the effects and side-effects to be expected of interventions before they are started. Studies of processes related to interventions after they have been started are called *'ex post* evaluations'. The term 'program evaluation' is used for sets of studies that are undertaken before, during and after an intervention that demands some years to be prepared, carried out and followed up.
2. See M J Carley and E S Bustelo, *Social Impact Assessment and Monitoring, A Guide to the Literature* (Boulder, Westview Press, 1984).
3. See H A Becker and A L Porter (editors), *Methods and Experiences in Impact Assessment* (Dordrecht, Reidel Publishers, 1986).
4. In this article, the term 'period' is used to indicate phases in the project described. Phases in studies of water management projects are called 'stages' or 'steps'. The same apllies to phases in the water management projects themselves.
5. H A Becker *et al, Management of Water Projects, Decision-Making and Investment Appraisal* (Paris, OECD, 1985).
6. The environmental scientist did not stay with the team to the end of the project.
7. O a L Apostel *et al*, (editors), *L'interdiscplinarité, Problemes d'Enseignement et de Recherche dans les Universités* (Paris 1972).
8. H A Becker *et al*, see reference 5, page 13.
9. H A Becker *et al*, see reference 5, page 15.
10. H A Becker *et al*, see reference 5, chapter XIV.
11. H A Becker *et al*, see reference 5.
12. H A Becker *et al*, see reference 5, chapter VII.
13. H A Becker *et al*, see reference 5, chapter XI.
14. H A Becker *et al*, see reference 5.
15. H A Becker *et al*, see reference 12.