

Thematic Review III.1

Economic and Financial Issues

Financial, Economic and Distributional Analysis

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Executive Summary

This thematic review provides an assessment of the effectiveness of actual practice and the identification of good practices among the various approaches, methods and tools for the financial, economic and distributional analysis of dams and their alternatives. Financial and economic analyses are primarily used in the context of dams to determine the profitability of the project to the project owner(s) and to society through cost-benefit analysis (CBA). Distributional analysis considers the broader question of who gains and who loses from a project and can be viewed both in purely financial terms and in terms of the effects of a project on the economic welfare of stakeholders.

The fundamental question addressed in this thematic is whether Cost-Benefit Analysis (CBA) is necessary and/or sufficient as a basis for societal decision-making regarding dams. Woven into this question are ethical and methodological concerns regarding discounting the future, assessing project costs and benefits, placing money values on non-marketed impacts, accounting for risk and uncertainty, assessing regional economic impacts and other contentious issues in economics. The current paper uses a series of contributing papers and emerging results from additional activities to highlight issues related to the economic performance of large dams.¹ The latter activities include preliminary results from the WCD case studies, a survey of actual practice in project appraisal, and review of existing literature. As these activities are ongoing, and the results of the WCD Cross-check are expected in May, further evidence on past practice and the economic performance of dams will be incorporated directly into the WCD outputs.

1. Overview on Economics and Decision-Making

Criticism of dam-building is often synonymous with criticism of Cost-Benefit Analysis (CBA) and, by inference, economics and economists. It is certainly true that since the 1970s CBA has become the World Bank's dominant decision support system at project appraisal and that the economic internal rate of return (or net present value) is the decision criteria most widely applied by government agencies and official aid donors today. This perspective, however, greatly exaggerates the grip of CBA, economics and economists on decision-making regarding dams. On the technical side it is worth noting that the application of Least-Cost Analysis (LCA) is at least as old as CBA and continues to be a fundamental criterion for screening and selecting projects. The larger point – as demonstrated by the WCD set of case studies – is that the political cost-benefit analysis applied by governments has long been not only the final arbiter, but also drives the planning and decision-making process in many cases.

The first finding that must be acknowledged in reviewing the practice of economic analysis of dams is that not only do political factors often drive the assessment of options and planning process but that ultimately political concerns, or more specifically, politicians take the decision to build or not build the project. It is after all the Executive Board of the World Bank that approves projects and not the team undertaking the economic analysis. Ultimately then the question of on what criteria a project is approved must be discussed simultaneously with the question of who has decision-making authority. Conventional methods for dam project assessments have tended to concentrate on performing financial and economic cost-benefit analyses (CBAs) using a limited set of quantifiable parameters, most of which were internal to the dam owners, and for which values were relatively easy to assign. Meanwhile, decision-making on dams has often been driven either by direct concerns of politicians or by the momentum established by large centralised institutions responsible for water and energy resource planning. Recent revelations made public with regard to one such agency, the US Army

¹ Two earlier papers under this thematic have already been produced and reviewed, so for the sake of convenience the current paper is called Version 3 and the earlier papers Version 1 and 2.

Corps of Engineers, highlight the relatively secondary role played by economists in many such institutions.

The picture that emerges from this discussion is that politicians, engineers and economists have all played their role in a planning and assessment framework and process that is not only limited in the concerns that it incorporates, but that is top-down, non-transparent and non-participatory. This approach has tended to ignore or under-emphasise: the external environmental and social impacts of dams (positive and negative) and the distribution of gains and losses among affected and interested groups. It is not the role of this thematic to hypothesise as to the balance of outcomes in this regard (though see WCD Thematic Papers I.1 and II.1). However observed behaviour in the context of dams suggests that in quite a number of cases (including a number of WCD Case Studies) the failure to attend to these issues has led to unsatisfactory social, environmental and financial outcomes. In recent years these outcomes have led to increased agitation by civil society groups, in turn giving financiers turn to pause before investing in large dams and, eventually, leading to the impasse that has given birth to the WCD.

Many of the solutions to this impasse will not be found in this thematic review paper. Issues of resettlement, equity, environmental restoration, participation, good governance and more are all covered elsewhere in the WCD Thematic Papers. This paper focuses on the areas where economics has fallen short in the past and the options that are available for turning this situation around. When it comes to the investment of large amounts of resources in pursuit of fairly specific objectives; i.e. for electric power, growing of food, supply of drinking water, etc.; there can be little doubt that economics has an important role to play. The fundamental question addressed in this paper is, however, how central should be this role. The subsidiary questions, once this role is defined, is what other changes in practices and processes are necessary to ensure that economics make a positive contribution in the changing context of political decision-making. Decision-making with regard to large dams will always be political and economics, as with any decision support system, must serve decision-makers. However, as the participation in decision-making processes broadens economics is provided the opportunity to serve not only the needs of bureaucratic and political elites, but to provide useful and digestible information to the larger body of civic society. A common, shared information base that makes the economic consequences of alternative choices explicit would seem one important element in enabling the future negotiations over dams and their alternatives to proceed in an orderly and informed manner.

2. Findings on Financial, Economic and Distributional Analysis

2.1 Findings on Actual and Best Practice: Methods

Valuation of Direct Costs of Projects. Discussion of dam costs typically revolves around the perception that cost overruns are endemic to the industry. The paper not only examines issues in construction costs but other categories of costs that are, or are increasingly treated as, direct project costs including a number of formerly external costs that are now incorporated in the financial and economic project budgets. Findings by cost category include:

- **Construction Costs.** Performance data suggests that dam projects often incur substantial cost overruns in construction. While, datasets from the World Bank, Inter-American Development Bank and Asian Development Bank reveal average cost overruns in the range of from 20-45% in nominal terms there is considerable variability in and amongst the samples.
- **Resettlement Costs** are highly variable depending on site-specific characteristics of the dam and the environs within which it is situated. Once overlooked considerable effort now goes into estimating these costs for project budget purposes. Still, overruns do occur for various reasons

including inadequate survey work and “pull” factors that lead to in-migration following the announcement of plans to build dams.

- **Environmental Mitigation Costs.** Environmental damages caused by dams are increasingly recognised and efforts to internalize these in the form of mitigation projects are growing. Mitigation may cost in terms of study costs, capital expenditure on mitigation infrastructure, routine O&M expenditure and/or the opportunity costs of lost production. These measures will also be site-specific and data on the costs of these measures is still unreliable, particularly as the effectiveness of the measures themselves is often questionable.
- **Operations and Maintenance Costs** of dams are low compared to capital costs (1-3%) yet are likely to rise over time as facilities age and efforts to mitigate the negative effects of sedimentation are undertaken.
- **Decommissioning Costs** are real costs that every dam project will face sometime in the future, although experience is yet limited in terms of evaluating their exact magnitude

The paper stresses that it is useful to recall that the “internalised” social and environmental costs as budgeted are not necessarily reflective of the full economic welfare effects of social or environmental impacts, but instead represent the financial costs associated with policies and regulations in effect. Incorporating such financial costs into an economic analysis must be regarded as a second-best approach where the resulting cost-benefit analysis is intended to represent the net welfare effects on society as a whole.

Valuation of Direct Benefits of Projects. While the valuation of social and environmental impacts of large dams is a topic much discussed it needs to be emphasised that the economic valuation of the direct project benefits provided by large dams is not as straightforward as it seems. The regulation of river flows in most countries is guided by the principle that water is the property of the state. From an economics perspective this principle is given expression through the analytical concept that river water, its flows and its quality are public goods. In a related fashion, the large-scale provision of water and energy services has been recognised as a natural monopoly.

A number of consequences for benefit valuation follow from this analytical approach to the public good character of water and the provision of serviced derived thereof:

- tariffs (i.e. financial prices) for power, municipal and industrial water supply may be used in financial valuation but are not necessarily good indicator of the economic price of these goods;
- increasing private sector participation in power markets will gradually ease the task of economic valuation of power benefits as prices emerging from power pools, etc will represent competitive market prices that serve as economic prices;
- similar developments in water supply markets will also gradually eliminate the need to depend on willingness to pay surveys in the economic valuation of water supply;
- economic valuation of the value of water in irrigation will remain a complicated and difficult affair requiring substantial survey data and/or complex computational techniques;
- flood control benefit valuation will continue to rely on non-market techniques due to its nature as a public good;
- economic valuation of navigation services provided by dams may be based on market prices where tolls are charged, although adjustments may be necessary where substitutes are absent (i.e. road, rail or air transport) or policy distortions exist in transport markets; and
- other direct benefits of dams such as commercial, subsistence and recreational fisheries and general recreation can be valued using market or non-market methods, but will need to account for the loss of such opportunities were the dam not have been built.

Pending the completion of ongoing surveys of the economic impacts of dams and dam evaluation studies a number of preliminary conclusions on the actual and best practice and the performance of benefit valuation may be offered at this point:

- the prediction of the timing and magnitude of water availability will play a very important role in direct benefit evaluation and will depend largely on quality and extent of historical hydrological records
- sophisticated best practice methods for the evaluation of power benefits are often employed in dam appraisal and these methods appear to be relatively reliable in predicting performance, however exceptions do occur, particularly where a simple alternative power plant method is applied;
- valuation of irrigation benefits remains a difficult endeavour due to the complexity of correctly estimating the respective contribution of irrigation water to augmenting productivity given the vagaries of accurately projecting hectares that will be brought under irrigation, crop choice and crop yield;
- economic performance in irrigation tends to deliver less than promised due to management reasons, over-optimistic time-tables and the inherent difficulties in valuation;
- water supply projects are typically evaluated using a least cost analysis, thus avoiding the difficulty of actually valuing these benefits; and
- flood control, navigation, fisheries and recreation benefits are rarely valued in dam appraisals where these uses are secondary benefits.

The conclusion that emerges from this discussion is that in many cases the methods are available to undertake more comprehensive, good practice valuation of direct benefits. In developed countries valuation tends to be more comprehensive as access to data, economic expertise, and resources is more pronounced. In addition, the use of willingness-to-pay surveys is easier and more likely to produce reliable results in developed market-oriented economies than in countries where potential respondents (i.e. consumers of services) are only marginally incorporated into the market economy.

Environmental and Social Valuation. In formal appraisals prepared by multilateral agencies it is rare to see a systematic approach to the valuation of environmental and social impacts of large dam projects. In some cases avoided emissions are valued, but outside of the inclusion of the financial costs of resettlement, compensation and mitigation measures in the economic analysis there is little attempt to incorporate these values into the economics of dam appraisal. This is somewhat surprising given the rather tractable nature of the welfare impacts of dam projects which take place primarily in rural settings and involve the evaluation of effects of dams on households and firms production and consumption options. Methods exist for the valuation of changes in subsistence and commercial production, water consumption, health impacts, recreation, and loss of land. Oftentimes the limiting factor may be obtaining the information on how ecosystem function will change when a dam is built.

While valuation of these impacts is increasingly undertaken in a developed country context where the data and technical expertise is available, developing countries are rapidly equipping themselves for this task. The difficulty will be cases where historical data on economic behaviour at the microeconomic level or ecosystem/hydrological function is required. Still, many experts suggest that the use of the more participatory methods of economic valuation hold out bright prospects for future valuation efforts. It is, however, important to stress that although economists can value a range of social and environmental impacts using best practice methods, a number of intangibles such as biodiversity and cultural values are very difficult to monetise. Further, within the context of a given dam project it will be extremely difficult and costly to provide precise valuation data on all, or even close to all the impacts.

Criticism of CBA is often based on its failure to incorporate the social and environmental costs of large dam projects. In the cases where CBA has been extended to incorporate evolving methods for

valuing environmental and social impacts, some feel that this approach has tended to result in even more controversy, and to focus criticism on the entire suitability of economic analysis as a meaningful and practical tool for dam project assessment. While this is an important perspective there remain many stakeholders in the dams debate who are asking for these impacts to be valued in economic terms so that they may be compared with the direct project benefits and costs and thus the debate continues, largely it appears in the absence of a dedicated program of experimentation in this area.

Discounting. Actual practice in dam evaluation amongst multilateral donors consists of applying discount rates for economic analysis in the 8-12% range (all rates cited here are in real terms). These may alternatively be based on host country calculations of the economic opportunity cost of public funds or the intent to ration available capital by the donor. In many cases appraisal documents simply take it for granted that the discount rate is the rate as applied and do not bother to cite a sources for this important parameter. Further, many appraisal do not actually use a discount rate to calculate a net present value but instead calculate an economic internal rate of return which is then compared with the stated discount or “hurdle” rate.

The literature on discounting is rich in alternative perspectives and suggestions. A number of views regarding the correct way to discount in economic analysis are as follows:

- to use a discount rate of zero in order to avoid making assumptions about the discount rates of future generations and to ensure that long-term catastrophic effects are valued at more than the value of a VW bug in current policy choices
- to use a discount rate that reflects the social rate of time preference or the rate at which people discount future consumption (on the order of 1-3% in many cases)
- to use a discount rate that accommodates both the social rate of time preference and the opportunity cost of capital (anywhere from 2-12%)
- to use the private sector rate of return as an indicator of the opportunity cost of public funds (roughly 16-20 percent)

Additional variations on the use of one of the following rates suggest above are:

- to use a discount rate that begins declining in a generation or two as a way of representing empirical research that has demonstrated that people do not discount the future in a linear fashion
- to use different discount rates for environmental good and services on the grounds that they will be scarce in the future

A final suggestion is to avoid incorporating additional concerns into the discount rate besides those it was designed to account for – i.e the economic “rate of exchange” of units of worth accruing in different time periods. Under this view it is better to proceed with the best estimate of the discount rate and then discuss alternative means of incorporating such concerns (such as long-run effects or resource scarcity) into the project appraisal or planning process.

Risk and Uncertainty. Risk is often assessed through sensitivity analysis based on analyst-selected ranges of a number of parameters. In multilateral appraisal, quantitative risk assessment using probability distributions is found only in best practice examples. The treatment of uncertainty is also accommodated through sensitivity analysis. Little effort has been made to date to conduct either quantitative options analysis or scenario analyses of the joint effects of uncertainty and irreversibility on dam decision-making. Where uncertainty over external impacts is extreme, an alternative that is now employed is to develop a compensatory project, but make the project a number of times larger than would seem necessary in order to err on the side of caution.

Regional and Macroeconomic Impacts. Models for examining regional and macroeconomic impacts have a number of functions which include analysis of the distribution of project impacts and the prediction and monitoring of how a project performs relative to sectoral, macroeconomic and international economic objectives. As a result such models may be used for determining the affordability of a very large dam project to a country. Economists (and policy regulations in some countries) generally agree that secondary economic impacts beyond the scope of project direct benefits should not be used in determining the net economic benefits of a project. Assuming full employment of resources in an economy the gain in secondary benefits from investment in one region will simply result in the off-setting loss of such benefits in another region as the change in supply and demand introduced by the market is accommodated and the economy returns to equilibrium. Still, there may be cases, particularly, in developing countries where the assumptions (such as full employment) do not hold and the results of such models will require further interpretation for decision-making purposes.

Models for use in predicting regional and macroeconomic impacts include input-output models, social accounting matrices, and computable general equilibrium models. These models are data intensive and require substantial investment of resources and technical expertise. As such these models are not often seen in dam appraisals in developing countries. Still, many developing countries do have these models and the expertise to work with them. The unanswered question is how well do these models respond to the outstanding concerns held by many about the economic and distributional impacts of large dam projects.

Distributional Analysis. The need for distributional analysis is increasingly recognised as a valuable input to decision-making, particularly given that perceptions regarding the inequitable distribution of costs and benefits of large dam projects is one of the major issues in the dams debate. Unfortunately, distributional analysis is rarely undertaken outside of Social Impact Assessment or the use of macroeconomic models. The use of distributional weights (Social CBA) is not practised. The use of distributional weights (Social CBA), which was widely promoted in the 1970s is not practised. The new Asian Development Bank guidelines currently recommend the use of a distributional analysis which is intended to show which sectors of society receive the economic benefits of the project and which sectors pay the costs. To date this has proven difficult to implement and the one existing application is reviewed in the thematic paper.

The WCD Case Study experience shows that it is technically possible to collate the material in the context of stakeholder processes, but that the complexity of the resulting matrix requires considerable explanation. In sum, there is considerable need for methodological and process innovation in this area if non-quantifiable indicators are to be incorporated alongside quantifiable figures. Participatory, multi-criteria approaches to decision-making have the advantage of incorporating both types of information into a process where there is time for participation and learning to occur so that distributional information coming from economic analysis and other sources can be understood and explicitly considered in the decision-making process.

Decision-making. Traditional methods for project selection have consisted of financial and economic analyses using a limited number of parameters, most of which were internal to the dam owner and for which values were relatively easy to assign. Decisions made to build dams solely on the basis of such an analysis are questionable given the failure to undertake options assessment and to include external impacts, particularly social and environmental costs. An alternative approach to a decision support system based on CBA is to use a method that recognises that projects often have multiple objectives and not simply economic welfare maximisation. Experience to date with these multi-criteria approaches suggest that while economic criteria remain important, these decision frameworks have the benefit of allowing disaggregated information on social and environmental impacts to enter directly into the decision analysis. Such decision support systems appear particularly appropriate and

useful in the case of large dams when implemented within a participatory, transparent multi-stakeholder approach.

2.2 Findings on Actual Practice: Process

As alluded to earlier, there are different perspectives on the role of economics in the decision-making process. One perspective has the results of these analyses being employed by decision-makers to select and approve the project for development, subject to political considerations. An opposing view is that a project is identified for political or institutional reasons and the CBA is simply used as a tool to legitimate the decision. The tendency to underestimate costs and overestimate benefits in dam appraisals only serves to promote the latter view.

Little divergence of opinion surrounds the claim that historically decision-making processes for large infrastructure projects, including dams, were top-down, non-transparent and non-participatory and were driven largely by political interests, engineers and economists. This approach has tended to ignore or under-emphasise the external impacts of dams (both environmental and social); the typically uneven distribution of gains and losses; and the inadequate compensation provided to those negatively affected. As a result the approach has frequently led to unsatisfactory social and economic outcomes.

An important aspect of the changing context that surrounds dams is the opening up of decision-making processes to a wider body of informed participation, and even to negotiation of decisions amongst stakeholders. Review of the gap between actual practice and that reflected in best “academic” practice and guidelines suggest that in a multi-stakeholder, multi-criteria decision-making arena it becomes important to rethink how evolving tools and methods of economic analysis can inform such decision-making processes in a transparent, participatory and accountable manner. In such a context emphasis needs to be placed not only on the financial sustainability of a project and its economic attractiveness but on the analysis of who gains and who loses from a project, i.e. distributional analysis. This information, when developed in an open and participatory manner can promote stakeholder understanding and negotiations surrounding the decision-making process.

3. Policy Principles for Financial, Economic and Distributional Analysis

The following policy-level principles pertaining to the application of Financial, Economic and Distributional Analysis to the assessment of alternatives for water and energy resources development and the evaluation of dam projects:

Options Assessment. A full range of dam and non-dam options should be included in the identification and preliminary assessment phase of selecting water and energy projects. An explicit comparison of options is a necessary precondition for ensuring efficient resource allocation. The options should include both supply and demand management options. The specific stages will vary from one context to the next however, the main objective is that an exhaustive scoping of options be conducted at the outset with subsequent screening out of unattractive options and that at least two viable alternatives be carried forward to the stage of project selection.

Decision-Making Criteria. Economic CBA is a necessary but not sufficient element of options assessment and project selection, monitoring and evaluation. Given that not all important impacts can be valued in economic terms, decision-making should not be based solely on the results of economic CBA, but rather the different aspects of financial, economic and distributional analysis of options should feed into multi-objective and multi-stakeholder decision-making approaches.

Equity Considerations, the Pareto Principle and CBA. It may not be enough that the economic gains of a dam project (or a dam option) outweigh the economic losses, rather those who gain must

actually make those who lose better off. Implicit to CBA is a weaker formulation of the Pareto Principle, namely the notion that winners *could* compensate losers. The premise of hypothetical betterment of those made worse of by a project due to the extinguishing of their rights and loss of social/environmental entitlements may be judged to be a poor basis for public policy and decision-making in today's context. (Note: this principle is intended to demonstrate that an argument for equitable outcomes can be found within the context of efforts to attain economic efficiency. The use of a dam project to effect a progressive redistribution of societal benefits would be a separate project objective where applicable – although economics could assist in monitoring and evaluation of such objectives.)

Distributional Analysis. A Distributional Analysis should be mandatory for both public and private sector large dam projects and their alternatives, and serve as a vehicle for informing stakeholder negotiations. The analysis should include an assessment of whether (and to what degree) the project affects vulnerable income groups and groups with distinctive cultural features.

Economic Analysis of Private Sector Large Dams. Since large dams typically involve many external impacts, an economic analysis (from the perspective of society) should be performed for projects owned by private enterprises, as well as for those owned by public institutions.

Decommissioning Fund. Decommissioning costs are real costs that every dam project will face sometime in the future. For privately sponsored dam project a decommissioning fund should be mandatory and initiated at commissioning.

Sensitivity Analysis. Sensitivity analysis of potential range of discount rates and quantitative analysis of risk factors must be undertaken as part of the economic analysis

Affordability. Countries must ensure that dam projects are affordable, taking into account relevant project risks. The possibility that revenue flows will not be forthcoming and hence, that loans will go unpaid, with subsequent deleterious affects on the macroeconomic health of a state or country needs to be carefully evaluated prior to project selection.

4. Recommendations for Future Practice: Methods

Environmental and Social Valuation. Placing monetary values on environmental and social impacts of projects is a useful and acceptable practice insofar as it permits explicit examination of project and policy alternatives. Studies of this nature should be located within the framework of a recursive consultative interaction with project stakeholders that allows for the identification, prioritisation, selection and valuation of project impacts. Valuation does not, however, preclude the direct use of social and environmental indicators in multi-objective frameworks. Where possible, values used to quantify these effects in monetary terms should be based on the choices actually made by individuals in relevant markets. Stated preference methods should not be used with cultures unaccustomed to market transactions. Economic analysis is based on the notion of consumer sovereignty, i.e. that the values reflected in the analysis should be those of the people affected by the project not those of politicians, activists, environmentalists, moral philosophers or economists. Projections of the relative changes in the scarcity of goods and services need to be adequately accounted for in the valuation process using appropriate price escalation factors.

As part of a recursive process with stakeholders the direct project benefits and impacts that need to be valued in economic terms should be developed with a view towards concentrating available funds on assessing those impacts that are expected to be significant but for which the level of magnitude is not clear from existing studies or evidence, or where divergent views on the valuation of the impact exist.

Discounting. The discounting of future flows from society's point of view (i.e. not the private sector discount rate) must accommodate the time preference of society for consumption and the opportunity cost of capital; the discount rate cannot simply be set at zero. It is of great importance to move beyond the ideological and philosophical debates over theory and methods, and foster applied research and development in this field.

Sensitivity and Risk Analyses. In deciding whether or not a project should be implemented, it is essential to measure, through sensitivity analysis, the robustness of the results of the analyses to reasonable expectations of changes in the key input variables. The choice of ranges of values for the key variables should be based on actual experience with other projects of a similar nature. Using previous experience, probability distributions for the key variables should be estimated and combined in an overall probabilistic risk assessment of the project.

Distributional Analysis. Improved distributional analysis is only possible if increased resources are invested in determining the impacts that large dams have not just on the national economy but on interested and affected populations. Macroeconomic models such as social accounting matrices should be considered where the secondary impacts of the project may be considerable. Financial and economic valuation of project impacts, including the social and environmental impacts, should take place as an integral part of the consultative process of social and environmental valuation described above. Placing valuation of impacts and the analysis of the distribution of these impacts within the context of negotiations over the project is recommended.

Harmonisation of methodological approaches and standardisation of key economic assumptions is required. Eliminating uncertainty with regard to key elements of technical approaches to the problem as well as standardising key variables (such as discount rates) at relevant levels (i.e. of the national economy) both promotes comparability of results and efficiency in the undertaking of analyses. A targeted program of applied research – most likely of a collaborative nature between development banks, research institutes and government agencies – would be ideal.

Financial Analysis. Financial analysis should be conducted, for both privately and publicly funded projects to accomplish the following:

- assess the financial viability of the project as a whole – is the present value of total annual revenues greater than the present value of total annual costs, measured at market prices?
- determine the annual profitability of the project enterprise – for each year of the project's life, will sufficient revenues accrue to the enterprise (from tariffs, government incentives, etc.) to cover all of its financial obligations including operating expenses, principle and interest payments on debt, income tax on profits, and required return to equity investors?
- in the case of a large project relative to the size of the country appropriate methods (including macroeconomic models) should be used to measure the impacts of the project on foreign exchange liabilities, production levels and prices in the various sectors of the economy, and the effects on the overall fiscal performance of the country? and
- ensure that investment in the project will not divert scarce government funds from important social programs and, by so doing, exacerbate the condition of poorer socio-economic groups.

Economic Analysis. Annual cash flow profiles computed in the financial analysis should be modified for use in the economic analysis. Taxes, subsidies and other distortions should be eliminated through shadow-pricing of inputs and outputs at their marginal opportunity cost; costs and benefits that are external to the project (externalities) should be included; and adjustments made to convert to a common price level using the appropriate exchange rate. The valuation of direct project costs and benefits, as well as of external costs, benefits and impacts should be done at three levels: identification, quantification and valuation. When there is general acceptance of the methods, and the

data are of sufficient quantity and quality, the monetary costs and benefits should be estimated and included directly in the economic cost-benefit analysis. Those that are not quantifiable in either physical or monetary terms should be presented to decision-makers in qualitative terms. Where different development options are being considered (e.g. high dam versus low dam), any differences in impacts among the options should be emphasised.

For a multi-purpose project, each independent component should be evaluated on its own merit on a marginal basis. Each successive component under consideration must increase the project's total net benefit in terms of the stated national/project objectives. Any incremental component that has a negative net benefit (i.e. has the effect of reducing the total net benefit of the project as a whole) should be dropped, even if the net benefit of the total project remains positive. In other words, individual project uses (e.g. hydropower, irrigation, water supply, etc.) should be justified incrementally. Those uses that have net beneficial impacts should not be used to cross-subsidise other uses whose net benefits are negative.

For a project to be considered economically attractive, the present value of its economic benefits must not be less than that of its economic costs. Also, the present value of the project's net benefits must be no less than the present values of mutually exclusive projects.

Multi-Criteria Analysis. Multi-criteria analysis is recommended as a more comprehensive method of decision-making provided that it is conducted in a participatory manner. The available approaches and methods in multi-criteria analysis are fully explored in the WCD Thematic Review on Planning Approaches and readers should consult this paper for more detail on recommendations in this regard.

5. Recommendations for Future Practice: Process

Project Assessment. At the outset of a project assessment, it is necessary for decision-makers, in consultation with stakeholders, to explicitly define and describe what their long-term policy objectives are, and how the project or options in question might contribute to promoting these objectives. Proponents and analysts should not be left, by themselves, to anticipate or decide on these objectives. These objectives must be elaborated on to ensure that there is a common understanding by all affected groups of the national and project objectives on which the project's performance will be judged.

It is also necessary, at the outset of the planning process, to define the framework within which the decision-making will take place; the scope of the various technical analyses to be undertaken; the options to be considered; and the range of values for important variables that will be used in the evaluation. Again, these tasks should not be left to project proponents and analysts alone but should also involve inputs from decision-makers and stakeholders.

The results of the process will be more credible and generally acceptable if the relevant objectives, decision-making framework, scope of analyses, options, and values for key variables are discussed and decided in advance, and if stakeholders are encouraged to participate. This approach will also contribute to the assessment process becoming more transparent, thus reducing the ability of certain groups to manipulate the results.

The prescribed process must be sufficiently flexible to allow analysts to make reasonable adjustments during the course of the work to reflect the interim findings of their analyses. However, any major changes in approach and assumptions should be made in consultation with decision-makers and stakeholders.

Options Assessment. At the outset funds should be made available to conduct pre-feasibility studies of a series of options to fulfill the defined objectives. While this list should be winnowed down

through feasibility, design and appraisal the decision to limit the field of projects to one should be avoided until uncertainty over potentially crucial aspects of the project are resolved. For this reason it is suggested that at least two projects be taken to appraisal. This will help avoid the problem that has arisen in the past where a single project that has been selected for feasibility study is discovered not to be as attractive than originally thought, but continues to be pursued because it is the only project that can be commissioned in time to meet an imminent shortage of power or water. It may be more cost-effective in the long run to advance spending money on additional feasibility studies rather than waste resources developing a sub-optimal project.

An Integrated, Multi-Disciplinary Approach. It is necessary to devise a process that integrates the expected environmental and socio-economic impacts of a project into the assessment process from the early planning stages, before decisions are made on the project's configuration, and before it is committed (politically) for development. In so doing, it will be possible to modify the scale and design of the project in order to minimise its impacts, including the costs of mitigation and compensation, and make it more acceptable to all parties concerned. Such an approach, both by private- and public-sector developers, represents enlightened self-interest since it reduces the financial and economic risks associated with project delays caused by protests and legal challenges from project-affected groups. This approach requires that specialists from a wide range of disciplines, including environmental and social scientists, as well as engineers and economists be included throughout the project assessment process.

Stakeholder Participation and Transparency. It is essential to a dam project's general acceptance, financial and economic sustainability, and equitable distribution of net benefits to consult with all those who will be affected, both directly and indirectly. These consultations should be conducted throughout the project planning, preparation, development and operating stages with the purpose of enabling those affected to have a material influence on the project's scale and mode of operation, as well as on the ultimate decision on whether or not the project should proceed.

This type of process is designed to help all participants to form and reveal their preferences with the objective of establishing a basis for negotiation and ultimate agreement. The process requires that all parties concerned have access to publicly funded analyses that are conducted in connection with the project (i.e. there is freedom of information). Also, it is essential that analysts view themselves not just in the service of project proponents but in the service of all parties affected by the project.

In developing countries, it is necessary that stakeholder consultations be facilitated, not by project proponents but, by impartial groups and individuals who are experienced in this area of endeavour, and who are familiar with the cultural environment in which the consultations are taking place. For the consultation process to be effective, all participants (project proponents, analysts, affected groups and decision-makers) must be objective, informed and flexible. Unless a general spirit of cooperation exists and there is widespread acceptance of, and confidence in, the consultation process, it is unlikely to be credible and successful.

Conflicts of Interest. In order to avoid conflict of interest, it is important that, although the various analyses should be highly coordinated, they should be undertaken by independent firms or individuals. In particular, the environmental and socio-economic impact assessments should not be performed by the same firm or group that is undertaking the engineering work.

Panel of Experts. For all large dam projects, an independent panel of experts should continue to be appointed to review project assessment. Care should be taken to ensure that the panel is multi-disciplinary in nature, composed of a wide range of eminent technical specialists including engineers of various disciplines, environmental scientists, and economists and other social scientists. It is essential that the panel be truly independent (see the WCD Thematic on Regulations and Compliance for more on this theme).

These specialists should not only review the assessment after it has been completed but should be involved from the early stages in helping to guide the process to ensure that the data, methods and subjective assumptions being used are rigorous and comply with accepted (improved) practice. The panel should also participate in the consultation process to ensure that the opinions of all affected groups, on issues specific to the project, are taken into account in the project design and assessment.

Political, Legal and Institutional Issues. The establishment and support of effective, relatively independent regulatory institutions to oversee project assessment, and to ensure that the prescribed rules for project assessment are adhered to is vital. Having such institutions in place will have the potential to improve the transparency and credibility of the process, and to provide more acceptance of the recommendations made by the regulatory institutions to political-level decision-makers.

It is important that the legal/institutional process that is developed be clear, timely and efficient. It should not add unnecessarily to the overall costs borne by the government, project proponents and those who would be negatively affected by the project. Nor should it be so protracted as to discourage development of projects that are fundamentally sound from the point of view of meeting stated national and project objectives.

Resources Available for Project Assessment. In order to achieve and implement the improved project assessment process outlined in the previous sections, it is essential that adequate resources, in terms of both time and money, be allocated by governments, and by lending and development institutions to conducting the various engineering, environmental, financial, economic, social (including distributional) and multi-criteria analyses required. If it is deemed desirable by those involved in the dams debate to significantly improve the assessment process and to design projects in such a way as to make them acceptable to the broad range of stakeholders involved, these agencies must commit more resources to project assessment than they have done in the past.

Basic Research and Information from International Funding Agencies. The international funding agencies should assist practitioners of project assessment by conducting, and regularly updating and publishing evaluations, on a regional and country basis, of the most appropriate values for basic financial, economic and social variables that should be used in the analyses. Also, on the basis of experience, they should provide plausible ranges for these variables to assist practitioners perform sensitivity and risk analyses. In addition, they should continue to publish and update specific, detailed and practical guidelines for conducting acceptable, comprehensive and high-quality project assessments. A number of areas that require further research and evaluation include:

- a systematic program for the application of methods of social and environmental valuation within the context of options assessment and project valuation of large dams and their alternatives;
- evaluation of global experience with macroeconomic models in the analysis of the economic impacts of large dams;
- the applicability of benefits transfer to dams as a means of lowering the cost of environmental valuation;
- harmonisation of discount rates at the country level and the application of existing methods in this regard;
- exploration of the implications of new approaches to analysing decision-making in the presence of uncertainty and irreversibility.