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# "Damning The Dams": A Study of Cost Benefit Analysis In Large Dams Through The Lens of India's Sardar Sarovar Project

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# "DAMNING THE DAMS": A STUDY OF COST-BENEFIT ANALYSIS IN LARGE DAMS THROUGH THE LENS OF INDIA'S SARDAR SAROVAR PROJECT

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## Abstract

Large dams, a tool for development in the past century, have changed the lives of millions, altered nations and had widespread environmental, economic and social effects. Whether dams ultimately bring more good or ill remains an open question. With the increasing amount of data available, the effects of dams can be assessed with greater accuracy and validity.

This thesis examines the evaluation of the economic, environmental and social effects of dams, and lessons learned from previous dams. It then focuses on cost benefit analysis as a decision-making tool pre-project for evaluating the potential gains and losses of building a dam; and as a framework for evaluating dams in operation. It reviews the basic assumptions required for a legitimate cost benefit analysis, and the inherent limitations of this method. It uses the Sardar Sarovar dam as a case study for the use and abuse of cost benefit analysis in decision-making, interstate politics, propaganda and activism. It also illustrates the difficulties in dividing costs and benefits in an equitable manner at national, state, and grassroots levels.

## Introduction

The debate on large dams has been ongoing since the 1970s, when environmental groups first mobilized to oppose large-scale dam projects in the US and in developing countries around the world. Given that so much is at stake, one could reasonably imagine that studies would have shown convincing evidence that dams have or have not ultimately brought more good than harm. However, until recently, this was not the case.

In the interests of attempting to answer this important and unresolved question, The World Commission on Dams (WCD) conducted a thorough and systematic evaluation of dams in 1999, publishing their report in 2000. Their report concluded that while dams are a flawed option, they are still necessary for development. The question of whether, and how, dams might be beneficial to all parties is unresolved, but worth investigation.

The economic viability and benefit of dams also applies to larger issues of policy-making regarding infrastructure. Many policies involve trade-offs, and dams are particularly complex as they encompass social, religious, environmental, and economic factors.

My paper begins by outlining the modern history of dam construction and evaluation. I will discuss the economic theory behind dams, and different factors to consider when using cost-benefit analysis as a tool for decision-making. I will then evaluate several aspects of past dams' performance — financially, environmentally and socially — based on the WCD and other studies. These studies reveal a large variance in performance of dams, from dams such as the High Aswan Dam which

has created huge economic benefits to Egypt, to dams which have only produced a fraction of their projected potential after creating environmental destruction, massive destruction and huge cost overruns. With the studies we have currently, conducting cost-benefit analyses across multiple dams and multiple countries yields no definitive answer as to whether dams cause more good or more harm to a country.

The more interesting question is to what extent using cost-benefit analysis affects the eventual outcome of a dam. I conduct a historical, economic and political analysis of one dam project, the Sardar Sarovar Project in India, to illustrate how political needs and entrenched interests, not economic cost-benefit calculations, are the main factor that determines the decision whether or not to build a dam, and decisions thereafter. I argue that this is the rule, not exception, in building large dams, and ground this in a strong critique of cost-benefit analysis.

It would be practically impossible to come to a consensus on whether dams have created net benefits or costs to the world, as every aspect of cost-benefit analysis done post-ante is highly dependent on details of implementation and political will to compensate losers rather than the initial conditions. Pro- and anti-dam groups argue about the economic benefits or costs of a dam, but the real debate is about conflicting visions of development. The widespread attention on the Sardar Sarovar Project and other large dam projects have brought into focus issues such as sustainability and equitability that test the constraints of a cost-benefit framework. As our world's resources become more constrained, these concerns will become

more pertinent and continue to urge decision-makers on all sides to change their approach to development of large dams.

# Chapter 1. The Politics and Economics of Dams

## Relevant History of Dams

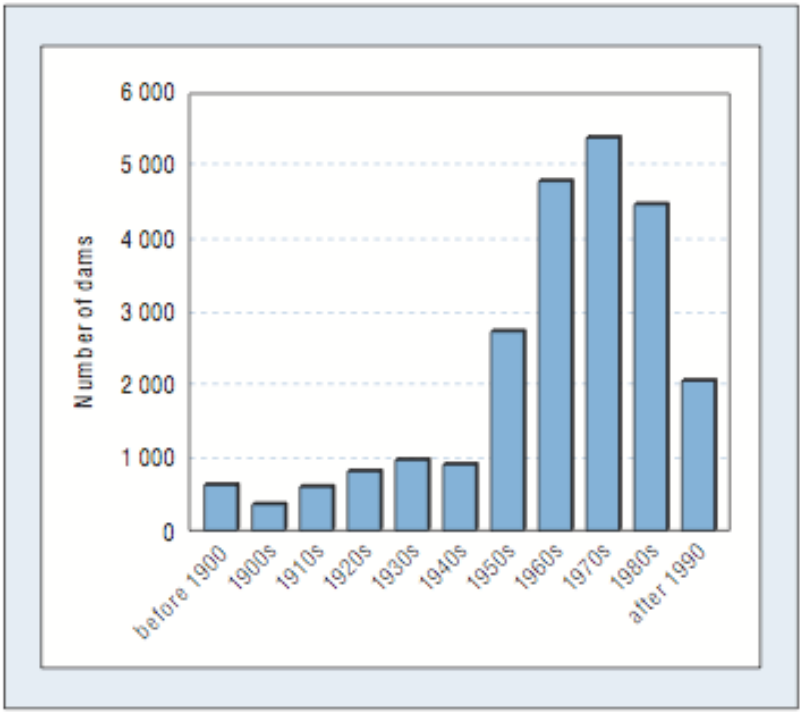
Dams are defined as structures that regulate, store and divert water from rivers. They provide water for agricultural irrigation, household and industrial use, and are used for electricity generation, and flood control. Dams have been built since at least 3000 BC in parts of the Middle East, but the modern era of dam building started in the 1940s and peaked in the 1970s. Large dams, as defined by the International Commission on Large Dams (ICOLD), are dams with a height exceeding 15 meters. In 2000, there were over 45,000 large dams in 140 countries. The top five dam-building countries account for nearly 80% of all large dams worldwide, with China alone accounting for close to half of them (WCD 9).

Dams have played a significant role in the economic development of the 20th century. Irrigated agriculture accounts for about 40% of the world's agricultural production, and dams supply up to 100% of water for irrigated production in some countries such as Egypt (WCD 13). Over 150 countries use hydropower to generate electricity, with 24 countries generating more than 90% of their electricity supply from hydropower, and another 63 countries generating more than 50% (WCD 14).

Dam construction on a large scale began in the early 1900s, mostly in industrialized countries. After the end of the Second World War, a sustained period of economic growth and stability spurred an increase in global dam construction that continued into the 1970s and 1980s, before dropping equally quickly. By the

mid-1970s, Europe, the U.S. and Canada had already exploited most of the economical sites for dam construction in their countries. With the exception of Japan, the locus of dam construction had moved to the developing world. Dam construction peaked in the 1970s, with two to three large dams being commissioned everyday in the world (WCD 10).

Figure 1.6: Construction of dams by decade (1900-2000)




Source: ICOLD, 1998. Note: Information excludes dams in China.

*Source: WCD 9*

For newly independent countries in the developing world, dam projects were often the largest ongoing public investment project. Dams were seen as a symbol of national development and pride, enormous monuments to progress and modern achievement. The first prime minister of India, Jawaharlal Nehru, praised dams as the new temples of modern India.

Geopolitical strategy also affected the construction and subsequent public perception of large dams in the developing world, with the Aswan High Dam in Egypt, conceived and constructed in the Cold War period in the 1950s and 1960s, being a prime example. In an effort to expand their influence and goodwill in Africa, The World Bank in conjunction with the American and British governments originally proposed funding the Aswan dam. This funding was contingent on a number of conditions, one of which was that the Egyptian government avoid 'imprudent financial decisions', mainly purchasing arms from the USSR. The Egyptian government (under Colonel Gamal Abdel Nasser) refused these terms, and after months of negotiations, the Western bloc withdrew their proposal and the USSR stepped in to fund the dam instead. The economic justifications for the Aswan High Dam were 'based on rough estimates…never refined' and 'ignored accepted means of assessing projects…for which an extensive literature was available' (McCully 238).

Not only was the decision to build the dam a politically-motivated one, the criticism of the dam from the West after the USSR funded the project was at least partially politically-motivated (Biswas and Tortajada 2001). Soon after the Aswan High Dam was built, American journalists published a series of articles condemning it for the social, environmental and economic harm it caused. In the Cold War climate, it is uncertain to what proportion the criticism stemmed from it being a project funded by the Soviet Union, and what proportion was due to the cited concerns. A subsequent study conducted by the Canadian International Development Agency in the 1980s and 1990s, concluded that it was one of the best

dams constructed when measured in terms of its positive net impact on the economic development in Egypt. Hence, evaluations of dams are also not necessarily unbiased, a problem that we encounter again in modern attempts to evaluate dams.

The environmental impacts of dams were not well understood in this early period. Environmental impact assessment was not included as a criterion for projects until the National Environmental Protection Act (NEPA) was passed in the United States in 1969. The rise in public awareness and advocacy against the adverse environmental effects of dams coincided with the shift of dam construction from the developed to the developing world. Northern activist groups and affected groups' associations in the developing world formed alliances to oppose dams worldwide, on environmental and human rights objections. As a result, the World Bank adopted an internal directive on indigenous peoples in 1982 and established an appeals mechanism in 1993 (WCD 19). Shifting public opinion, a change in dam financing from public to private sources, and increasing costs of large dams resulted in a decrease in dam construction across the world from the 1970s. As dam building in developed countries has largely stopped since the 1970s, most of the activist effort against dams has taken place in the developing world.

Both proponents and critics of large dams agree that there is a lack of systematic documentation and evaluation of dam operations, particularly those completed 10 to 20 years after commission. The World Commission on Dams was formed to remedy this. Its two aims were to 'review the development effectiveness of large dams and assess alternatives for water resources and energy development', and to 'develop internationally acceptable criteria, guidelines and standards where

appropriate, for the planning, design, appraisal, construction, operation, monitoring and decommissioning of dams' (xxx).

The WCD examined 1,000 dams of various sizes, and conducted in-depth case studies of eight large dams on four continents; and reviewed two countries (China and India). The WCD members included well-respected representatives of both the pro and anti-dam establishment. Its report is the most bipartisan and comprehensive evaluation of large dams to date, and I have used their data as the backbone of my global analysis of dams' performance. The release of the WCD report in 2000 rejuvenated interest in the study of dams, and many other studies assessing the impact of dams have since been published.

Reaction to the WCD report was mixed: some governments such as Sweden and Germany applauded the WCD's findings and incorporated their recommendations as criteria for financing dam projects. Other governments, particularly those in two of the largest dam-building countries, India and China, rejected the report. Significantly, the World Bank, one of the major sources of dam funding and an initial supporter of the establishment of the WCD, distanced itself from the report and did not adopt the report's recommendations in their published studies of impact assessments or their policies on resettlement of displaced peoples (Scudder 11; Biswas 2012, viii).

Fujikura and Nakayama analyzed the WCD report and identified key weaknesses which prevented it from being widely adopted: vague guidelines, unrealistic standards that were not achievable, and inconsistencies between the evaluation data in Part I and recommendations and policy in Part II (Fujikura and

Nakayama 2009). The lack of substantial World Bank involvement (in the form of the presence of a World Bank Commissioner on the panel, or by greater focus on World bBank dam projects) may have hampered the acceptance of the WCD's recommendations. Although the release of the WCD Report did not significantly change dam projects and water management policies as its authors had hoped, its evaluations questioned the dogma of infrastructure development inevitably leading to broad-based economic growth, an idea based on economic models created at the World Bank and other development agencies.

**Economic Models: Public Goods, Development and Cost Benefit Analysis**

Economic models assessing the viability of expensive large-scale development projects often utilize the concept of public good. A public good is defined as a good that is non-rivalrous and non-excludable. Dams share those qualities, to some extent. Power generated by a hydroelectric dam increases the amount of energy capacity available, driving down the price of electricity for all. Farmers living downstream of a dam also benefit from better irrigation and flood control, which lead to improvements in crop yields. These benefits are non-rivalrous, as one person's benefit of having fewer floods does not reduce another person's benefit; and non-excludable, as no one in the downstream vicinity is excluded from benefitting from the dam. Due to the expense and risk involved in building a dam, the state often takes the responsibility of investment.

However, unlike morally unambiguous public goods such as lighthouses, large dams also impose huge environmental and social costs. Historically, many dam projects were evaluated based only on projected economic benefits and the direct

cost of dam construction, ignoring the other potential losses in environmental degradation, cultural destruction and displacement of affected peoples. When one factors in these negative externalities, it is unclear whether dams are net positive or net negative. In addition, dams and other large infrastructure projects are prone to cost overruns and delays, which can turn an initially net-positive project in net-negative by the time of completion.

For the latter half of the 20th century, dams were a popular development tool, with the World Bank and other credit organizations from the developed world pouring massive loans into building dams in the developing world. This coincided with the Big Push model, outlined by Paul Rosenstein-Rodan in 1943, that states that 'even the simplest [economic] activity requires a network of other activities and that individual firms cannot organize such a large network, so the state or some other large agency must step in' (3). The theory posits that as poor countries do not have the capital to fund all these interconnected investments, they are stuck in a poverty trap of zero economic growth. To get out of the poverty trap requires a Big Push in foreign aid and investment, leading to a country's take-off in income. Dams are an example of a 'node' in the network that, in theory, would accelerate the economic development of a country by reducing agricultural shocks, ensuring a steady supply of freshwater, and enhancing agricultural productivity. The World Bank, the leading donor financing large dams, as well as other organizations such as the International Finance Corporation and various regional banks, enthusiastically backed this theory (Scudder 270).

Nevertheless, recent historical analysis has shown that a Big Push alone is not enough to ensure development, particularly as large infrastructure projects are prone to corruption, regulatory capture, and mismanagement. As William Easterly points out, the Big Push theory of the 1950s and the current Big Push theory popularized by the economist Jeffrey Sachs both do not give enough emphasis to the role of good governance in economic development (294). Easterly's own research finds no proof for the poverty trap narrative, showing with simple regressions that poor countries' growth rates are more associated with bad government than initial income. The data also disproves the narrative of zero economic growth in poor countries. Takeoffs in growth are also rarely associated with foreign aid and investment in the way the Big Push theory would imply (Easterly 315).

The cost benefit analysis is a useful tool in deciding whether a proposed dam is the best option. Cost benefit analysis originated with the Kaldor-Hicks criterion, which states that a public policy is justified if it produces social gains in excess of social losses, so that it is possible from the policy to compensate losers. Whether or not this actually happens is irrelevant, as economists were concerned with separating the efficiency question from the equity question. Nevertheless, in the long-term, technological gains would bring growth to the entire company, benefitting the initial losers as well as winners. This would create a true Pareto-improvement (Persky 2001).

A simple cost benefit analysis would consist of calculating the projected economic benefit of the dam and weighing it against the economic cost of building a dam. Increased agricultural productivity does not necessarily lead to increased

income, since a large increase in supply of agriculture, all else equal, would lead to a drop in agricultural prices. The dam should also be weighed against the opportunity cost of other critical infrastructure projects and water-management solutions. If the dam project has the highest estimated rate of return, then planners ought to move forward with it. If it does not, another project should be chosen.

More sophisticated cost-benefit analysis models have been proposed to account for environmental and social impact of dams. Long-term environmental cost must be taken into account, as negative environmental effects may not be felt for decades. Uncertainty and irreversibility when dealing with environmental costs make valuation extremely difficult (Atkinson and Mourato 2008). Faced with uncertainty, economists sometimes use a quasi-option value, which errs to the side of caution when dealing with decisions that entail losing environmental assets such as ecosystems.

Environmental impact assessments have become, at least on paper, an important part of the cost benefit evaluation process prior to building a dam. Biswas suggests that the current model of EIAs are fundamentally flawed as they only consider the negative impacts of a proposed project, rather than a two-pronged approach that identifies the positive benefits and how to maximize them, as well as an assessment of negative impacts and how to minimize them with policy action (13). The current model, he argues, does not provide enough information for sound, long-term decision-making by governments.

The danger with Biswas' proposed two-pronged process is that the positive benefits are uncertain and may take place only years in the future, while many

negative impacts (inundation of fragile ecosystems, displacement) take place immediately. The immediate negative impacts are more easily foreseeable than benefits, which are highly dependent on variable rainfall and climate patterns which fluctuate even more with the advent of global climate change. In view of this, one may argue that the analysis should be weighted more heavily towards the costs rather than the benefits. A more nuanced EIA that outlines various options and how to structure technical and policy options to maximize benefits and minimize cost and risk, is necessary.

Social impact assessments are also important in ensuring the efficiency does not come at the cost of equity. Égré, Dominique, and Senécal, in a study of three large dams in China, Turkey, and Colombia; found the following key factors to mitigating the dam's social costs and improving human outcomes after the project: conducting pre-approval social impact assessments, cultivating trust and open communication, and incorporating a realistic resettlement action plan into the dam budget. They emphasized that any feasibility study must involve a 'systematic comparison of project alternatives on the basis of technical, economic, environmental and social criteria through a participatory approach until an optimal balance of societal needs are achieved' (223). Reliable ground-level data for environmental and social impact assessments needs to be collected prior to project decision, to avoid working based on assumptions.

The difficulties of conducting cost benefit analyses on dams are compounded by ideological differences. There is little neutral ground in this debate. Some parties favor dam development under certain conditions while others reject dams

completely. Pro and anti-dam establishments have both used their own methods of evaluating costs and benefits to come to conclusions that fit their view of development.

**Scholarly Views on Dams**

The WCD assessed large dams based on their technical, financial, economic, environmental and social performance. The authors found that many large dams have not delivered their expected technical, financial and economic benefits, and imposed significant social and environmental impacts. These adverse effects have been disproportionately borne by the poorest and most vulnerable communities. They observe that as "the environmental and social costs of large dams have been poorly accounted for in economic terms, the true profitability of these schemes remains elusive" (xxxi). They also remark on the paucity of substantive evaluations of completed projects, criticizing them for having a "narrow scope, poor integration across impact categories and scales and [inadequate links] to decisions on operations" (xxxi). It takes a highly critical view of previous dams, indicting dam planners for the damaging effects that dams have imposed on the environment, livelihoods of affected communities, and cultural loss. Equity of benefit and cost is a deep concern, as those who benefited have not adequately compensated the parties with significant losses. In one sense, the WCD report emphasizes the humanitarian and environmental costs of dams more strongly than its economic inefficiencies.

The authors' further demonstrate the WCD's implicit anti-dam stance by devoting the second half of the Report ("The Way Forward") to examining past and

current alternatives to dams, particularly in regards to addressing global challenges for meeting the world's energy and water needs. They emphasize that while the final decision is important, the process of planning, decision-making and financing must involve a comprehensive and fair evaluation of all available options, including demand-side management.

The WCD advocates a rights-and-risks approach for equitable decision-making. This is a negotiated approach that involves all parties, and where no one party's right should take precedence over another's. Cultural, social and economic rights should be recognized in addition to civil and political rights, within a framework where each party's claims can be reviewed and negotiated. This approach attempts to correct the unequal burden of risk (WCD 206). Dam building institutions take on financial risk voluntarily and can define the boundaries of their risk behavior, and this is usually the only risk that is taken into account in the project analysis. However, those affected by the dam take on far larger risks that directly affect their health, well-being, community ties, economic security, and even their lives, often without consultation or consent. These involuntary risk bearers often have the least negotiating power and the least means of recourse when something goes wrong. If the good-faith efforts of all parties fail to result in an agreement, alternative options should be considered or the project should go to arbitration. These decisions should abide by national legislation and constitution as well as international conventions, and citizens should retain the right to challenge decisions and seek reparations in court.

Individual scholars in the emerging body of dam research have also laid forth their conclusions and philosophies on dam development. Scudder[1], a foremost expert in dam resettlement who found that large dams in most cases were "part of a flawed paradigm that causes an increasing disconnection between the necessary environmental health of river basins and the current needs of people and governments for the provision of water, energy, and food" (16). Nevertheless, he still sees dams as a possible development option for governments when needs reach a crisis or near crisis proportion in developing countries. He suggests a participatory options assessment process to maximize and allow an equitable distribution of benefits, as well as to minimize losses.

Biswas[2], a water policy expert, believes that the polarized debate on dams needs to be refocused to consider the overall goals of water development (16). He strongly objects to primarily Western-based NGOs intervening in dam projects in developing countries, asserting that a decision to build a dam should be their own, not be imposed on them by Western activists in a neocolonialist fashion or even by urban decision-makers outside the region. He concludes that the external and internal forces governing the circumstances under which a country decides on a water management solution are so complex that no blanket prescription would work for every case, and dams should not be dismissed a priori before an objective and honest discussion about its trade offs.

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[1] Thayer Scudder, an anthropologist who served as a Commissioner on the World Commission on Dams, who has consulted for several dam projects of the World Bank as well as provided material to the International Rivers Network, is often regarded the world's foremost expert on dam-induced resettlement. Having researched and written on dams for over 50 years, his stance has changed from being a supporter of large dams to a more nuanced stance.

[2] Asit Biswas is founder and director of the Third World Centre for Water Management in Mexico and a water policy expert.

Patrick McCully, a leading figure in the anti-dam movement, holds an opposing view. [3] He disagrees completely with the likes of Biswas and other proponents of large dams, calling the World Water Council that Biswas co-founded the 'water mafia'. In his popular manifesto "Silenced Rivers: The Ecology and Politics of Large Dams", Patrick McCully documents the tremendous hidden costs that dams have imposed on society, and faults the trifecta of development agencies (particularly the World Bank), governments, and dam construction companies for massive human suffering, irreversible ecological damage, and impending environmental disaster. He contends that the benefits of dams have been exaggerated, and could often have been produced by other less destructive and more equitable means (xv).

Examining previous evaluations of dams can provide a clearer picture of whether the costs and benefits have been properly accounted for. This can help to determine in retrospect whether a particular dam was a good investment for a country. While there are many interconnections between all aspects of a dam, I have separated these evaluations into three aspects: financial and economic, environmental and social impacts.

[3] Patrick McCully is also the former Executive Director of International Rivers Network, the leading non-governmental organization dedicated to preserving rivers and campaigning against dams.

# Chapter 2: Evaluations of Dams' Performance Globally

## Where's the Money Going? Financial and economic performance of dams

Financial performance for dams in producing hydropower can be measured in two ways; by comparing the cost of hydropower dams with other options (essentially calculating the opportunity cost of hydropower), or by calculating the estimated internal rate of return (EIRR) on a dam project. These different methods of cost calculation do not line up neatly for comparison, as the first method is a more theoretical options-assessment that makes many assumptions about carrying capacity, load, water volumes and so on. It also assumes away the initial cost of construction, a very substantial assumption as 80% of the cost for hydropower generation is the capital cost of dam construction (McCully 269). On the other hand, if done properly it gives a better context to judge dams' performance, as alternative options may come with huge costs (eg. coal despite its low private costs, comes with high health costs) hydropower may prove to be best solution in final analyses. In comparison, the EIRR measures costs incurred over the duration of dam construction, incorporating unplanned expenses such as cost overruns, time delays, corruption, maintenance and repair costs; and balances it with the realized benefits from the dam.

I calculated the opportunity cost of hydropower dams using data from MIT's Center of Energy and Environmental Policy Research as well as the U.S. Energy Information Administration (EIA). This data compares the cost of electricity generation with existing hydropower facilities in the United States to other forms of

electricity generation (including nuclear energy, traditional coal-firing and natural gas). Greenstone and Looney divided total costs into private costs and external costs; and found that existing nuclear energy was the cheapest option at 2.2 cents per kwh, with the next cheapest option being existing hydropower at 6.4 cents per kwh (2012). The EIA estimation included new generation resources coming online in 2017, and found natural gas to have the lowest levelized cost at 6.31-6.91 cents per kwh, while hydropower had the next lowest levelized cost at 8.89 cents per kwh (EIA 2012).[4]

From this cursory inspection it appears that hydropower is a relatively cheap electricity generating option. However, there are certain important caveats to these calculations. The biggest one is the costs for generation of electrical power depend on the country's natural resource endowments and technological advancement, and its relative ability to use and transport these resources efficiently. In addition, these options are not available to all countries, of which the clearest example is nuclear plant power, which is exploited in less than 30% of the world's nations.

The validity of the calculation is also affected by temporal dislocation as electricity generation technology has advanced significantly over the last fifty years. Older dams built in the pre-war period generate less electricity than new dams due to the effect of sedimentation, and their less efficient design and technology.

There is tremendous hope in the rise of clean alternative energy sources that avoid many of the adverse effects of hydropower. However, 'clean' energies such as

[4] Levelized cost is defined in the paper as the cost of building and operating a generalizing plant over an assumed financial life and duty cycle. It takes into account overnight capital costs, fuel costs, operation costs, financing costs and an assumed utilization rate for each plant type.

wind (9.6 cents per kwh) and solar power (15.2-24.2 cents per kwh) have not achieved the technological and scale efficiencies to be a competitive renewable alternative to hydropower. Hydropower remains an established technology that generates electricity at low cost for a long time period after construction. When evaluating the optimal power generation mix for countries, hydropower (though not necessarily large dams) may still provide the best possible solution.

The financial performance of dams built for other purposes such as irrigation, water storage, safety and multi-purpose dams can be measured by calculating the extent to which the dam has been able to achieve its stated goals; both quantitative (agricultural production targets) and qualitative (flood protection, increased trade).

In the WCD assessment of dams' financial performance, one-quarter of the dams achieved less than planned capital cost targets, but almost three-quarters of the dams experienced capital cost overruns. 16% of the dams cost over twice as much as planned (39). A World Bank study compared hydropower projects between 1965 and 1986 to other development projects, and found that the average cost overrun for hydropower projects were on average 27%, compared with 6% for thermal power projects and 11% for 2,000 other development projects (WCD 41).

These numbers suggest that while there is a tendency for large projects to overrun their initial budgets, dams fare worse even among development projects. The regional variation in cost overruns was also significant — 53% in Latin America, 69% in Europe, 108% in Central Asia, and 138% in South Asia (WCD 40). This suggests a failure of governance on the part of dam authorities. Much of these cost overruns are blamed on time delays due to the discovery of less favorable site

conditions and opposition to the dam. However, this points to a deeper problem of poor development of technical and cost estimates of dams. These estimates fail to factor in realistic delays and resettlement costs, as well as the costs of poor planning by suppliers and contractors. These delays and cost overruns delay revenue generation, increase interest payments, and affect delivery of services, causing a dampening effect on net benefit.

Almost half of the dams in the WCD Knowledge Base fell short of their irrigation target, mostly during the first five years of project life. However, there is high variability, with 50% achieving or exceeding their targets (WCD 43). Smaller dams tend to perform closer to the predicted targets, while all the dams that performed below 90% of their targets were large dams (WCD 44). In cases of dams successfully meeting their irrigation targets, estimation of dam effect is fraught with difficulty due to the presence of confounding factors. Farmers may change the cropping pattern, from staple crops to high-value crops, as in Aslantas Dam in Turkey. This switch to high-value crops increased the monetary value of agricultural production (WCD 44). Improved varieties, mechanization and other yield-increasing technology may also result in increased yields, which makes it impossible to isolate the effect of the dam. It may be argued, however, that these are all multiplier effects attributable to the dam as these developments would not be possible without the dam's supply of water.

**Environmental Performance of Dams**

Dams divert the natural flow of rivers, an important part of a dynamic ecosystem. This monumental change in the natural environment cannot help but have unexpected, and often adverse, effects on its other moving parts. Occasionally they bring about unexpected benefits, such as large dams in South Africa that have become important dry-season and drought refuges for waterfowl. Unfortunately, 67% of the ecosystem impacts are negative, as found in the WCD's Cross Check Survey (93).

Until the 1970s, the environmental effects of dams were not considered when evaluating projects. Since then, environmental impact analyses have become a standard procedure in dam approval, yet according to the WCD's evaluation, the efforts to counter the ecosystem impacts of large dams have only partially succeeded. To a large extent this is due to the shoddy effort in understanding the ecosystem and the possible impacts, the inadequate approach to assessing even anticipated impacts, and only partial success in mitigation.

The World Commission on Dams separates ecosystem impacts into first-, second- and third-order: first order being physical, chemical and geo-morphological consequences of altering a river's flow, second order being changes in primary biological productivity of ecosystems, and third order being impacts that involve alterations to fauna due to a first or second order effects (74). Finally, larger biochemical changes in the natural riverine system causing emissions of greenhouse gases are also assessed. However, as explained in the literature review portion, the irreversible nature of many ecosystem impacts makes it difficult to accurately assess or quantify its benefits or losses. For instance, the loss of biodiversity through

the extinction of yet-undiscovered plant and animal species in riverine systems and pristine rainforests, is a loss to the world that is impossible to quantify (it may be quantified, but outside verification is by definition impossible).

By damming the natural river flow, communities can become more vulnerable to environmental shocks than before. Dam overtopping can cause devastating human losses, such as when two dams burst in Henan, China, overwhelming villages at nearly 50 kilometers an hour. According to Human Rights Watch, an estimated 85,000 died in the immediate flood, and another 145,000 in the epidemics in the ensuing weeks (Scudder 115-117). This potential risk should also be included in the cost-benefit calculations, as the appearance of flood control and safety encourages higher population density at the base of the dam, which can lead to disastrous results if the dams overtopped.

Dams also decimate fish stock (85). This devastates livelihoods of fishermen who depend on river fish for their income as well as low-income river communities that depend on the river's abundance for most of their protein. The low-mineral quality of dam water (as opposed to natural flooding, which flushes down minerals and soil along with the water, creating richer soil) can also lead to reduced agricultural fertility, which leads to lower productivity and an increased reliance on commercial fertilizer.

On the other hand, climate change creates opportunities for using dams for flood control and water storage to bring a measure of stability, essential for economic development, in areas that have seen increasing volatility in snowmelt and rainfall. This is the case in areas of Latin America where the snowmelt caused

by global warming has created a need for reservoirs or other water management systems to eliminate flooding.

Overall, analyzing the ecosystem effects of dams is made difficult by a combination of changing weather patterns, global warming, and a lack of research especially in tropical regions where most of the dam-building activity has been centered since the 1970s. There is a high need for more studies to better understand the ecosystem effects that dams are having on our environment and our future.

**Social Performance of Dams**

The impact of dams on people and society is arguably the most contested and researched effect of dams. The strong activism levied against dam-building by human rights activists is a result of the devastating effect of failed dams on vulnerable communities today and in the past. The human costs of dams range from the most direct, property loss due to submergence by the reservoir, and extend to loss of economic livelihood due to displacement, break-up of community and its resulting negative effects, a loss of culture and identity, deterioration in health (especially the reservoir-related spread of schistosomiasis, a devastating water-borne disease parasite that thrives near dams), and social marginalization and conflict in the resettled area. These effects continue for generations, and often the affected peoples cannot recover their previous standard of living.

Thayer Scudder's research on dam-induced resettlement underlines the severity of this problem. Of the 44 large dams he surveyed, only three of the resettled populations of those dams had improved their living standards, and five

others had restored them. The other 36 populations experienced worsened living standards after resettlement (Scudder 61).

These costs are disproportionately borne by the poorest and most vulnerable sector of society, the indigenous people who sustain themselves from the richness of river basins and forests as well as rural farmers who have little or no integration into the cash economy. In addition, the promised benefits of increased irrigation, electricity, flood control, tourism and reservoir fishing have often been diverted away from these sectors most impacted by the dam.

There has been very little investigation on the economic impact of social costs. One of the obvious shortcomings of the current options evaluation process is measuring value gained or lost simply by measuring the change in income or compensation with land or cash. The rest of the losses or gains must be quantified or the cost benefit analysis will naturally be skewed toward the highest income producing uses like hydroelectricity rather than the less tangible benefits of culture preservation, environmental protection and biodiversity. At the very least, the dam cost projections must include adequate (the WCD recommends generous) compensation, and provisions for development opportunities to ensure that the welfare of resettled populations is improved through the dam. While there is a measure of uncertainty, the total costs for resettlement are not difficult to calculate. The hesitation to do so usually stems from the unpleasant fact that a complete accounting reduces the return on investment for the project. When it is in the interest of state officials, dam building consultancies and funding agencies to get projects approved, these costs can easily be manipulated to show a positive return.

Michael Cernea, in his risks and reconstruction model, points out that conventional risk analysis calculates the risk taken by capital shareholders, due to the government taking steps to provide guarantees, but the high risks borne by resettlers is not in this equation despite them having the most to lose. He argued that risk analysis for dam projects had to 'recognize risk distribution among all project actors and address equitably the direct risks to area people as well' (Cernea 1581).

Scudder, Cernea, and other experts in the field caution that resettlement may be too complex a process for project authorities to manage successful outcomes. Hence, project authorities should preferentially select options that minimize or avoid involuntary resettlement, and this has been incorporated into World Bank resettlement guidelines. Unfortunately, the trend of building large dams has gone in the opposite direction, with two of the largest dam-building countries, India and China, building dams on major rivers that will displace upwards of one million people.

There are also many social benefits that are directly attributable to dam development including reservoir tourism, as well as the intended benefits of increased incomes to downstream farmers, stable electricity, and flood control. However, as previously discussed, these benefits from dams are difficult to isolate and have been poorly studied, not to mention highly prone to capture by well-connected elites, as shown in many cases in India of reservoir fishing licenses being given to contractors from outside the catchment area. On the whole, these benefits

have not benefitted the intended recipients as much as hoped, and in many cases worsened their living conditions and narrowed their opportunities.

**Dam Cost Benefit Analysis**

The capital expenditure for the construction of dams is frequently funded by loans from development agencies and banks. The criteria for loan approval has historically been tied to a certain economic internal rate of return (EIRR) and financial internal rate of return (FIRR). These are used to determine the economic return to the country and the profitability to the project funder respectively, and have traditionally been determined with cost-benefit analyses.

WCD figures show an average of 10.5% economic internal rate return on fourteen projects funded by the World Bank and Asian Development Bank (47). In the WCD evaluation studies of nine large dams, only one project, Tucurui Dam in Brazil, failed to meet targets by a significant amount (56). In this dam, the large subsidies to industry and the operating facility as well as large cost overruns during the building process eroded any competitive advantage the dam had in producing a cheap source of hydroelectricity. In this case, the failure of government is especially apparent as there were little efforts to aim for economic profitability or cost recovery in the planning process.

Due to the low reliability and availability of official project appraisals and the lack of long-term studies on dams' economic returns, it is difficult to say whether dams have created positive financial and economic return on average. There are

also significant problems with using pre-project cost-benefit analyses as the basis of evaluating a project's return.

First, cost-benefit analyses are not always done before a project and are often done ex-post to justify the cost of a project. The World Bank's 1991 review highlighted that it is 'common practice when bureaucrats propose water projects in India to ensure project acceptance by inflating benefits and underestimating costs' (World Bank 22). Second, cost-benefit analyses often only account for a small set of economic costs and benefits. For example, cost overruns due to project delays are often not budgeted for in the project. More importantly, the cost of resettlement for affected communities is also often not included in the costs, and even when it is; little effort is made to seriously consider compensation that goes beyond the price of land and new housing. Other long-term costs such as economic schemes to help the livelihood of the dispossessed are not included into cost calculations. Environmental destruction to the area is also not quantified and the cost of efforts to mitigate the damage not included in the budget.

Almost no cost-benefit analyses include the projected cost of decommissioning, the inclusion of which is standard in the nuclear plant industry (McCully 127). When the costs of maintaining a dam exceed the benefits generated from its use, or the aging plant becomes a safety hazard to nearby dwellers, plans must be made on how to repair or decommission it. These costs, in addition to lifetime maintenance and repair costs, are not always included in the cost-benefit analyses.

From an economic standpoint, the other missing component from cost-benefit analyses is a comprehensive evaluation of the opportunity cost of dams. Due to the significant capital expenditure (ranging from a million to tens of billions of dollars) required, a dam is a large and potentially risky investment for any country. Dams involve significant upfront cost, years or even decades of building with no revenue generation, and a long repayment period that can tie up a country's budget, all while providing no guarantee of future benefits. With the high capital cost necessitating large loans from development agencies and banks, countries are vulnerable to currency devaluation and interest rate fluctuation.

Other development needs, such as sanitation, education, roads and health provision, are less glamorous and flashy than a dam, but may nevertheless generate a higher economic return and spur development in an impoverished region. These options need to be given equal consideration besides dams. With regard to the function of dams, other options such as watershed management, smaller flood control or irrigation structures, and other electricity-generating options such as natural gas and solar ought to be considered as well.

On the benefits side, the WCD acknowledges that the multiplier effects from a dam is difficult to foresee and has not been adequate studied. Rita Cessti and R.P.S Malik examined the indirect economic impacts of three dams: Bhakra Dam in India, High Aswan Dam in Egypt, and Sobradinho Dam and Reservoirs in Brazil (19). Using different input/output models, they calculated several scenarios to find the regional value add or income multiplier values with and without a dam. In all cases, the net effect on income was a positive multiplier; as agricultural productivity and area

increased, stable electricity was made available to rural households, and flood control was implemented. These have led to an increase in income, particularly for the poorest households. However, by only assessing changes in income, they failed to account for other costs that the dams bring, including, increasing soil exhaustion and salinity, a decline in shrimp and sardine fish catch, and an increase in schistosomiasis, and degradation of formerly cultivated land in the High Aswan Dam, as well as the displacement and poorly-planned resettlement of 25,000 people in the Sobradinho Dam. Hence, the multiplier effects on income do not necessarily capture the full range of benefits and costs (particularly non-monetary changes caused by the dam) that dams bring.

Esther Duflo and Rohini Pande's paper "Dams" examined the distribution of benefits and costs of dams. It examined the correlation between dams and income across different states in India, and showed a redistribution of benefits from catchment area (upstream) farmers to downstream farmers. There was a slight decline in poverty for downstream farmers, but a large increase in poverty upstream as farmers are forced out of productive lands to less productive areas. In addition, they found that "in areas where the institutional structure favors the politically and economically advantaged, dams cause a greater increase in poverty" (640). With a development project where the most advantaged groups can easily capture the benefits while the poor bear the brunt of the costs, it is important to examine closely the equity effects on society.

**Political and Institutional Context Matters**

Thus far, I have attempted to analyze dams' benefits and costs neutrally. However, it is important to acknowledge the larger political and economic system in which these projects are created and realized, which brings us to the politics of dam building.

As previously discussed, the WCD failed to bring all stakeholders in the dam industry to consensus. Anti-dam activists believe the WCD did not put enough emphasis on alternative water management solutions or seek sufficient engagement with the World Bank to create greater impact, while the dam industry and the largest dam building countries see the WCD as unfairly critical of dams by not doing enough to acknowledge the great importance dams play in a nation's development. The WCD and anti-dam movement has also been criticized as being hypocritical, since the largely first-world activists have the luxury of preaching the anti-dam gospel after their own water resources have been fully exploited and their population's water and energy needs are secured. Thirteen years after the WCD, contrary to Patrick McCully's hope that "the dam industry is entering a recession that they will never recover from" (309), it has actually seen a renaissance.

Water security has become a vital issue in our global political economy, and international disputes stemming from competing national interests, such as in the Mekong River which spans five South-east Asian countries; will become increasingly important. Costs and benefits of future dams will be disbursed not just to different populations within a country but to different countries; and the compensation and negotiation process must also be a multilateral one. In cases where there is a huge difference in economic and political might between countries (for example, between

Nepal and India), it would be easy to imagine how cost and benefit distribution may be inequitable.

We will investigate how this happens in the next section, which focuses on India's dams and the Sardar Sarovar project in particular. There are several reasons why Sardar Sarovar is a good case study to illustrate these challenges. First, with its dubious status as the most well-known dam controversy in the world (more recently, the Three Gorges Dam in China may have taken that title), there is a sufficient amount of academic literature and public documents for it to be possible to analyze the situation *ex situ*. Second, it involves almost all of the adverse impacts of dams — displacement, exploitation of indigenous rights, environmental destruction, loss of culture and social cohesion, and widespread corruption. Third, the complex interactions of India's political system, whereby states and federal government share power, make it a useful case to observe how the interplay between different state agencies, the judicial system and the wider international funding agencies affected every aspect of the dam development; from initial decision making to construction to subsequent apportioning of cost and benefits. Fourth, the Sardar Sarovar dam was the birthplace of the global anti-dam movement based in the South with the Narmada Bachao Andolan (Save the Narmada River), and its ripple effects have been instrumental in changing policy as well as people's attitudes towards dams not only in India but throughout the dam-building and funding world.

# Chapter 3: The Sardar Sarovar Project, 1957-2006

## Historical, Political and Economic Context of Indian Dams

Agricultural irrigation in India has developed in traditional forms for thousands of years; spanning the gamut of small dams, wells, rainwater harvesting, and other terrain-specific irrigation methods. The temporal and geographical scarcity of water in India has been an ever-present concern throughout its history.

In the 1960s, the Green Revolution began in India; tripling rice yields and leading to massive growth in agricultural productivity. Between 1951 and 2000, food grain production in India nearly quadrupled, with 2/3 of this increase coming from irrigated areas (Duflo 606). New intensive cropping methods required far more water, leading to a greater need for dams to provide a stable irrigation supply for farmers and a cushion during times of drought. Dams in India are estimated to have contributed between 10% and 80% to the growth in India's agricultural production since 1950 (WCD and ICOLD figures, respectively).

Planners and international agencies responded to the increased need with dam-building fervor. Between 1950 and 1993, India was the largest single beneficiary of World Bank lending for irrigation. There were over 4,050 dams in India in 2006, with another 475 under construction, of which over 80% are irrigation dams (Central Water Commission 2004).

In addition to the building of dams for irrigation, hydropower dams are a solution used by the government to meet the increasing needs of the Indian industry, particularly in aluminum manufacturing. Hydropower in India is a cheaper option

than thermal production (from coal and gas). Indian industrialists, who in general are supporters of hydropower, are well-connected and able to influence government decisions and policies in support of their interests (Dwivedi 123).

Decision-making on water policy and dams in India is a complex issue. Water rights in India are constitutionally state matters, but inter-state water disputes can be referred to the government for an investigation by a federally appointed tribunal, which will then appoint a final verdict. However in the Sardar Sarovar Project (SSP), various stakeholders who were not included in the original investigation repeatedly challenged the verdict of the Tribunal. This further illustrates the difficulties of apportioning benefits and costs in a complex and dynamic environment.

'Center-state relations' (the relationship between the federal and the state governments) were extremely influential in the planning and construction of the SSP. During certain periods of SSP dam contestation from 1963 to 2006, particularly in the mid-60s and 70s, the party in power at the national level was weak and required state support. This enabled politicians of strong states like Gujarat to wield more power in negotiations with the government. This compromised the ability of the federal government to bring states together and act decisively on the SSP.

The context of Indian political and economic culture is highly relevant to the problems that arose with the SSP. It is one that is rife with endemic corruption; a problem enabled by bureaucratic red tape, opaque policies, and the wide income and education gap between elites and the poor. In 2012, India ranked 94$^{th}$ of 183 nations on the Transparency International Corruption Perceptions Index. This has adversely affected the amount of net benefit that India gains from its dams. The

WCD found that dams built in South Asia were most likely to exceed projected construction costs due mainly to time delays. India also has "the worst record on resettlement for any democratically elected country", displacing over ten million people from dams alone (Scudder 2003, 3).

The communities affected by the SSP were particularly vulnerable. Tribals (adivasis), a group that is considered even lower than the lowest rank in the caste system, are only 5% of India's population but comprise more than 50% of those displaced by dams (Parasumaran 1999, cited in Scudder 2003). As they sustain themselves on the produce of the forest and are mostly self-sufficient, with little need for the cash economy, they are most likely to lose their livelihoods in the displacement process. They are also the least politically enfranchised group, which has made them most vulnerable to exploitation and unfair treatment (Baviskar 1999).

Social action groups (non-governmental organizations) advocating for tribal's rights and environmental issues became significant players in the SSP dispute. They successfully brought widespread media attention to their causes, and were able to use public opinion to apply pressure on state and national government to provide better compensation for the displaced communities.

**The Sardar Sarovar Project**

The Sardar Sarovar Project is situated on the Narmada River, the largest river in western India and the fifth largest in the subcontinent. It flows east to west, through a relatively narrow valley for 1300 kilometers from the Western Ghats to

the Gulf of Cambay. It takes up a total of 800sq km, and is distributed throughout Madhya Pradesh (87%), Gujarat (11%) and Maharashtra (2%). Annual flow averages 45,000 million cubic meters (36.48 million acre feet - MAF), with over 90% of runoff during the monsoon season (Dwivedi 59). Agriculture is the main economic activity in the Narmada River basin, with livestock management, foraging, and fishing in the tribal areas. For centuries, the Narmada River has held special spiritual significance to Hindus and is regarded as India's most holy river, with many travelers walking the length of the river on pilgrimage (Baviskar 1999).

The Narmada Basin development program, as sketched out in the Tribunal Report, is a cascade of dams on the main stream and on major tributaries. Sardar Sarovar Project was to be the only one on the main stem of the Narmada in Gujarat, the rest of the projects being in Madhya Pradesh (Scudder 2003). The Sardar Sarovar Project would divert 9.5 MAF of water annually out of the total agreed-upon flow of 28 MAF.

Under the Tribunal's agreement, the water benefits of the dam would mostly accrue to drought-prone Gujarat, while the hydroelectricity benefits would go to the less-developed states of Maharashtra and Madhya Pradesh. The main canal would irrigate an area of 1.8 m.ha, roughly 20% of the total cultivable area of Gujarat. A canal network of around 50,000 km would serve this command area. The main canal with 31 branch canals will cover 12 districts and 3,344 villages in Gujarat. The 1,450 megawatt installed capacity from the SSP would be fed into the Western Regional Electric Grid, and its benefits would go mostly to Madhya Pradesh and Maharashtra.

The projected costs for this project range from $15 billion over 45 years, to Rs 62.6 billion (see Table 1 in Appendix).

As with all large infrastructure projects, despite a net benefit to society, the SSP will create winners and losers. A potential beneficiary of the project is the industrial sector, which consumes 70% of electricity in India. Industrial estates expect power and water benefits from the dam, and have the most political and economic power to ensure that the benefits are diverted to them first (Dwivedi 123). Farmers at the head end of the command area, comprised mostly of rich farmers doing capital-intensive agriculture, will be the first to benefit. Farmers at the tail end of the command area, in places that are drought-prone, will only receive benefits at the pace of irrigation infrastructure (Dwivedi 124). In addition, a higher demand for wage labor will benefit local villagers as irrigated farming develops, creating a multiplier effect. Professionals such as NGO workers and project administrators and bureaucrats will also benefit, as skilled labor constitutes 27% of project costs (Dwivedi 126).

Less publicized but certainly present are the gains to rent seekers, those who benefit materially from corruption present in each aspect of planning and execution of the project - contractors, bureaucrats, consultants, politicians (Dwivedi 126). Finally, affected villagers and fishermen benefit from an improved drinking water supply. This benefit however, cannot be expected until 20 years after dam completion. Fisheries can expect reservoir development, however the gains are prone to capture by private contractors who buy up the auctioning rights.

Downstream farmers may gain some benefit from the periodic drawdown of water from the dam (Dwivedi 127).

The biggest losers are farmers in the reservoir zone, although the relative impacts will differ based on region and ethnic group. Families with large holdings in fertile areas lose the most, as there is a cap on compensation. Adivasis, who are least integrated into modern society, suffer due to social marginalization when resettled, and are not compensated for the loss of common resources, which allowed them to live off the land. Landless laborers and marginal farmers, who comprise more than 50% of project-affected people in the reservoir zone, also face high risks of impoverishment (Dwivedi 128). Women also often suffer disproportionately in the resettlement process as they lose their common resources and social networks, depriving them of their economic contribution to the household and their community support (Mehta 115, cited in Dwivedi 129). Canal-affected people, fishermen, and forest encroachers also face economic losses with no certainty of compensation or benefits, as they are not included in the compensation scheme (Dwivedi 130).

While the displacement costs are likely to be extensive, there have been no definite figures on the number of people affected. Figures range from 90,000 people (with an average of 6 in a family) to over 500,000 people, when canal owners, landless laborers, and forest encroachers are included (see Table 2 in Appendix).

**Alternatives to Sardar Sarovar Project**

What are some of the alternative water management schemes that would provide benefits to the affected people with fewer negative impacts? One solution is to build smaller, community-managed village dams and water structures. An unpublished study from the Narmada Valley Task Force, formed by the government of India in 1988 and consisting of independent experts, government officials, and NBA representatives, investigated the possibilities for non-conventional power sources (Dharmadhikary 2000). The WCD also emphasizes the need for demand-side management and improvements in the efficiency of water and electricity distribution, as open reservoirs lose a lot of water simply through evaporation (221).

One alternative that was studied by Scudder is the Bunga check dams, set up in a small village of 178 families. Researchers from the University of California found the dams created significant benefits and multipliers that increased income to villagers and surrounding areas, including reduction of rainy season flooding, a reduction in erosion due to catchment protection, and a raised water table that allowed the introduction of a tube well. Marginal and small farmers increased their incomes by a greater percentage than medium and large farming households (Scudder 2003).

The Government of India's and the pro-dam establishment's response to this is that these alternatives are unrealistic (Biswas 5). Even if they are able to provide a decent amount of water for a community's irrigation and electricity, small dams cannot meet demand for water security, because they do not store enough water for sustenance during drought periods. In addition, some communities (such as in "thirsty" Rajasthan) do not have enough water to sustain their needs locally.

Small dams or other small-scale solutions provide less incentive for political adoption. They lack glamour, and do not provide politicians and local governments the level of publicity that they need for re-election. The decentralized nature of small dams and community management also means that there are fewer opportunities for personal gain by taking advantage of massive coordination problems. For similar reasons, the rejection of small- scale and alternative solutions to large dams in India is echoed on the international stage.

# Chapter 4: Critique of Cost Benefit Analysis and Implications for Decision-Making

## Cost Benefit Analyses in the SSP

It is striking to note how all the decisions on whether Sardar Sarovar dam should be built, its technical details (height of the dam), the apportioning of benefits and extent of rehabilitation costs were not dependent on one pre-project cost-benefit analysis, but were hammered out through a series of multi-year negotiations and confrontations between various quarters. All the parties involved invoked some form of cost benefit analyses as a means of justifying the course of action they promoted. By examining these analyses, we see how changing the assumptions on which cost-benefit analyses are determined, can drastically alter the rational path of action, and how economic arguments can be used to disguise or justify political decision.

The conflict in the Sardar Sarovar Project began as an inter-state water dispute. The states of Madhya Pradesh and Maharashtra, located upstream of the river, wanted to build their own dam to generate hydroelectricity and were resentful of sharing what they saw as their rightful resources, even though they had less need for the water at the time than the more-developed state of Gujarat. Madhya Pradesh and Maharashtra repeatedly tried to block Gujarat's claims in the courts, and protested to Rajasthan, a non-riparian state, being included as a claimant to the dam as Rajasthan would side with Gujarat. Gujarat wanted the dam to be built to channel water to its arid western regions. Gujarat had a more effective and

politically connected government that was better able to argue their needs, and therefore was often able to win in the water disputes.

As the allocation decisions often depended on relative states' bargaining power rather than on an equity principle of helping the least developed, the less-developed states received proportionately less benefits. The Khosla Committee[5], judging based on national interest and the maximal benefit from allocation, favored Gujarat in their decision. There was an evident tension between upholding states sovereignty and serving national interest. This was especially evident in the decision to include Rajasthan, a non-riparian state, as a disputant, as under an ownership paradigm they should not be included. However, due to their need for water, even the high cost required to build canals reaching into Rajasthan was justified in the national interest.

In addition, the original cost-benefit calculations from the Khosla Committee continued to be used in the Narmada Water Disputes Tribunal (NWDT) decision to allocate benefits and costs for each state. Reappraisals in the 1990s conducted by both the government of India as well as the World Bank showed a positive internal rate of return (Table 3 in Appendix). Anti-dam activists argue that the true resettlement and environmental mitigation costs were flawed, due to a lack of political will to calculate the true costs. In the later years, as the NBA (Narmada Bachao Andolan), the leading anti-dam NGO in the SSP, increased its influence, it continually challenged the accuracy and veracity of the NWDT's claims. The government continued to assert that the SSP would result in a positive internal rate

[5] An expert committee headed by A. N. Khosla set up to apportion benefits fairly among different states. Please refer to SSP Timeline in Appendix for further details.

of return, but it did concede to increasing rehabilitation and resettlement compensation for resettlers. The advocacy of the NBA also rekindled worldwide interest on the relative costs and benefits of dams, which was part of the impetus for studies such as the World Commission on Dams.

The Tribunal's decision, as covered by India's Water Disputes Act of 1957, is meant to be final; but the steps of its implementation were not specified in the Award. To do facilitate this process, the government set up the Narmada Control Authority (NCA). However as the legal process was continually challenged in court by public interest litigation over the next few decades, the question of whether the dam should even be built came to the forefront. There also existed significant internal and external pressure to reassess the project – from within the government (through the Ministry of Environment and Forests with the passing of India's Environmental Protection Act), from local and international NGOs, and from international funders (The World Bank Independent Review reviewed the project negatively).

The significant negotiation and concessions from the state governments in the terms of the Award showed that decisions of NWDT were not completely binding, which allowed more questioning of the rationale of the entire project. India's prior record on resettlement has been heavily criticized, but it does have a strong democratic tradition, powerful media, and viable political opposition. This environment allowed for advocacy groups to trigger public debate and gain media attention.

The strength of civil society in advocating against the SSP was not entirely a good thing for the efficacy of the dam building process. The absence of a strong state able to execute effectively and quickly, combined with a lack of political will to push through an unpopular decision, led to many delays, which increased costs and reduced the IRR of the project. Contrary to the aims of the NGOs who advocated on behalf of the resettled groups, the uncertainty, delays, and lack of information placed huge psychological stress on would-be resettlers, whose living standards often worsen as they are unable to plan for the future nor given the compensation they were promised (Scudder 33).

As a last resort, the NBA put their faith in the judicial system to stop the dam building process, filing a writ petition against the government of India. Initial environmental clearance required states concerned to take certain steps including resettlement and rehabilitation, *pari passu* (in step with) the construction of the dam. The NBA alleged that this was not done, and on that basis filed their suit. They sought for all construction on the dam to be stopped, and the case eventually went to the Supreme Court. They were hopeful of the Supreme Court's support, as the courts had previously issued a stay on construction in 1995. Much to their surprise, the Supreme Court's final decision in 2000 was that the conditions had been followed, and that SSP's construction could be resumed immediately. The Supreme Court justified their decision as one of maintaining the separation between judiciary and the executive/legislative powers, and disclaimed responsibility for deciding on whether the SSP represented a net benefit for the country. Many saw in the SSP decision the Supreme Court's a move away from entertaining public interest

litigations (Wood 191). In the next section, which views the Sardar Sarovar debate through a political lens, I will examine the arguments put forth by the Supreme Court, particularly in regards to cost benefit analysis.

**Political Uses of Cost Benefit Analysis in the SSP**

The SSP dispute started as one between state riparian rights and national interest. In the 1970s, around the time of environmental movement's rise in the West, the first activist groups started bringing attention to the plight of adivasis and other vulnerable groups. The debate became one of redistributive justice and fair treatment, and there was room from negotiation between the state governments and the activist groups. However, as the crisis deepened, and evidence of the empty (or erratically fulfilled) promises of resettlement increased (particularly in Madhya Pradesh), some NGOs changed their stance towards the dam. The NBA, which worked primarily in the poorer states of Madhya Pradesh and Maharashtra that bore most of the resettlement and environmental destruction burden; adopted a radical stance against all dam projects. This stemmed from their disillusionment that the government and project authorities were serious about conducting proper rehabilitation, as evidenced by the lack of a national resettlement policy that was due in 1980, and the appalling lack of studies on the extent of rehabilitation and number of people who needed to be resettled. Tellingly, this information is still not available from the government today.

In contrast, ARCH-Vahini and other NGOs working in Gujarat were more amenable to negotiations with project authorities for better resettlement conditions.

Their early victories in gaining concessions for Gujarat oustees may have shaped their political views, just as the reluctance of authorities to act on the heavier human and environmental costs in Madhya Pradesh hugely influenced Medha Patkar to radicalize NBA. As the NBA gained momentum and gained strength and legitimacy from the international anti-dam movement, the critique against dam projects evolved into a larger socialist critique of capitalism and the development paradigm.

The radical stance adopted by the NBA and other groups had significant political implications. Although NBA lost the SSP battle, they had moved the needle on the public's understanding of the issues concerning dams and large infrastructure projects. Their advocacy brought international attention to the Indian government's lack of care in resettlement and environmental mitigation, and their work has improved the rehabilitation terms at least on paper. What was the cost however, at which this was achieved? It may be argued that through their hardline position, the NBA alienated more people than they enlisted, and as a result created general skepticism of anti-development critiques in India. There are some indicators that public opinion turned against the NBA in 1999-2000, but with the quick reversals of politics, there may be a resurgence of anti-capitalist politics at some point in the future (Wood 178). What is less speculative are the very real effects of defeat for oustees. The villagers who played a leading role in the NBA now find themselves on the losing end, having lost everything they owned and forced to ask for the little compensation they are entitled to from their previous opponents (Dwivedi, xxiv).

Besides advancing public understanding of the costs associated with dam building, the other significant contribution of the NBA and other groups that opposed the dam, including the World Bank Independent Review, was to challenge the legitimacy of cost-benefit analyses done ex-post to justify the dam. The official figures are reliant on so many assumptions of uncertain variables (rainfall, siltation rates, costs of submergence and rehabilitation) that it is hard to disclaim the possibility of political manipulation. The NBA movement was unconvinced by multiple reappraisals of the dam by the government and the World Bank, which showed a positive return as they continued to doubt the methodology of their analyses.

As Theodore Potter writes, "the power of techniques like cost-benefit analysis lies not in their actual results but in the promises that these results are available through their application. The essence of the promise of these results lies in the legitimacy of the ritual" (1991, cited in Dwivedi 119). Cost-benefit analysis operates upon the assumption that the preferences of decision-makers reflect broader societal values. State objectives become proxies for societal welfare. In assessing the merits of various projects, the cost-benefit analysis will thus take into account the state's objectives, what it wants to do with resources and how it wants to distribute them. The analysis ought to echo state preferences in resource development (Dwivedi 122). This preference of state interests over other stakeholders' interests leads to restrictions on information and access, especially from 3rd party observers or anti-dam advocates. Scudder writes of being prohibited from meeting NGO leaders while on a World Bank mission to assess rehabilitation

policies, an act that restricted his ability to observe conditions firsthand (Scudder 2003). Another example of this is the lack of a national rehabilitation policy, a key human cost and a significant right of the displaced communities. This is in spite of overwhelming evidence and strong recommendations from multiple observers' reports.

A legitimate cost benefit analysis cannot be done ex-post as there is no incentive to find out the true costs and benefits and compare them to other alternatives when the decision to proceed has already been made. The appropriateness of cost benefit analyses' conducted at one point in time is also inherently limited. Estimations of costs increase as more information becomes available, as in the rising estimations of resettlement costs; and dynamic factors such as raw material prices fluctuate - thus the assumptions of the original cost benefit analysis are no longer valid. As Dwivedi points out, the cost of the SSP has increased rapidly, from an initial estimate of Rs. 42,000 million in 1982-83, to about Rs. 146,000 million in 1991-92, a 130% increase over the costs approved by the Planning Commission in 1989 (225). The actual considerations of what should be included in cost estimations have also changed considerably as public understanding of the need for more equitable resettlement compensation, and environmental mitigation increases. Even the most comprehensive cost benefit analysis conducted in the 1950s would not be valid half a century later.

The SSP illustrates how ineffective government and protracted dispute directly increases economic cost. If the project authorities had been willing from the mid-1980s to implement the minimum requirements of the World Bank's guidelines

on involuntary resettlement and on tribal people, and follow the requirements of their own Narmada Water Disputes Tribunal which stipulated the way in which Narmada basin development was to proceed, it is quite possible that a 138 meter high dam would have been completed during the 1990s. In that event estimated expenses exceeding one billion dollars due to opposition-caused delays could have been avoided (Blok and Haas 2003, cited in Scudder 2003).

Cost benefit analysis is not value free. The cost benefit analyses done by project authorities privilege a different kind of risk from the alternative ones proposed by the Narmada movement privilege different types of risk. Project authorities valued optimal risk, which leads to a higher willingness to bear costs in order to reach a theoretical "optimum". In contrast, activist groups prioritized oustees' welfare and minimizing environmental destruction; and focused on minimizing and were willing to give up uncertain returns to avoid certain losses (Dwivedi 194). As a result, the benefits are overstated and cost understated in the former, while the opposite occurs in the latter.

As Iyer[6] notes, even the language used in cost-benefit analysis can obfuscate the true issues involved. For instance, terms such as stakeholders are misleading as it gives every party an equal, neutral stake in the discussion, even those who may not have legitimate claims on the benefits. The losses of a company or the World Bank from a stake in financing the dam cannot be compared to the loss of a landless farmer in the command area, although the latter's financial loss may be monetarily

[6] A member of the Five Member Group (appointed by the central Ministry of Water Resources in response to the Narmada movements demands for independent evaluations of the SSP) as well as the a member of the team that wrote the India country study for the WCD Report.

much less than the former. The term stakeholder also masks the fact that there are unwilling victims to development. In fact, due to the redistributive nature of the dam, some people are stake-losers and others are stake-winners (Iyer 2001).

Stating an argument in the framework of cost benefit analysis is a persuasive tool that was employed by both sides. The NBA intentionally used the language of science and invoked cost-benefit analysis techniques to win support, despite beliefs within the movement itself that these were flawed techniques. Some of the issues challenged by the Narmada movement are outlined in the Appendix (Table 5). By employing scientific terminology and appropriating knowledge used by the project authorities to object to the dam, the Narmada movement sought legitimacy for its claims, cast doubt on official figures, and placed pressure on the government to improve their terms for rehabilitation by awaking public scrutiny.

The subjectivity of cost-benefit analyses and the extent of political influence upon these figures were also thrown into relief by the arguments from the Supreme Court's ruling. The Supreme Court's justifications for its decision were skewed towards large dams, citing the benefits that dams bring without consideration of the large body of literature that disputes these benefits. The Supreme Court also disagreed that oustees' fundamental rights were violated through displacement, justifying this with the argument that living conditions would be much better for them than what they had in their 'tribal hamlets' (Wood 180).

In their judgments, they found the NBA guilty of negligence of duty in not approaching the Court before 1994, by which time construction had begun, and significant amounts of public money had been spent. They also judged that issues of

the height of the dam, extent of submergence and hydrology was not a matter open to challenge from the petitioners or within the jurisdiction of the Court. By doing so, they curtailed the ability of the public to challenge government decisions through the Court. The Court also found the rehabilitation and relief measures adequate, and upheld the binding verdict of the Tribunal's award (Wood 179-184). In the end, it was a judicial decision that ended the stalemate between the government and the anti-dam opposition.

Some observers speculate that there were significant political considerations in the Court's decision. At the point of the judgment, over half the dam had been built and millions of dollars spent on its construction. A complete stop of the dam would not only reflect badly on the government of India, and bring into question the legitimacy of numerous other ongoing dam and development projects, but also ensure that no benefits would ever come from the long-awaited SSP (Wood 182).

## Conclusion

The debate regarding dams places countries into two camps, with developed countries on one side and developing countries on the other. It reflects conflicting visions of development. Developing countries argue that a double standard is placed on them, as developed countries were not required to abide by very high standards when they were still developing. Developing countries often frame environmental mitigation and the strong protection of human rights as 'luxuries', while developed countries see them as necessary boundaries of development.

Something that is often lost in the righteous struggle of anti-dam activism is the lack of development can be just as devastating on the environment and people as the developments which they oppose. Despite all the challenges and uncertainty in picking a path for development, different sides must engage to create a new paradigm. This challenge must be met with new tools and with a willingness to compromise, an emphasis on equitable development, and a move away from pure economic accounting. Equitable compensation and a fair share of the benefits to oustees is an achievable goal that must be prioritized, and will answer many of the reservations of the anti-dam movement. Environmental ramifications remain harder to account for and to mitigate, but as new data becomes available, it should incorporated into analyses and policy.

The controversy over the costs and benefits calculations on both sides of the divide in the Sardar Sarovar project illustrates that cost benefit analyses can be subverted into a strategy of competing truth claims with both sides seeking to claim

the higher ground of rationality and neutrality. This decades-long struggle shows that at the end, cost-benefit analysis, with all its uncertainties and contingencies, is a fraught exercise whose final result is often more dependent on political variables than economic ones.

# Appendix

Table 1. Projected Costs

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|---|---|
| NWDT Award | $15 billion over 45 years for the entire Narmada Basin program (including SSP). Total cost of SSP (1983) set at $6.3 billion. |
| Tata Economic Consulting Services | Rs 48,870 million over 23 years. |
| World Bank (1975) | Rs 62,639 million for power and irrigation dam. |

*Source: Dwivedi 109-110*

Table 2. Displacement Figures

| Source | Number of Displaced |
|---|---|
| Narmada Water Disputes Tribunal (1979) | 6,603 families in M.P. and Maharashtra, another 8,500 families in Gujarat based on 1981 census. |
| Government of India (1983) | At least 225,000 individuals, given approximately 5.5 members per family in Gujarat, 6 in M.P. and 8.5 in Maharashtra. |
| World Bank Independent Review (1992) | Estimated 25,000 families to be resettled from Madhya Pradesh and Maharashtra. |
| Michael Cernea (1999) | Over 200,000 people. |
| Thayer Scudder (2003) | Including canal owners, landless laborers, and forest encroachers, number of those displaced could exceed 500,000. |

*Sources: Dwivedi 128, Scudder 2003.*

Table 3. Return Calculations

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| Gujarat government's 1983 appraisal | 18.3% at 12% discount rate, project horizon of 51 years |
| World Bank's 1985 estimation | 13% at 12% discount rate, project horizon of 50 years |
| World Bank's 1985 sensitivity analysis (risk analysis) | Projected ERR between 7.4% and 18.9% |
| Gujarat government's 1988 reappraisal | 13.12% IRR, with assumption of 10 years project implementation instead of 17-22 years |
| World Bank's 1990 reappraisal | 12.1% IRR, with assumption of 12 years construction instead of 10 years |

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| | - Adjusted resettlement costs upwards by 300%, yields in less suitable soil adjusted down 25%, environmental benefits and losses added |

*Source: Dwivedi 115*

Table 4. Timeline of Sardar Sarovar Project

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| 1946 | Government of two states ask the Central Waterways, Irrigation and Navigation Commission (CWINC) to undertake a basin-wide investigation of the Narmada River from the standpoints of flood control, irrigation, power and navigation possibilities. The commission reveals excellent prospects and recommends seven potential sites. |
| 1950 | Planning for water resources development in the Narmada Basin begun through three major projects. The downstream most amongst the three subsequently named the Sardar Sarovar Project after Sardar Patel. |
| 1957-1959 | Preliminary proposal revised to build the reservoir in two stages, from Full Reservoir Level 49m in first stage and to FRL 96.7m in second stage. |
| 1955-1956 | Gujarat and West India faces drought. |
| 1961 | Bifurcation of Bombay state becomes Gujarat, first stage of construction approved in February. Jawaharlal Nehru, first prime minister of independent India, lays foundation stone. New states of Gujarat, and Maharashtra and Madhya Pradesh upstream review planning afresh. |
| 1963 | After new surveys done a new dam site with greater storage capacity is selected, and the plans discussed at meetings between the government and Gujarat and Madhya Pradesh chief ministers. Results in the Bhopal Agreement, sharing costs and benefits between Gujarat, Madhya Pradesh and Maharashtra. |
| 1963 | Bhopal Agreement is rejected by the Madhya Pradesh Legislative Assembly, but ratified by the Gujarat Legislative Assembly. The height of the Navagam dam determines the extent of the irrigation potential in Gujarat but also the amount of submergence affecting Madhya Pradesh and Maharashtra. |

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| 1964 | In the absence of consensus, an Expert Committee chaired by Dr. A.N.Khosla considered various proposals and recommends a high dam with FRL 152.4 m. The committee proposes 13 major projects on the Narmada, 12 in Madhya Pradesh and 1 in Gujarat. The committee recommended irrigation of over 1.8 Mha through a right bank canal in the northern region of Gujarat, also to cover parts of the state's western peninsulas of Saurashtra and Kutch, as well as extension into Rajasthan. Gujarat accepts the recommendations of the committee, while Madhya Pradesh and Maharashtra reject them. |
| 1965 | Madhya Pradesh and Maharashtra sign agreement to build hydroelectric dam at Jalsindhi, challenging the Expert Committee's allocations. No consensus by the states even after Chief Ministers agree on Navagam dam height, however Madhya Pradesh's Chief Minister cannot get cabinet to go along with his plan and negotiations fail. |
| 1967 | Indira Gandhi is re-elected but with a weakened majority. Deputy prime minister Morarji Desai, who has strong support in Gujarat, challenged her and lost. Gujarat government's weak connections to Mrs Gandhi's government probably reduced the center's incentives to deal with Narmada issue. |
| 1968-1969 | Gujarat and West India faces drought. |
| 1969 | Gujarat files complaint with Government of India under India's Inter-State Water Dispute Act, 1956. Formation of the Narmada Water Dispute Tribunal. M.P. and Maharashtra Chief Ministers jointly declare their opposition to the formation of the NWDT. M.P. files writ petition to Delhi High Court, seeking to restrain central government from constituting a tribunal and disputing that Rajasthan's claim to be a disputant in the award. |
| 1972 | Mrs Gandhi's party has overwhelming win, all the disputant states have Congress governments. While the Chief Ministers attempted new talks with the Prime Minister's assistance, monsoon failures and rising food prices in the next few years create public anger and reduces political leverage for the center. However, Rajasthan is included in the disputant states and Chief Ministers agree that quantum of river available for allocation is 28 MAF. |
| 1972-1973, 1974-1975 | Gujarat and West India faces drought. Drought-relief measures cost government millions of rupees. |
| 1974 | NWDT resumes deliberations. Tribunal made a point of not meeting politicians. Hearings and consultations with affected peoples are not held, and environmental issues are never brought up. |
| 1975-1977 | India in state of Emergency after war with Pakistan. Mrs. Gandhi virtually an authoritarian ruler. |

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| 1978 | NWDT Award mostly reiterated the Expert Committee's recommendations and favoured a high dam at the same site, irrigating over 2.1 Mha and generating hydropower through an installed capacity of about 1200 MW in the riverbed powerhouse and 300 MW in the canal head powerhouse. Award planned for interlinking canals that depend on a computerized system coordinating the entire network of upstream dams and reservoirs, such that as each of the latter filled up during the monsoon season, its water would be released gradually to maximize storage and keep Sardar Sarovar and the canal system operating year round. Allocation was for 75% dependable yield of about 35.8 BCM (billion cubic meters) for irrigation between the three riparian states and to the fourth water-deficit state of Rajasthan to the north of Gujarat. The hydropower to be generated was allotted only to the three riparian states. A detailed project report was then prepared by Gujarat state. Gujarat would receive a disproportionate share of the water due to higher need and no other river to rely on, but they would bear most of the costs. R&R package (land for land) is better than the current standard of cash for land. At the time the 'weighing and balancing' undertaken by the Tribunal in its equitable apportionment approach and the resultant trade-offs it created made its Award politically acceptable in a way that had often seemed impossible during the previous two decades. |
| 1980 | The Narmada Control Authority (NCA) was established to implement the tribunal's decisions. NCA set up separate subgroups to look into rehabilitation and resettlement, environment and other aspects of the award. Sardar Sarovar Construction Advisory Committee (SSCAC) was formed to advise the Government of Gujarat on its construction. The anticipated benefits of the Sardar Sarovar Project cover almost 75% of the population of Gujarat. |
| 1980 | Beginning of NGO (voluntary activism) movement in India. Gujarat NGOs start to form, primarily concerned about the plight of adivasi oustees. |
| 1983-1985 | As World Bank's principal SSP resettlement consultant, Thayer Scudder visits India several times and writes of the poor implementation of R&R in affected villages. |
| 1986 | World Bank's Board approve SSP for a US$200 million loan and combined US$140 million IDA credit, subject to 16 covenants dealing with resettlements, three on health and three on environment. |
| 1980-1985 | Department of Environment and Forests, set up in 1980, had refused environmental clearance to the project. When upgraded to Ministry in 1985, came under pressure from different sides to release forest land. Project authorities go ahead and sign loan agreements with the World Bank without the mandatory environmental clearance from the MoEF. |

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| 1987 | India's Environmental Protection Act passed, environmental clearance required and conditionally obtained in June (under significant pressure from the World Bank and government of India), asking the states concerned to take certain steps including resettlement and rehabilitation, *pari passu* (in step with) the construction of the dam. |
| 1987 | Arch-Vahini (Gujarat NGO) scores victory in gaining R&R concessions from the Gujarat government. |
| 1989 | Two committees set up by Medha Patkar protesting the dam in Madha Pradesh and Maharashtra merge to form the Narmada Bachao Andolan ("Struggle to Save the Narmada"). NBA campaign starts gaining national and international publicity. |
| 1989 | Morse Commission, set up by World Bank due to pressure from activists, recommends consultation with project-affected families for resettlement and rehabilitation package. |
| 1990 | Confrontations between Gujarat government, NBA supporters, and affected peoples become more heated. At its height, the Gujarat and Maharashtra police are called in to move Manibeli residents. |
| 1991 | World Bank Independent Review is commissioned after pressure from several member countries to assess project implementation in regard to R&R and environmental impact. |
| | Subsequent Morse and Berger report is critical of the SSP, citing lack of basic data and planning for financial, environmental and rehabilitation costs, as well as blaming the World Bank for not abiding with a more stringent standard before awarding loan. Calls for a suspension of funding. Report is rejected by the government of India. World Bank also not convinced of the acceptability of the report, assures India it will continue funding. However, World Bank continues to bring up issues with Indian Government. |
| 1993 | After a split vote on whether or not to pull out of the dam, the World Bank agrees to continue funding the project on the face-saving condition that the Indian government meet six bench-marks related to resettlement, including improved data of project-affected people and satisfactory resettlement and rehabilitation plans in all three states, in six months. Government 'forced' to ask World Bank to withdraw from the Sardar Sarovar project. Five Member Group of experts set up by Ministry of Water Resources to conduct review discussions in response to suggestions from protesting activists. |
| 1994 | NBA files Public Interest Litigation in Supreme Court, seeking to halt SSP for not acting on various conditions of environmental clearance. |
| 1995 | Court orders stay on continued construction above EI 80m to enable states to fulfill the *pari passu* condition satisfactorily. This is seen as huge success for NBA. |

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| 1998-2000 | Public support for NBA flagging due to public weariness on its uncompromising stance. Confrontations between NBA and its former supporter, the M.P. government, over dam construction in three sites. NBA resources spread thinly. |
| 1999 | Gujarat constituted Grievance Redressal Authority to directly address resettlement concerns by affected people, and is praised by the Gujarat Chief Minister and even the NBA. Maharashtra and Madhya Pradesh soon follows suit. |
| 2000 | NBA leader sits on WCD. WCD recommendations rejected by many as impractical and largely not found acceptable by the developing world. |
| 2000 | Supreme Court returns 2-1 decision in favor of raising of dam to EI 95m, ordering that project should be completed at the earliest and states must comply with conditions regarding R&R and environmental impact mitigation. NBA holds protest demonstration, Medha Patkar and Arundati Roy are arrested for contempt of court and given symbolic one-day sentences. |
| 2001 | Maharashtra government agrees under pressure to set up a Joint Task Force on resettlement with NBA and other NGOs. Their 2002 report concludes that resettlement was incomplete with over 3000 families yet to be physically relocated as required, while rehabilitation was incomplete for the 500 families that had moved. |
| 2002 | Ministry of Environment and Forests set up a multi-disciplinary committee of experts to review fulfillment of conditions laid down at the time of environmental clearance. Committee reports that the environmental clearance conditions were satisfactorily fulfilled. |
| 2003 | Supreme Court allows raising of dam to EI 100m. During monsoon season, over 12,000 families adversely affected by flooding. |
| 2004 | NCA allowed raising of dam to EI 100.64m. |
| 2006 | NCA allowed raising of dam to EI 121.92m, after reports of actions taken for resettlement and rehabilitation had been vetted by the Grievance Redressal Authorities of the three states, and thereafter approved by the Narmada Resettlement and Rehabilitation, and Environmental Sub-Groups of the NCA. After protests, the Supreme Court decides to stay dam. Prime Minister appoints SS Relief and Rehabilitation Oversight Group (OSG) to decide if Award was given to M.P. fairly, and NBA protests manner of investigation. OSG returns positive verdict with some deficiencies, allowing go ahead of the project. |
| 2006 | After series of defeats in dealing with concerned state governments, project authorities, World Bank, and courts up to the Supreme Court of India, the Court disposes of NCA's public interest litigation (17 April 2006). |

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| 2013 | Height of dam has been built up to 121.92m. Contention between Gujarat state government and opposition parties over who is responsible for the failure of canals being built to distribute water, with the Gujarat state government blaming the Center and the opposition blaming the Chief Minister Narendra Modi. |

*Sources: Dwivedi 2006; Wood 2007; Thatte in Tortajada, Altinbilek and Biswas 2012, India Times 2013*

Table 5. Points in Government Cost Benefit Analysis Challenged by the Narmada Movement, and the Official Response

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| Amount of water in the Narmada | The Narmada movement challenged the estimates of water based on hind-casting, arguing it was overoptimistic. They provide their own, lower, figure.<br>Officials respond that hind-casting is an acceptable method, and was agreed by the four Chief Ministers. |
| Dependable Availability of water | The Narmada movement believes 60% utilizable flow is too high. |
| Likelihood of Water Reaching Drought-Prone Areas | The Narmada movement argues that large parts of the water-deficient areas in Gujarat are not in the proposed command areas, and they also lie at the tail end. If water use intensifies in the already developed districts of Baroda, Bharuch and Ahmedabad, they would be unlikely to reap benefits.<br>There would probably be an increased concentration in head end of water-intensive cropping, reducing downstream supply. Downstream releases of water for environmental mitigation purposes will also reduce water to the command area. Project authorities respond that they have never claimed the water can reach all areas - it is governed by supply constraints, water scarcity, drought-proneness, and ultimate irrigation potential of the district. They also counter with proposed innovations in water management. |
| Suitability of Command Area for Irrigation | ORG's studies showed that only 10% of the SSP command is eminently suitable for irrigation, another 40% suitable, and large tracts of land in Gujarat's command area tail end found unsuitable. This creates fear of waterlogging and salinization.<br>Project authorities argue this problem is anticipated and control measures have been devised. |

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| Power Generation Potential | The Narmada movement claim that the power benefits are deceptive, actual power generation in first phase is only 439 MW and in final phase only 50 MW. The RBPH has faced technical and financial setbacks and may have to be abandoned. As peak demand operation consumes power and catchment treatment in other projects has been poor, the cumulative effect is 30-50% of power loss, which makes the component uneconomic. Social cost is also enormous (70% more population affected for an extra 19 ft of dam).<br>Authorities' argument is that hydro is cheap, cleaner, and they need power especially in the western grid. |
| Environmental Impact Assessment and Mitigation | The Narmada movement criticizes the credibility of studies and outline many risks. Forest losses are not properly accounted for, the seismic impact not properly assessed, and credible action plans for proper surface and vertical drainage is lacking. The *parri passu* clause viewed with suspicion, can continue construction even when studies have not been done.<br>The authorities basically downplay most of the risks, saying forest losses are not as significant - virtually all forests were degraded, fear of earthquakes is displaced, and that downstream impact is not all negative as they reap irrigation benefits. |

*Source: Dwivedi 196-226*

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