World Bank Lending for Large Dams: A Preliminary Review of Impacts

Large dam projects are controversial. Their proponents point to the social and economic development benefits that dams make possible, by providing electric power, irrigation for agriculture, and residential and industrial water for growing towns and cities. Critics consider that project sponsors and financiers systematically downplay the deleterious effects that dams can have on displaced people and the environment. They argue that there are usually cheaper and more benign alternatives to meet the same developmental goals.

This phase aims to contribute to the refinement, dissemination, and broader adoption of sound standards for planning, building, operating, and financing large dams.

World Bank role

The World Bank has directly or indirectly assisted only 3 percent of the dams in developing countries. Today, the Bank is financing about four dam projects a year—half the rate of the 1970s and 1980s. Since 1986, the Bank has approved 39 dam projects: 33 mainly or exclusively for hydropower, three mainly for irrigation, and three for water supply or navigation. Lending for these 39 projects, at $7.4 billion, accounts for about 3 percent of total World Bank lending in the past ten years.

At first, large dams were simply regarded as engineering structures—that is, in terms of their usefulness for generating electric power and improving the management of water. In the 1960s, cost/benefit analysis became accepted as the standard criterion for the justification of large dams, and the World Bank pioneered the modeling of river basins and new methods of economic analysis of multipurpose projects in developing countries.

It was not until the 1970s and 1980s that social and environmental impacts, previously treated as inevitable "side effects," emerged as fundamental concerns. The Bank responded by adopting guidelines to integrate social and environmental concerns into the analysis of proposed projects and to avoid or mitigate the adverse consequences of large dams. It issued guidelines on dam safety in 1977; on involuntary resettlement in 1980, 1986, and 1990; on safeguards for indigenous people in 1982; on natural habitat in 1986 and 1995; on environmental aspects of dams and reservoirs in 1989; and on environmental assessment in 1991.

The standards embodied in the Bank's policies have yet to be universally adopted. Even the governments that accept them in principle may lack the regulatory framework, the participatory mechanisms, or the domestic capacities needed to translate the new standards into results on the ground. The advent of private financing for public infrastructure
Box 1: Scope of study

The review is based on information from Bank reports, borrowers and operating agencies, nongovernmental organizations, and Bank operational staff. It covers all the completed and evaluated projects that have involved the construction of a dam more than 50 meters high or that have flooded more than 200 square kilometers. To be conservative, the review also includes some projects that have attracted controversy and involve dams more than 60 meters high for which data were available. The projects were approved between 1956 and 1987. Schemes still under construction, among them the Sardar Sarovar (Narmada) in India, are excluded.

Given the long implementation periods typical of large dam projects, all but 14 of the dam projects reviewed were appraised before the Bank first adopted guidelines on the resettlement of displaced people in 1980, and all but one were appraised before 1986, when the Bank first adopted guidelines on protection and management of the environment.

Development benefits

The 50 dams reviewed have made major contributions to economic development. They have created an installed power generation capacity of 39,000 MW and they replace the equivalent of 51 million tons of fuel in electric energy production annually. They control floods and provide water for urban populations and for industrial development. They have extended irrigated areas by about 1.8 million hectares and improved irrigation for another 1.8 million hectares, substantially increasing cropping intensity and yields of major food crops.

In Pakistan, for example, the direct benefits from irrigation made possible by the Tarbela and Mangla dams are estimated at about $260 million annually. The added supplies of irrigation water have made it possible to grow the equivalent of two wheat crops a year on 400,000 hectares of previously irrigated land and 400,000 of previously rainfed land. Indirect benefits are difficult to quantify. But an impact evaluation shows that farmers with irrigated land have increased their incomes and are spending them on consumer goods and on education, including for girls (see Précis No. 124, Irrigation Investment in Pakistan). The increased farm activity generates demand for associated industries such as fertilizer production and agricultural output processing.

Social and environmental impacts

Resettlement

Resettlement has been inadequately managed in half the projects. Overall, the 50 dams have displaced about 830,000 people. Based on information in Bank reports, the outcome of resettlement has been satisfactory in 25 of the large dams (involving 540,000 people), unsatisfactory or unknown in 24 projects, and no resettlement was required in one project. However, most projects predate the Bank’s resettlement guidelines, and often, judgments on outcome are largely based on the views of the implementing agency rather than on audits to establish whether displaced people’s incomes have been restored to pre-project levels, as required by today’s guidelines. (See Précis No. 53, Early Experience with Resettlement.)

The resettlement results of recent projects are better than those of projects approved before the guidelines came into force. Of the dams appraised since the first resettlement guidelines were issued in 1980, relatively few have yet been completed and evaluated. But it appears that the guidelines have improved performance: of the 14 completed and evaluated dam projects appraised since the guidelines were issued, resettlement has been unsatisfactory in two (Kedung Ombo in Indonesia and Kiambere in Kenya—Box 2).

Problems with resettlement and compensation of indigenous people appear to have been frequent. Many dams are in remote areas whose people have a social and cultural identity that is distinct from the dominant society and makes them vulnerable to being disadvantaged by development. Unfortunately, because most of the projects in this review were approved before the Bank’s guidelines on indigenous people were issued in 1982, few of them recorded information on the condition of indigenous people before and after project interventions. OED impact evaluations and reports by other agencies point to this as an outstanding issue for the Bank and its borrowers.

Environment

The Bank’s guidelines now provide that any project-induced environmental degradation must be avoided, mitigated, or offset as part of project design and implementation. It is too early to judge compliance with the new standards, but it appears that many problems identified by the OED review are more prevalent in early projects than in recent ones.
The 50 dams have a mixed record on the management of environmental consequences. In areas where tropical waterborne diseases are endemic, new reservoirs can add to health risks. Most of the projects have controlled health risks successfully at moderate cost. Many have mitigated losses to fisheries by creating new fisheries within the reservoirs, and few have experienced serious threats to water quality. A few of the dam projects have enhanced natural habitats, for example by creating nearby protected areas for wildlife (Box 3). Concerns about the loss of natural habitats have been raised in connection with 13 of the projects, only two of which appear to have taken adequate mitigatory measures. In two cases (Bayano in Panama and Kariba between Zambia and Zimbabwe) major irreversible degradation of a pristine natural habitat has been reported. The adverse impacts on habitats in the other 11 projects have in general not been large or irreversible.

Watershed degradation and downstream effects. Watershed degradation, leading to sedimentation of the reservoir, sometimes accompanies the building of a dam and the opening up of a new area to settlement and deforestation. These problems have affected the viability of only one of the dams (Kulekhani in Nepal), but in another 18 projects they are serious enough to warrant continued monitoring. Where increased waterlogging and salinity and other adverse effects have occurred downstream of dams, they have usually been the result of inadequate complementary investments rather than of problems inherent in the dam projects themselves.

Benefits versus costs

The large majority of the dams reviewed are yielding benefits that far outweigh their costs, including the costs of adequate measures to mitigate their adverse impacts. Among the 50 dams as built, 45 are yielding acceptable benefit/cost ratios. Adding the probable costs of measures that the projects could have taken to satisfy today's guidelines on resettlement and the environment makes little difference to the estimates of economic returns.

In almost all other cases, mitigation measures, including appropriate resettlement programs, could have been financed without jeopardizing the dams' economic returns. Thus, by today's standards, and based on the available information, 13 of the 50 dams can be regarded as acceptable; 24 as potentially acceptable; and 13, all appraised before 1985, as unacceptable (see figure).

Preliminary lessons

The tentative finding that 74 percent of the dams (37 of the 50) are acceptable or potentially acceptable under the Bank's current guidelines suggests that large dams can be designed, built, and operated so as to make a positive contribution to development while protecting the environment and restoring the livelihood of people who must be resettled.

The changes introduced in the Bank's environmental and resettlement guidelines mark a significant shift in the Bank's threshold of acceptability for dams. Based on available information, without additional mitigation measures only five of the 50 dams

Box 2: Resettlement: contrasting experiences

Kiambere hydroelectric project in Kenya, as soon as commissioned in 1990, supplied 30 percent of Kenya's energy and saved the country $25 million worth of fuel oil (in 1994 prices). But resettlement had not been adequately considered. When dam construction began in 1983 it was estimated that 1,778 people would be affected, but eventually 7,500 people were displaced or dispossessed. The resettlers moved into areas inhabited by their own tribespeople, but their compensation was too small to buy land equivalent to their original holdings. Many of them spent their compensation money on marriages, old debts, and household items, with the result that they became landless. Resettlers lost the diverse sources of income they had had before moving. They had less access than before to pasture, firewood, water, and trees for building. And they remained worse off than the host populations.

Lubuge hydroelectric plant in China, at its completion in 1992, supplied 26 percent of the power demand and 21 percent of the energy demand of Yunnan province. The 2,320 people displaced were satisfactorily resettled, under a plan that offered them a choice between continuing to farm on new land irrigated under the project, or being retrained for new occupations. Resettled families have more living space than before and the project has brought them drinking water, electricity, and transport and communication facilities.

The impact of large dam projects

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<th>Under old policies</th>
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<td>(10%) Unacceptable</td>
<td>(26%) Potentially acceptable</td>
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<td>(90%) Acceptable</td>
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reviewed fall short of the old standards, but 37, or three-fourths, fall short of the current standards. Though preliminary, the results suggest that the Bank's current resettlement policies are providing much better protection to people displaced by dams.

The implication is that the Bank should continue supporting the development of large dams provided that they strictly comply with Bank guidelines and fully incorporate the lessons of experience. Some of these lessons follow:

- It is never too early to consider social and environmental issues. The damage caused by adverse social and environmental impacts is much greater than the cost of mitigation. The potential social and environmental impacts of projects need to be considered—on the basis of detailed reliable information—starting at the planning and pre-feasibility stage.

- If a project is economically justified, an adequate resettlement program and adequate measures to mitigate environmental impacts are likely to be readily affordable.

- Institutional capacity and commitment are crucial. With enough commitment, knowledge, and resources, the adverse impacts that have occurred could have been prevented, reduced, or offset. Careful assessment of the responsible agencies' capacity and commitment to manage the social and environmental aspects of a project, and adequate provisions to ensure their satisfactory performance, need to go hand in hand with concern about physical magnitudes such as the area of habitat to be flooded or the number of people to be resettled.

- It may be appropriate for the Bank to require an ex ante environmental and resettlement assessment for all dams that it might assist, directly or indirectly—much as it already requires a safety evaluation. This would provide an opportunity to identify additional mitigatory measures as needed, and to require these measures to be implemented as a component of Bank support.

The Committee on Development Effectiveness of the Bank's board of executive directors, discussing the Phase I study, found the results encouraging. The committee noted that most of the Bank's projects had met the standards in force at their appraisal, and that even if the costs of adequate mitigating measures were included, the benefits from dams would normally far outweigh the costs.

Committee members emphasized that dams will continue to be built, with or without the Bank's involvement, but that the Bank's environmental and resettlement guidelines appeared to have a positive impact on the dam projects that the Bank has financed. The committee stressed the need for the Bank to be involved and monitor project impacts after the Bank's loan disbursement has been completed. Bank management confirmed that for dams that the Bank finances, a borrower's legal obligations to meet the Bank's policy guidelines extend for the life of the loan (often up to 30 years), so that the Bank retains the right to ensure that these obligations are met. Committee members noted the need to develop a

Box 3: Pehuenche and the Chilean Burrowing Parrot

Pehuenche hydroelectric project, commissioned in 1991, is the second largest power plant in central Chile, which is home to 93 percent of the country's people. The project relies on a 90 meter dam and reservoir of two square km. Though the reservoir displaced no people, it was part of the habitat of an endangered species of parrot. The

Bank Group policy that would seek to ensure consistency in guidelines for investments in dam projects by IBRD, IDA, IFC, and MIGA.

The committee also discussed the broader question of whether and how the Bank can influence the human and environmental consequences of dams that it does not finance. The committee urged management to make the most of the Bank's potential to affect the consequences of dams indirectly, through providing advice and help to borrowing countries for institution building, sectoral policy development, and environmental assessments. Committee members noted that private financiers of dams may see a benefit from involving the Bank either in co-financing or in a certification role, because of its high standards on environmental impacts and resettlement.

The committee agreed with OED's proposal for Phase II of the study and suggested several additional issues to be addressed: a comparison of the experience of dams financed by the Bank with that of dams financed otherwise, in both developing and developed countries; an analysis of cost overruns and how to prevent them; recommendations on how the Bank can ensure that mitigating measures are in fact taken, and not just identified as feasible in dam projects. The committee urged OED to ensure that Phase II reflects the views of civil society, including those of private investors and nongovernmental organizations.

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